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VOL. III.—PART II.

NUMERATION — R.

(TESTIMONIALS AT THE END OF LAST VOLUME.)

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Nu'meration [Lat. *numeratio*], the art of reading numbers when expressed by means of numerals. (See NOTATION.)

Nu'merator, that term of a fraction which indicates the number of fractional units that are to be taken. In a common or vulgar fraction the numerator is the number written above the horizontal line; in a decimal fraction it is the number that follows the decimal point. Thus, in the fraction $\frac{3}{7}$ the numerator is 3; in the decimal .0314 the numerator is 314. W. G. PECK.

Numer'ical. The term *numerical* in analysis stands opposed to the term *literal;* it implies that the quantities considered are expressed by figures and not by letters. A *numerical equation* is an equation in which all the quantities except the unknown or the variable quantities are numerical. The *numerical value* of an expression is the result obtained by assigning numerical values to all the quantities which enter it, and then performing the indicated operations. Thus, the numerical value of $a^2b - c^2d$ is 10, when $a = 2$, $b = 3$, $c = 1$, and $d = 2$. The term *numerical* sometimes stands opposed to the term *algebraical;* thus, the numerical value of -5 is 5. W. G. PECK.

Numid'ia, that part of the northern coast of Africa which extended between Mauritania in the W. and *Africa Propria*, the ancient territory of Carthage, in the E., corresponding nearly to the modern Algeria. It was inhabited by the same race of people as Mauritania, the Moors, the ancestors of the modern Berbers, and it was divided between many different tribes. By the help of the Romans, as a reward for his support in the wars against Carthage, Massinissa succeeded in uniting the tribes and establishing an empire, several of whose rulers became famous in the Roman history; as, for instance, Jugurtha and Juba. In 46 B. C. Numidia was made a Roman province, and the Romans formed several colonies here, of which Hippo Regius was the most noticeable.

Numid'idæ [from *Numida*—*i.e.* Numidian—the generic name of the guinea-fowl), a family of gallinaceous birds typified by the well-known guinea-bird. The general form is familiar to all, and in this respect all the species of the family agree, the body being squat, with the head small and the neck comparatively long, but not as much so as in the turkeys; the head is always more or less wattled and naked; the bill moderate; the nostrils large, oval, and partly covered by a membrane; the tarsi moderately long; the hind-toe a little elevated; the tail depressed or bent downwards. The family is sustained, according to Prof. Huxley, by a number of osteological characters. It differs from all others by the absence in its representatives "of any backward process of the second metacarpal, and in the obtuseness and somewhat outward inclination of the costal processes. The acromial process of the scapula is also singularly recurved." In most other respects, however, it agrees essentially with the *Meleagridæ* and *Phasianidæ*, having the same kind of sternum, skull, etc., but slightly modified. The family is peculiar to Africa. The species are chiefly found in the woodlands, and especially along the margins of rivers, and congregate in flocks of 200 and 300 individuals, scattering along in search of food, which consists of insects (grasshoppers, ants, etc.) as well as small grains. The eggs are numerous and laid in a rude nest, generally concealed in the bush. According to G. R. Gray, there are eleven species, representing three genera, viz.: (1) *Numida*, with ten species, including the common guinea-fowl (*Numida meleagris*); (2) *Agelastes*, with one species; and (3) *Phasidus*, also with one species. These nearly average in size the domestic species. THEO. GILL.

Numismat'ics [Gr. νόμισμα, "coin"] comprehends all about coins; as such it deals with stamped pieces of metal of known weight and authoritative issue, implying as a science definite rule and civilization as opposed to barter and barbarism; and as such it tends to illustrate and confirm history. It has been usual to divide coins for purposes of study (omitting minor details) into three grand classes: (1) *Ancient*, from their earliest existence in the seventh century B. C. to the deposition of Romulus Augustulus (A. D. 476); (2) *Mediæval*, from this period to the Reformation (A. D. 1517); (3) *Modern*, from the Reformation to the present time. Each of these has its own subarrangements and characteristics, but the *ancient* and *mediæval* so far agree that their coins are mercantile rather than commemorative. In the first class scarcely any coins would answer to that we call "*medals;*" while in the second distinctive *medals* have little more than commenced.

To take first *ancient* coins: these are classed under (1) Greek, (2) Roman, (3) Græco-Oriental or Byzantine, under each of which it is customary (following the arbitrary arrangement proposed by Eckhel of Vienna) to take the countries in their order from W. to E., the cities of each country being placed alphabetically. Of the three, the Greek are unquestionably the most important. Greek coins are found in Europe in Spain, Gaul, Britain, Italy, Sicily, Thrace, Macedonia, Thessalia, Attica, Bœotia, and the Peloponnesus; and in Asia in Ionia, Phrygia, Lydia, Caria, Cilicia, Phœnicia, and Egypt. Besides these as authorities, there is Epaminondas on Bœotian, Herodotus on Halicarnassian, and Cicero on Magnesian money; sometimes, too, celebrated games—*e. g.* those of Olympia—are commemorated, as in the chariot-race types of Syracuse, or well-known myths, as that of the Labyrinth on coins of Cnossus in Crete. Maritime states are often denoted by dolphins and other fish; rivers, like the Achelous, by bulls with human heads. The material of coins is gold, silver, bronze, electrum, an alloy (sometimes natural) of silver with gold, or potin or billon, bronze or copper washed with silver. It is supposed that the metal was first formed in roundish lumps and then struck cold, but no ancient die, so far as we know, exists in any museum; the materials, however, for coining, the hammer, the anvil, and the tongs, may be seen on a denarius of the Roman family Carisia. Inscriptions on Greek coins are generally in the genitive, on Roman and Oriental in the nominative, the word νόμισμα ("coin") being in the first case understood. The finest period of Greek art scarcely lasts longer than sixty or seventy years—say, from B. C. 460 to B. C. 390—and is nearly coincident with the best period of sculpture; and, as a rule, the colonial coins of Italy and Sicily indicate great wealth and luxury, their finish being unrivalled; they are, however, surpassed in grandeur by the money of some of the parent cities. In one instance, that of Athens, the coins remain to the last rude and ugly, perhaps owing to their great commercial importance. Thus, in modern times the Chinese long refused any European coin except the Spanish "pillar" dollar, while the Abyssinians declined quite recently any type but the dollar ("thaler") of Maria Theresa of 1782. In weight, Greek coins are generally very accurate, but different countries and towns preferred the different standards of the Phœnician, Aginetæ, or Attic talent. No less than thirteen multiples or submultiples of the Athenian drachma (67.5 Troy grains) are known; and of these, 100 went to the *mina*, and 60 minæ to the talent. The double (didrachm) and the quadruple (tetradrachm) are the most usual sizes, the gold generally following the standard of the silver. Bronze coins are usually submultiples of the *obelos*, itself one-sixth of the drachma.

In point of art there is nothing noticeable in those of Spain, Gaul, or Britain; but in the first the elder have some interest, as retaining the old Celtiberian alphabet and a few words of the Basque language. British coins are copied from those of Gaul, and these again from the types of Philip of Macedon; but none of these are probably earlier than B. C. 250. On British coins are some historical names, as Cunobelinus (Shakspeare's Cymbeline), the father of Caractacus, and the towns of Verulamium and Camalodunum (St. Alban's and Colchester, respectively). In Italy we find magnificent specimens of the Greek colonial coinage at Heraclea, Metapontum, Neapolis, Pandosia, Tarentum, Terina, Thurium, and Rhegium; of very early types at Caulonia, Croton, Pæstum, Populonia, and Sybaris; of the ancient mode of writing, from right to left, on some of the earliest; and of the use of the digamma at Heraclea. The Samnite coins point to a confederacy of states and give examples of Oscan characters. The finest coins of Sicily are in like manner colonial, with some resemblance to those of Italy, the earliest ascending in date to B. C. 490 or 480. The most usual type is that of the chariot, either moving slowly or at great speed, and in many instances, as at Camarina, Catana, Messana, and Syracuse, unquestionably refer to the Olympic games; indeed, on those of Catana the goal may be noticed, and on the largest of Syracuse a suit of armor, with the word ἆθλα (the "prizes of victory") inscribed. Moreover, of Pindar's fourteen odes, it must be remembered that six refer to victories in the games won by Sicilians; while at Messana the *biga* (or chariot with two mules) refers to a victory won by Anaxilaus of Rhegium. At Agrigentum the name of the people is written *boustrophedon*—*i. e.* from right to left and from left to right, as an ox ploughs. The Syracusan decadrachms represent the largest of ancient Greek coins, and, though very fine, are not equal to the best of Greece proper; at Syracuse, too, the name of two artists, Cimon and Enænetus, have been preserved on the money. Connected with Sicily are some very fine coins bearing Phœnician inscriptions, sometimes attributed to Carthage; indeed, there is no doubt the best specimens were struck for that great city in Sicily at Panormus and other places, and by Greek artists. The beautiful coins of Philistis commemorate a lady not mentioned in history, but believed to be the wife of Hiero II., as her name is found carved on a seat in the theatre at Syracuse.

Proceeding to Greece proper, we find very early and beautiful specimens of Greek art at Abdera, Œnos, and Thasos, and in various towns of Macedonia and its neighborhood, as Acanthus, Amphipolis, Chalcidice, Lête, and Neapolis. The types in many cases refer to old and well-known myths, as the Gorgon's head at Neapolis. The lion seizing the bull on those of Acanthus confirms the story of the lions who attacked the baggage-horses of Xerxes at about the same time as these coins were struck. Two remarkable coins exist of Geta, king of the Edoni, both of which were found in the Tigris, and therefore may have been carried back to Persia after the defeat of Xerxes. Of Philip and Alexander the Great coins abound in gold and silver, but are less frequent in bronze, the former being of good art, and the latter confirming the extent of his conquests; while those of Lysimachus, king of Thrace, are noteworthy for the portrait they exhibit of Alexander himself, with the symbols of the Young Ammon. Thessaly exhibits some good specimens in the money of Larissa, with some resemblance in fabric to those of Sicily; and Epirus offers the beautiful series from Ambracia, with the noble head of its king, Pyrrhus, treated as the Jupiter of Dodona. The coins of Pyrrhus were probably struck at Tarentum or Syracuse. Corcyra, Acarnania, Ætolia, and Locri are also well represented; and in Bœotia we find a series of remarkable archaic coins (as at Tanagra and Thespiæ), and one reading ΕΠΑΜΙ, reasonably attributed to the celebrated Epaminondas. Athens naturally affords the largest series of Greek coins, but, as we have said, her money has no artistic merit; some specimens, however, are as early as B. C. 500. Those of the adjacent island of Ægina are very interesting from their antiquity, and from the tradition that Pheidon, king of Argos, first struck coins here in the eighth century B. C. In the Peloponnesus the series of the money of Corinth claims especial attention from its great extent and long-preserved excellence. Here, too, we find archaic specimens, with the old form of the κ (ϙ) preserved on them. Achaia records its celebrated league, and Sicyon is justly famous for the beauty of its money. At Elis we find the digamma on early types of the time of Xerxes, and a magnificent series of the finest period, with the head of Juno and her name, ΗΡΑ, inscribed on a bandeau over her forehead. These are as fine as any of the purely Greek coinage; and with these may be ranged scarcely less noble specimens from Trazene, Arcadia (with the head of Zeus Ætophoros), and Stymphalus—the latter possibly Cretan. Sparta naturally records her famous ruler, Lycurgus, though on a late copper coin. Mantinea and Heræa have good archaic types.

Of the islands, Crete takes the lead, and in the abundance of her fine coins gives ample evidence of her ancient wealth and of the skill of her artists. It has been thought, however, that the Cretan style is too pictorial. Local myths largely prevail in the types, as those of Europa and Minotaur, and of the Labyrinth or Maze. Very fine specimens exist of Chersonesus, Hierapytna, Phæstus, Cnossus, Gortyn or Gortyna, and of Cydonia, all in this island. On one of Gortyna we find the word σαιμα (σῆμα, "the badge"), referring probably to the actual type. Those of Phæstus are of especial beauty. Over the islands of the Archipelago we need not linger, though some of the coins of Tenos are fine, while Cyprus offers us an Oriental alphabet only slowly yielding to the genius of the decipherer.

Asia Minor to the N. has little of interest, excepting one magnificent head of Mithridates VI. of Pontus; in Mysia, we have, however, a unique series of *electrum* coins, called *staters* of Cyzicus, with other splendid trophies of Greek art, in the money of Cyzicus, Phocæa, and Pergamus. The tetradrachms of the last place are called, from their peculiar type, *cistophori*. Ilium in Troas naturally records its local traditions, placing Hector ('ΕΚΤΩΡ) on its money, and Æneas carrying Anchises and leading Ascanius. Lydia comes next, with its rude and archaic gold coins, probably, as we have noted, the really earliest specimens of Greek numismatic art, though those of Ægina could not have been much later; then comes Ionia, with its great series of Smyrna and Ephesus, and the noble coins of Clazomenæ. Of this town a very rare tetradrachm exists with an inscription on it, Θεοδοτος εποιει ("Theodotus made me"). Magnesia records its river by the type of a bull butting within the pattern, hence called "Mæander." Early coins of Phocæa exhibit the seal, whence its name; and Chios, Samos, Calymna, and Cos many very early and curious specimens. The coins of Rhodes have an importance of their own, confirming, as they do remarkably, the statements of history. In remote times the three towns of Lindus, Ialysus, and Camirus struck their own money. They then combined and built Rhodes about B. C. 450. We have no coins of Rhodes before that time, but immediately after very fine specimens, with the head of Apollo, probably the same type as was afterwards known as the Colossus of Rhodes. On the opposite coast Lycia and Pamphylia afford a remarkable series; the elder ones inscribed in the local character and language; Side in the latter province having some especially fine tetradrachms, with the pomegranate fruit (Σιδη) as their type; whence, too, the name of the place. In Pisidia we have curious locally inscribed coins at Selge, resembling those of Aspendus in Pamphylia. Phrygia offers several coins of interest of the imperial times with local myths, such as that of Deucalion and Νωε, and Cilicia some remarkable coins inscribed with Phœnician characters and struck by the Persian rulers of that district. These are called "satrap" coins. There are also some interesting types at Tarsus, bearing legends similarly written. These, and the types prevailing along the coast of Syria, at Sidon, Tyre, Aradus, and Byblus, together with the early money of the Bactrian series, might perhaps best be termed Græco-Oriental. With the well-known series of "Antiochia ad Orontem," of the Seleucid kings of Syria, of the Ptolemies in Egypt, and of Cyrene in Africa, we close our brief notice of the Greek series. The native coins of Carthage and Judæa must be called Oriental; they do not exhibit anything worthy of remark, except, perhaps, the earliest "shekels" of Judæa, which were probably struck soon after the return of the Jews from Babylon.

The second great subdivision of numismatics, the Roman, commences about 230 or 240 B. C. with a massive copper coinage, termed, technically, "*æs grave*," having the As for its largest size, and the *uncia* (or ounce) for its unit. At first, the As actually weighed one pound, and hence was called "*As libralis*," the ounce being its twelfth part; but it was soon and rapidly reduced. The leading types of the Roman As are the "*Janus bifrons*" and the prow of a galley. Other and similar coins were struck in the adjacent towns of Etrusia and in Umbria and Apulia. All were on Greek models. About B. C. 170 gold, silver, and copper coins were issued by various Roman families, who were permitted by the state to strike coins—often, too, beyond the bounds of Italy; and with Julius Cæsar commenced the imperial series, which lasted, as we have stated, till A. D. 476. The main characteristic of Roman art is individuality as opposed to idealism; faithful portraiture, often exceedingly good, as in the cases of Antonia, Nero, the Antonines, Faustinas, etc., with a remarkable permanence of religious types on the reverses. Many historical events are recorded on them, as the crowning of Ptolemy Epiphanes by Lepidus, the introduction of elephants into Rome by Metellus, the construction of the port of Ostia and of the Colosseum by Nero and Vespasian respectively, and the overthrow of Judæa by Titus.

It is probable that all the finest Roman coins were executed by Greek artists, and their chief value for study is the illustration they afford of contemporary sculpture, and the influence they have exercised over mediæval and modern art. After Julius Cæsar the senate reserved to itself the striking of the copper money, which for a long time is always marked with S. C. (*senatûs consultu*). Names for Roman coins are scarce, but we know that the earlier gold and silver coins were termed, respectively, *auræ* and *denarii*, the latter of which has been preserved through the Middle Ages as the *denier* of France. In later times the *solidus* was introduced, and this likewise has become the *sol-d'or* of France (ultimately *sou*) and the *soldo d'oro* of Italy, whence *soldato* ("soldier"), meaning the "hireling." Besides the regular coins, the Romans had also what are termed *medallions*, which in some degree resemble modern *medals*, and *contorniates*, which were probably tickets of admission to the theatres or games. Christian types, as the *labarum* or standard bearing the cross, are found from Constantine downward, and on one of Vetranis are seen the celebrated words, "*Hoc signo victor eris*." With the imperial Roman it is usual to class the *imperial Greek* coins, struck by nearly every emperor in the Greek cities of the empire, and in some cases, as at Antioch and Alexandria, forming a series unrivalled in number and duration. Artistically, this class has no value, but it is rich in its records of ancient myths and in historical allusions.

The third, or Græco-Oriental series, mainly consists of the coinage of the Byzantine emperors to the capture of the city by the Turks in 1453; but some writers class under the same head coins inscribed with Phœnician or other Oriental characters, and the darics of Persia, but these are best kept separate. The Byzantine series is generally supposed to commence with Anastasius in A. D. 491. The inscriptions on it are at first in Latin, thence continuously in Greek, its varying orthography showing the gradual change of the language. The Byzantine coinage is mostly in gold, and its chief interest is that it was the principal coinage of Middle and Eastern Europe till the introduction of the florins and ducats of the Italian republics; and, further, because the money of the Vandals in Africa, of the Ostrogoths in Spain,

and of Nicæa, Thessalonica, and Trebizonde, was framed on Byzantine models.

Over the remaining leading divisions of numismatics, the mediæval and the modern, it is not necessary to detain the reader very long; indeed, they might well be taken together. It is necessary, however, to state, generally, that the early mediæval types are a barbaric imitation of the Roman, their art being progressively worse as they were removed farther and farther from Italy, which always retained some traces of her earlier civilization. The earliest mediæval coins are those of the Lombard and Merovingian kings and of the dukes of Benevento, and in Britain the small silver pieces called *"sceatas."* Thence gradually arose an improved system, led by the German empire in Northern Italy, Germany, and France, and by the Scandinavians in England. In this system, which continued little changed till the revival of learning, the *denier* and the *penny-sterling* (*i. e.* "Easterling") were the common and the most important coins. Coins were (except in England, where the right of striking coins was always much restricted) issued by princes and ecclesiastics, as well as by kings, and somewhat later by free cities and corporations. The first really good coins are those of the Italian republics and of Frederick II., and henceforward they have some value in the history of art, though by no means so much as seals. In the middle of the fifteenth century medals, in our sense of the word, begin, and hold an important place in the art of Italy, and subsequently of France and Holland. The art of engraving medals, which occupied the talent of some of the greatest artists of the day, is strictly comparable with the painting and sculpture of the same period, and thus forms the true school in which the modern medallist should be trained. The last great series of medals issued are those recording the victories and other achievements of Napoleon I.

It seems unnecessary to give details here of the modern coinage of Europe and other countries, but we must state that besides the various series enumerated there exists a vast number of coins struck by different Oriental rulers from the commencement of the empire of the khalifs to the present day. These coins are worthless in the history of art, but very valuable in determining the dates of dynasties; as a rule, with the exception of the Chinese, they are written in the characters of the Mohammedan conquerors, or in some modification of the Devanâgari (or Sanskrit) alphabetic system. W. S. W. Vaux.

Nummulite. See Foraminifera.

Nunda', post-v. and tp., McHenry co., Ill., 2 miles N. E. of Crystal Lake, on the Chicago and North-western R. R. Pop. 1548.

Nunda, post-v. and tp., Freeborn co., Minn. Pop. 675.

Nunda, post-v. and tp. of Livingston co., N. Y., 60 miles E. of Buffalo, on the New York and Erie R. R., has 1 academy, a fine public hall, an academy of music, 1 tannery, several good hotels, 2 newspapers, 6 churches, 2 banks, and stores. Pop. of v. 1189; of tp. 2686.

C. K. Sanders, Ed. "Nunda News."

Nu'ñez (Alvar), called **Cabeza de Vaca,** b. in Spain about 1490; was second in command in the expedition of Panfilo de Narvaez to Florida 1527–28; escaped from the shipwreck near the mouths of the Mississippi, and after wandering eight years reached Sonora 1536; was entrusted in 1540 with the government of Paraguay; after a turbulent administration of two years was sent to Spain a prisoner, and banished to Africa, but subsequently regained favor and became a magistrate at Seville, where he d. 1564. He wrote a narrative of his adventures in Florida, entitled *Naufragios* (1544), and his secretary, Fernandez, compiled a volume of *Comentarios* (1544), giving an account of his travels in Paraguay.

Nuo'ro, town of Sardinia, province of Sassari, situated in a magnificently wooded region about 2000 feet above the sea. Its position is healthy, and the neighborhood abounds in delicious game and trout. The streets are generally paved and the buildings are mostly of granite. Among the objects of interest in the vicinity are a balanced granite boulder, or "rocking stone," of great size; twenty-four *nuraghi*, or round towers, the origin or purpose of which has been much discussed; remains of an ancient construction resembling a fortress, in which lead pipes are said to have been found, and near which are four of those huge stone sarcophagi known as *sepulturas de gigantes;* also a series of those small chambers cut in the solid granite which have been called *virghines* or *domos de janas*, and the uses of which are equally unknown. Pop. 5739.

Nu'remberg [Ger. *Nürnberg*], town of Bavaria, on the Pegnitz, was once the wealthiest and most important of the free imperial cities of Germany, and although it suffered greatly during the Thirty Years' war, and gradually declined until in 1806 it lost its independence and was annexed to Bavaria, it is still a great and rich town. Its fortifications, consisting of a double wall and a moat, were demolished during the occupation by the Prussians in 1866, and have been transformed into promenades. Of all German cities, it is the most interesting and characteristic with respect to its architecture; its streets look like incarnations of mediæval legends. The houses face the street with their gables, and balconies profusely ornamented with carvings in stone or wood overhang the sidewalks. Also it is very rich in splendid mediæval monuments which show that its ancient fame of being the commercial, industrial, and literary centre of Germany was not vainglorious. Of its many remarkable buildings, the richest and most striking is the church of St. Sebald, a Gothic structure of perfect elegance, ornamented with paintings by Albert Dürer, and containing the famous tomb of St. Sebald executed in bronze by Peter Vischer, who with his five sons worked on it for nearly thirteen years. The town-hall, the largest building of its kind in Germany, with subterranean dungeons and torture-chambers, the castle, and the church of St. Lawrence are also fine and interesting edifices. In the *Albrecht Dürer Platz* was raised a statue of Albrecht Dürer in 1840. The principal manufactures of Nuremberg are carvings in wood, bone, and metals, children's toys, and dolls, lead pencils, chemicals and ultramarine, looking-glasses, watches, carriages, and machinery. Its trade is very extensive. Pop. 83,214.

Nurpur', town of British India, in the Punjaub, at the foot of the Himalaya Mountains, in lat. 32° 12′ N., lon. 75° 40′ E., has well-stocked bazaars and large shawl manufactures. Pop. between 6000 and 8000.

Nurse, a popular name for several sharks; *e. g.* on some parts of the New England and colonial coasts it is applied to the *Somniosus microcephalus;* in Florida, Jamaica, etc., to the *Ginglymostoma cirratum;* and in Australia to the *Cestracion Philippi*, the box or Port Jackson shark, a remarkable fish of the Pacific Ocean.

Nusairieh, Ansyreeh, or **Ansonians,** the name of a Mohammedan sect which branched off from the Shiites by adopting various Jewish, Christian, and pagan ideas. They inhabit the lower Ansyrean mountain-range between Lebanon and Antioch in Syria, and also some towns and villages along the coast. They are ignorant, superstitious, and thievish, and very little is known of their doctrines, as they keep their religious tenets concealed from all foreigners, though in other respects they are very hospitable and communicative. Their prophet, Nusair, taught that God had appeared eleven times in human form—in Abraham, Moses, Jesus, Mohammed, Ali, and the other imams—and would appear once more in Mahdi or Messiah. He also taught the transmigration of souls. Those who neglect their religious duties, and especially those who betray their religious secrets, are transformed into Jews, Mohammedans, Christians, or animals. The religious rites of the sect are said to be very licentious.

Nut Bush, tp. of Warren co., N. C. Pop. 2430.

Nut'cracker, a name applied to *Nucifraga columbiana*, a bird of the Pacific States, and to *N. caryocatactes*, its European and Asiatic representative. They are of the crow family, and approach the jays in habits. They are noisy, shy birds, feeding on seeds, pine cones, grubs, and other articles of food. The Old-World species nests like the woodpecker, in a hole excavated in a dead tree.

Nutgalls. See Gall-Nuts, Galls, Gall Insects, and Gallotanic Acid.

Nut'hatch, a genus (*Sitta*) of birds of the family Paridæ, sub-family Sittinæ. There are many species found in various parts of the world. The typical species is *Sitta Europæa*. The U. S. have *S. carolinensis* (white-breasted nuthatch), *S. canadensis* (red-bellied nuthatch), besides *S. aculeata*, *pusilla*, *pygmæa*, etc. They feed on seed, nuts, insects, grubs, etc.

Nut'meg, the kernel of the seed of *Myristica moschata*, and sometimes of *M. fatua* (long nutmeg), trees which are natives of the Eastern Archipelago and belong to the order Myristiceæ. Besides these, several other trees of this order furnish inferior nutmegs. The true nutmeg is now successfully cultivated in India and tropical America. Nutmegs are principally used as a spice in cooking, but are employed in medicine also. They are aromatic and stimulant, with somewhat narcotic properties. The aril which surrounds the nutmeg constitutes Mace (which see). Nutmegs yield on pressure a half-solid fixed oil, called oil of mace from its peculiar flavor; they yield on distillation an abundant volatile oil which has exactly the flavor of the nutmeg.

Nutria Fur. See Coypu.

Nutri'tion [Lat. *nutrire*, "to nourish"], "that function by which the nutritive matter already elaborated by the various organic actions loses its own nature and assumes that of the different living tissues, to repair their losses and maintain their strength." (*Dunglison.*) In its widest sense, "it comprises the history of the proximate principles, their source, the manner of their production, the proportions in which they exist in different kinds of food and drink, the processes of digestion and absorption, and the constitution of the circulating fluids; then the physical phenomena of the circulation, and the forces by which it is accomplished; the changes which the blood undergoes in different parts of the body; all the phenomena, both chemical and physical, of respiration; those of secretion and excretion, and the character and destination of the secreted and excreted fluids." (*Dalton.*)

The exact manner in which the nutritive process is accomplished is not positively known. The blood is chiefly concerned in the maintenance of this function, and in order to understand it thoroughly it will be necessary to study the composition of the blood and the phenomena of the circulation. As the blood circulates in the living body it is composed of two essential parts—a thin, transparent, colorless fluid known as *liquor sanguinis*, in which float a vast number of small red bodies known as the *red blood-corpuscles*, in contradistinction to the *white corpuscles*, which are also found, but in very much smaller numbers. The human red blood-corpuscles are small, circular, biconcave bodies of a faint yellow color when viewed alone, but of a deep red, giving the color to the blood, when seen collectively; they vary in diameter from $\frac{1}{3000}$th to $\frac{1}{2800}$th of an inch. The white corpuscles are somewhat larger, and present an irregular surface. They are supposed by some to be primitive red corpuscles. When the blood has been drawn from the body and allowed to stand, it coagulates, forming at first a jelly-like mass, which after a while separates distinctly into a *clot*, which grows constantly smaller; and a fluid, known as *serum*. When the clot is examined under the microscope, it is seen to be composed of a number of fibrillæ entangling the red corpuscles. The fibrillæ are known as *fibrine*, which in the living blood is held in solution in the liquor sanguinis or *plasma*, but which begins to coagulate immediately after it is drawn from the vessels or whenever the circulation is arrested. The serum is merely liquor sanguinis deprived of its fibrine. The distribution of the constituents may be seen by the following table:

Living blood.....	Liquor sanguinis....	Fibrine, Albumen, Water, Salts,	in solution.
	Corpuscles suspended in liquor sanguinis.		
Dead blood.......	Clot........................	Fibrine, Corpuscles.	
	Serum	Albumen, Salts, Water,	in solution.

The composition of the blood is as follows:

Water...		796.93
Solid matters:		
Fibrine..	1.95	
Corpuscles...	103.23	
Albumen..	70.75	
Extractive matters and salts............	27.14	— 203.07
		1000.00

We must now take a glance at the process of DIGESTION (which see). We have, as its result, albuminose, glucose, and fat in a state of emulsion, all in the upper part of the intestinal canal, and ready to be absorbed into the general system. The process of absorption is effected chiefly by the villi of the small intestine; these are minute conical projections, most numerous in the upper part of the intestinal canal, and gradually diminishing in number until they entirely disappear at the beginning of the large intestine. Each villus is about $\frac{1}{35}$th of an inch in length, and is composed of a network of blood-vessels—the commencing rootlets of the portal vein—through the centre of which runs a lymphatic vessel ending in a blind extremity, the whole covered with cylindrical epithelium. These blood-vessels and lacteals (as the lymphatic vessels are called) absorb the prepared ingesta by a process of ENDOSMOSIS (which see). That portion absorbed by the blood-vessels is taken immediately into the portal circulation, thence to the liver and heart; that absorbed by the lacteals is carried by them to the receptaculum chyli (a pouch situated in the back part of the abdominal cavity against the spinal column); from here it passes through the thoracic duct, and enters the circulation through the left subclavian vein, thence to the heart. The ingested materials may be recognized in the circulation shortly after they have been absorbed, but they are soon transformed into other substances, and become incorporated with the blood-corpuscles; so that we are seldom able to recognize them after the blood has passed through the lungs.

Another important change intimately connected with the process of nutrition, and which takes place in the lungs, is the aëration of the blood. The circulating fluid, in passing through the lungs, becomes changed from venous to arterial, loses carbonic acid (an effete matter which has been given up to it from the tissues during its passage through the capillaries), and absorbs oxygen, which is appropriated by the tissues for their nutrition.

Ingesta serve for the formation and maintenance of the different parts of the body, and therefore must contain all the elements entering into its composition. We have traced these through the various transformations until they were incorporated with the blood, which thus becomes enriched with all the compound principles of which the tissues are formed; and the process by which each particular tissue selects from the circulating fluid (which is brought into intimate contact with it through the agency of the capillaries) the materials necessary for its maintenance and growth is called *assimilation*. But simultaneously with this is going on a process known as *destructive assimilation*, by which the various tissues are undergoing disintegration and waste; new substances are formed, which enter the circulation, and are carried to the lungs, kidneys, skin, etc. Here they are filtered from the blood and discharged from the economy. They are known as *excretions*, and embrace urine, sweat, fæces, carbonic acid, etc. EDWARD J. BERMINGHAM.

Nut'tall (THOMAS), b. in Yorkshire, England, in 1786; was brought up a printer; came to the U. S. in youth; devoted much time to botanical and ornithological studies; travelled in nearly every State of the Union; explored the great lakes, the upper courses of the Missouri and Arkansas rivers; crossed the country to Oregon, the Sandwich Islands, and California; published, among other works, *The Genera of North American Plants* (2 vols., 1818), *A Journal of Travels into the Arkansas Territory* (1821), *A Manual of the Ornithology of the U. S. and Canada* (1832–34), and *The North American Sylva* (3 vols., 1842–49), being a continuation of F. A. Michaux's work on the same subject. Nuttall was curator and lecturer at the botanic garden of Harvard University at Cambridge 1822–28; returned to England about 1841 on inheriting an estate, and d. at St. Helen's, Lancashire, Sept. 10, 1859.

Nut'ter's, tp. of Wicomico co., Md. Pop. 870.

Nux Vom'ica [Lat.], an important drug consisting of the seeds of the *Strychnos nux-vomica*, a small tree of the natural order Loganiaceæ, growing in the coast-districts of India. The seeds are gray, disk-shaped, a little less than an inch in diameter, and about a quarter of an inch in thickness. They have a very bitter taste and are exceedingly poisonous, both these qualities depending on the presence of three alkaloids—strychnine, brucine, and igasurine. Of these, strychnine is the most powerful and important. It is a white powder, almost wholly insoluble in water, odorless, but of an intensely bitter taste. It is highly poisonous, producing in poisonous dose, within half an hour after taking, violent tetanic spasms, the body during the paroxysms being arched backward, with every muscle convulsed and stiff. The mind is unaffected. Death occurs within an hour or two. There is no certain antidote, but drugs producing motor paralysis, such as calabar bean, hemlock, tobacco, the anæsthetic ethers, etc., are useful in mitigating the severity of the spasms. Medicinally, strychnine and preparations of nux-vomica seeds are used in small repeated doses in cases of nervous debility and paralysis of various kinds, to help in restoring proper functional activity in the affected muscles or organs. EDWARD CURTIS.

Ny'ack, post-v., lying principally in Orangetown and partly in Clarkstown tps., Rockland co., N. Y., situated on the W. bank of the Hudson River, 28 miles from New York City, on the Northern R. R. of New Jersey, has daily connection with New York by steamers, and with Tarrytown across the river by ferry. There are 5 schools, 7 churches, 2 banks, 2 weekly newspapers, several fine hotels and private boarding-houses, manufactories of shoes, cedar pencils, tubs, churns, an efficient fire department, gas, a good supply of water, and a young men's Christian association, which has a library of 1200 vols. Pop. 3438.
JOHN CHARLTON, ED. "ROCKLAND CO. JOURNAL."

Nyan'za, a general word in Africa for large bodies of water, and especially applied to two great lakes in E. Equatorial Africa, the *Victoria Nyanza*, or *Ukerewe*, and the *Mwutan*, or *Albert Nyanza*. The Victoria Nyanza is a large fresh-water lake between lat. 2° 31′ S. and 0° 21′ N., and E. lon. 31° 35′ and 34° 45′. Its estimated area is 25,000 sq. m.; its height above the sea 3808 feet, and its greatest depth, as far as known by soundings taken at its

northern extremity, is 275 feet. About three-fourths of its coast-line has been explored, and is irregular, being indented with small bays and openings formed by the mouths of rivers. At its south-eastern extremity there is a large gulf, about 25 miles wide, to which the name has been given of Speke Gulf, formed by a promontory, Uriwi, which stretches westward, and by the large island of Ukerewe to the W. of this promontory. The Victoria Nyanza has eleven large islands lying close to the coast-line —Ukerewe, Ukara, Ugingo, Usugura, Uvuma, Namungo, Bugeyeya, Wanzi, Lalamba, Sasse, and Bumbireh, the largest of which is Sasse—and many small ones. Whether there are other islands in the central part of the lake is not known, as it has not been explored. The lake, though of large extent, is supposed to be shallow. Its principal affluent is the river Shimiyu, which enters near the south-eastern extremity with a width at its mouth of about a mile, but which soon contracts to 400 yards. The source of the Shimiyu, and, as far as known, the remotest source both of the lake and of the Nile, is the Liwumba, a river which rises in a hilly country in about the 5th degree of S. lat., and a little E. of the 34th degree of E. lon. This stream in the more northerly part of its course is known as the Monungah. Two other rivers, the Luwamberri and the Duma, flow into it, the former from the S., and the latter from the E., and from its junction with the Duma to the lake it is known as the Shimiyu. Eight other rivers flow into the Victoria upon its E. side, the largest of which is the Ruana; and five enter it, as far as known, upon the W. and S.W. sides, the largest being the Katera or Kitangule, which, as an affluent, is second only to the Shimiyu. The outlet of the lake is at its northern extremity, in about 33° 40′ E. lon., and is known by the several names of the Somerset, the Victoria Nile, and the White Nile, the latter of which will probably be ultimately adopted. This outlet or river flows out of a bay called Napoleon Bay, and in the commencement of its course has a fall known as Ripon Falls, from whence it runs in a north-westerly direction, entering a large sheet of water found by Col. Long in descending the river in 1874, which may be either a permanent lake or simply a depression in the land subject to a temporary overflow. From thence the river continues first north-easterly, thence north-westerly, and thence due E., until, at Magunga, about 2° 25′ N. lat. and 31° 40′ E. lon., it enters the Mwutan, or Albert Nyanza, a large lake, the north-eastern part of which, from 1° to 2° 30′ N. lat., and from 31° to 31° 40′ E. lon., is alone known, but which is supposed to extend as far S. as the equator. Whether its greatest extremity, however, is in that direction or toward the W. is yet in doubt, Col. Gordon, from recent inquiries made in the vicinity, being inclined to the opinion that the latter supposition is the true one. It is assumed that a river, the Bahr-el-Gebel, which is one of the western branches of the Nile, is the outlet of this lake at its northern extremity, but the fact yet remains to be established.

The Victoria Nyanza was discovered by Capt. J. H. Speke in 1858, upon the return of the expedition in which he and Col. R. Burton discovered Lake Tanganyika. From what Speke saw he was impressed with a conviction, which subsequent explorations have confirmed, that the Victoria Nyanza was the great reservoir of the Nile. Upon that occasion he explored only a portion of the southern extremity. In 1861 and 1862, Speke, together with Major J. A. Grant, in an expedition chiefly at the expense of the British government, after many trials and difficulties, explored the country lying W. of the lake until they reached the capital of M'tesa, the king of Uganda, the country surrounding the north-western part. Their journey was around the S. W., the W., and the N. W. parts of the lake; during which, however, they were frequently in view of it, and were able to estimate its length with tolerable accuracy, and to form some conception of its general extent. They found the country W. of the lake hilly, well wooded, healthy, and exceedingly fertile, with low, swampy plains stretching as far as the eye could reach to the lake, interspersed with patches of water. These plains, they were assured, had formerly been covered by the water of the lake, when it was navigable to the base of the hills, showing that the lake had shrunk away from its original margin. In 1874, Col. Long reached the northern shore of the Victoria, and made a partial exploration of that vicinity, returning with the erroneous impression that the lake was not more than 25 miles wide. He afterward descended the White Nile, finding the large body of water or lake before referred to, and explored the river to the Karuma Falls, thereby proving its connection with Lake Mwutan (Albert Nyanza). In 1875, H. M. Stanley, at the head of an expedition the expense of which was borne by the New York *Herald* and the London *Telegraph*, after losing nearly half his men by disease and hostile attacks of the natives, succeeded in reaching the south-eastern extremity of the Victoria Nyanza from Zanzibar in the short space of 90 days, more than two-thirds of the journey being through a country wholly unknown. In a small vessel, which had been carried in separate parts by his men and put together on the lake, he carefully explored every portion of the south-eastern, eastern, and northern parts of the coast, reaching Ulagalla, the capital of King M'tesa, on Apr. 14, 1875. He found the country E. of the lake in some parts mountainous, but consisting chiefly of level, well-watered, and fertile plains, stretching far inward, and in parts densely populated.

The present opinion is that these two lakes are the principal reservoirs of the Nile, and that the remotest source of that river is the Liwumba, before referred to, in 5° S. lat. Several prominent geographers and travellers regard the great mountain-chain which lies midway between the Victoria and the E. coast of Africa, and extends from Abyssinia to about 5° S. lat., as the chief source of the streams that flow into this lake. This mountain-range is the highest land in Africa, and is capped by two great snow-crowned peaks, Kenia and Kilmanjaro. The supposition is, that the heavily-freighted etesian winds which in their course along the Nile valley deposit no portion of their moisture upon the land beneath are arrested by this great mountain-barrier, and with the clouds that break against its sides and upon its summits, aided by the melting of the snows under the equatorial heat of summer, cause in this region heavy tropical rains, which swell the water-courses, rivers, and lakes, and thus become one of the chief agents in producing the remarkable phenomena of the annual inundation of the Nile. CHARLES P. DALY.

Nyas'sa, a lake in the interior of Africa, situated in lat. 14° 15′ S., 350 miles from the coast of Mozambique, was discovered in 1861 by Dr. Livingstone.

Nyáya, the logical school. See HINDU PHILOSOPHY.

Nycticeb'inæ (from *Nycticebus*—νύξ, νυκτός, "night," and κῆβος, "monkey"—a genus of the group), a subfamily of Lemuridæ or half monkeys. They have 36 teeth, viz. M. $\frac{3}{3}$; P. M. $\frac{3}{3}$; C. $\frac{1}{1}$; I. $\frac{2}{2} \times 2$; the neural spines of the dorsal and lumbar vertebræ are inclined backwards; the tail is either short (*i. e.* always shorter than half the length of the body) or rudimentary; the hind and fore limbs are not very unequal, although the hind ones are longest; the ears in the typical forms are small, with the helix little marked, and the tragus and antitragus absent. The sub-family is composed of four genera, of which two (*Perodicticus* and *Arctocebus*) are inhabitants of Africa, and the others (*Nycticebus* and *Loris*) of the East Indies. The species are small, nocturnal, with staring eyes, live in trees, and feed on insects and small birds. THEO. GILL.

Nye, county of S. Nevada, consisting of a large area covered by N. and S. ranges of parallel mountains, with wide and sometimes fertile intervening valleys. Silver-mining is the leading industry. There are considerable tracts where agriculture is successfully carried on. Cap. Belmont. Pop. 1087.

Nye (JAMES W.), b. in Madison co., N. Y., June 10, 1815; became a distinguished lawyer and political speaker, noted for humor; was governor of Nevada Territory 1861–65; U. S. Senator 1865–73. D. at White Plains, N. Y., Dec. 25, 1876.

Nyir-Egyha'za, t. of Hungary, manufactures spirits, soda, and oil, and carries on an active trade. Pop. 17,487.

Ny'kerk, or **Nieuwkerk,** t. of Netherlands, province of Gelderland, on Zuyder-Zee, has a good harbor and considerable trade in tobacco, grain, and cattle. Pop. 7428.

Nylghau. See NILGHAU.

Nymphs [Gr. νύμφη], in Greek and Roman mythology, a numerous class of inferior divinities, imagined as beautiful maidens, not immortal, but always young, inhabiting rivers and streams (naiads), forests and groves (dryads), etc. They were considered as tutelary spirits not only of certain localities, but also of certain races and families, and sacrifices of goats, lambs, fruit, and oil, but never of wine, were made to them. They occur generally in connection with some other divinity of higher rank, and they were believed to be possessed of the gift of prophecy and of poetical inspiration.

Nym'wegen, or **Nijmwegen** [Fr. *Nimègue;* Ger. *Nimwegen*], town of the Netherlands, province of Gelderland, on the Waal. It is an old and interesting town, fortified, and important on account of its commanding position on the Rhine and Waal, and carrying on a lively trade and extensive manufactures of beer, brandy, eau de cologne, tobacco, and cigars. A treaty of peace was concluded here between Holland and France (Aug. 11, 1678), between Holland and Spain (Sept. 17, same year), and between France and Germany (Feb. 5, 1679). Pop. 22,785.

O.

O, a vowel, stands in English for not less than four distinct sounds—those heard in *rove, nor, move, love;* while *oo* has as many as three sounds, as shown in *moon, book, blood.* In the digraphs *o* has various powers. As an abbreviation, O. stands for Ohio; O in chemical notation is the symbol of oxygen; on the mariner's compass it stands for east (orient).

Oaja'ca, or **Oaxaca,** a state of the Mexican confederation, bordering on the Pacific Ocean and the Gulf of Tehuantepec. Area, 31,822 square miles. Pop. 490,000, mostly consisting of mestizoes and different tribes of native Indians. The surface is mountainous and the soil very fertile; when irrigated sufficiently, two crops of wheat and maize are produced annually without any manure. Sugar, coffee, cotton, indigo, tobacco, and many varieties of fruits are grown. The forests yield excellent timber and different kinds of dyewoods. Minerals are found, but the mines are very imperfectly worked. Cattle-breeding is carried on to some extent, but the principal product of the country is cochineal. The climate is delicious and healthful, rain frequent, and the heat seldom oppressive.

Oajaca, or **Oaxaca,** town of Mexico, the capital of the state of Oajaca, is beautifully situated and well built, its houses being surrounded by gardens, orchards, and whole plantations of cochineal. Its trade and manufactures are not important, but it has several good educational institutions, and is the residence of many wealthy families. Pop. 25,000.

Oahu. See HAWAIIAN ISLANDS.

Oak [Ang.-Sax. *ac;* Ger. *Eiche*]. The oak family, or order Cupuliferæ (a part of the great order Amentaceæ), comprising the oak, the chestnut, the beech, and the hazel, is found everywhere throughout all temperate regions. In the northern temperate zone it is abundant, and it occurs, though not in great numbers, also in the southern. A few species are found upon the mountains within the tropics, but none in the valleys. As now constituted, it is a strictly natural family. Most of the trees belonging to it are remarkable for their thick and rugged bark and for the great abundance of tannin which it contains. They have large and strong roots, penetrating very deeply or extending very far horizontally. The trunks are distinguished for their massiveness, and for the weight, strength, and, in most cases, the durability of their wood. Their branches are strong and irregular, and form a broad head. The buds are fitted for a climate with severe winters, the plaited or folded leaves being covered by imbricate external scales, and often still further protected by a separate downy scale surrounding each separate leaf. The leaves are plane and alternate, and usually supported by a footstalk, at the base of which are two slender scales or stipules, which for the most part fall off as the leaf expands. The fruit is valuable to man and animals. The fruits of the chestnut and hazel have been long cultivated on the Eastern continent, and much improved in size and quality.

The genera found in the northern part of the U. S. are the oak, the chestnut, the hazel, and the beech. The oak (*Quercus*) is found growing naturally in all parts of the northern temperate zone, and in all contributes to the subsistence of a great variety of animals. De Candolle, in the *Prodromus*, published in 1868, describes more than 280 oaks, of which 33 or 34 are found within the limits of the U. S., 90 in Mexico and Central America, 21 in Europe, 2 in Africa, 28 in China and Japan, 60 in continental Asia, 26 in Java, 14 in Sumatra, 6 in Hong-Kong, 3 in Borneo, 1 in the Moluccas. Several have since been found on the Pacific slope within the U. S.; Dr. Gray finds 16 in the Northern U. S. In Europe the stag, the roebuck, and the wild-boar winter upon its fruit. In Asia, pheasants and the wood-pigeon share it with animals of the deer kind. In our own native forests the bear, the raccoon, the squirrel, the wild-pigeon, and the wild-turkey delight in various kinds of acorns, and swine, hardly less wild, fatten upon them. In England, the tree was once prized only for the acorns, which were the chief support of those large herds of swine whose flesh formed a considerable part of the food of the Saxons. The oak is subject to the attacks of insects, causing a variety of galls, some kind being found in almost every part of the tree, and some of which were once supposed to be the fruit of the tree. (See GALL INSECTS.) The most important are known in commerce as GALL-NUTS (which see), and imported in large quantities into this and other countries from Aleppo and other ports in the Levant. Oak-galls are amongst the most powerful vegetable astringents known, and form the basis of many styptics and astringent medicines. An infusion of them is said to be the best antidote for an overdose of ipecacuanha. Galls contain a peculiar astringent principle called gallic acid, which strikes a deep purple color, gradually becoming black, with the soluble salts of iron. This property renders them a valuable dyestuff. They also form the basis of the common black ink. The bark of most species of oak contains abundance of tannin. That of the common black (*Quercus tinctoria*) is used for tanning and for dyeing. The bark of the cork oak of Spain (*Quercus suber*) furnishes cork.

Yet the great value of the oak in all countries is for its wood. It is applied to a greater variety of important uses than that of any other tree. With the exception of the teak tree, it makes the best ship-timber known, and for this purpose the American white oak is perhaps equal to the English oak, and surpassed only by the live-oak. For thorough hardness, toughness, and durability united it is unsurpassed, though each of these properties singly is found more abundantly in some other wood. It is almost indispensable in the manufacture of implements of husbandry and all kinds of wheel-work. When employed for ornamental uses the wood should be cut obliquely, to exhibit the rich reddish-silver grain.

The Oak.

The oak is distinguished from all other trees by the acorn, for which the fruit of no other tree can be mistaken. The leaves of the commoner species are larger towards the extreme end; in some they are more or less deeply lobed, with rounded or blunt lobes; in others, toothed with large round teeth; in others, deeply cut, with the divisions terminating in a long, bristle-like point. The flowers of both sexes are on one plant; the sterile, disposed in long, slender, pendulous catkins, which are in groups; the fertile flowers, in a bud-like, scaly cup. The seed-vessel of the fertile flower is divided into three compartments or cells, in each of which are two embryo seeds; but only one in one of the cells comes to perfection, whence the acorn is a one-celled, one-seeded nut, surrounded at the base by the enlarged scaly cup. The acorns of some species come to maturity in a single season, but many of the American species require two seasons to ripen. There is scarcely any seed in which the vitality is so transient. Few of them will germinate after having been kept a year, and must therefore be planted at once. Most of the American oaks must be

trees of considerable height and age before they begin to bear, but they become more fruitful as they grow older, and continue bearing till the last. The rate of growth of the oak is very different in the different species. Slow in the early stages of its growth, it continues to make steady progress for many years, and requires 100 or 150 years to come to perfection. The average growth of the white oak is found to be not far from two inches in diameter in ten years after it has been growing thirty or forty years. An oak of thirty years may be eight inches in diameter and forty feet high. An easy calculation shows that, although its apparent growth after that age is less than before, the real growth of each individual tree is greater. In ten years more it will be ten inches in diameter. Two inches will have been added throughout the whole forty feet, and, as the circles of annual growth enlarge in the proportion of their diameter, the 64 of the former years will have become as 100 for the ten years' growth, and the successive additions in periods of ten years will be as the numbers 36, 44, 52, 60, etc. A tree of thirty years, therefore, will in ten years increase 56 per cent.; in the next similar period, 68 per cent.; in the third, 79; in the fourth, 93; in the fifth, 106. That is, an oak of eighty years of age grows more in ten years than it did in the first thirty; and an oak of 130 more than it did in the first forty. When, therefore, it is desirable to keep the forest for timber, the process of thinning may be continued with strict economy, as the increase of the thirty or forty trees left on the acre will counterbalance in a great degree the loss in numbers. Some acres in every large forest should be thus left for the use of the shipbuilder. Those species of oak most analogous to our white oak are known in Europe to continue to grow and flourish for centuries. There are oaks in Britain which are believed to have been old trees at the time of William the Conqueror; some are supposed to be 1000 years old. For planting, the largest acorns should be selected, and such as have grown upon the most vigorous trees. They should be sown as soon as possible and covered in light soil to the depth of an inch. The largest and most thriving plants alone should be selected for transplanting, and to secure good roots the plants should be removed before their final planting from one part of the nursery to another, after having the long tap-roots cut off. This induces a mass of fibrous roots. They should be planted out at the age of three, four, or five years. For successful planting it is safest to have pines, larches, or other trees intermingled among the oaks. GEORGE B. EMERSON.

Oak, tp. of Mills co., Ia. Pop. 748.

Oak, tp. of Stearns co., Minn. Pop. 478.

Oakal'la, p.-v. of Loda tp. Iroquois co., Ill., on Chicago and Cairo line of Illinois Central R. R. (LODA STATION).

Oak Apple. See GALL INSECTS and GALL-NUTS.

Oak Bow'ery, tp. of Chambers co., Ala. Pop. 1144.

Oak Creek, tp. of Butler co., Neb. Pop. 119.

Oak Creek, post-v. and tp., Milwaukee co., Wis., on the Milwaukee division of the Chicago and North-western R. R. Pop. 1959.

Oak'dale, post-v. of Washington co., Ill., on St. Louis Vandalia Terre Haute and Indianapolis R. R. Pop. 116.

Oakdale, tp. of Howard co., Ia. Pop. 176.

Oakdale, post-v. of West Boylston tp., Worcester co., Mass., on the Worcester and Nashua R. R.

Oakdale, post-v. and tp., Washington co., Minn., on the St. Paul Stillwater and Taylor's Falls R. R. Pop. 456.

Oakdale, post-v., cap. of Antelope co., Neb., on the Elkhorn River, has 1 weekly newspaper.

Oakdale, tp. of Monroe co., Wis. Pop. 619.

Oakes (Gen. JAMES), b. in Pennsylvania about 1825; graduated at West Point 1846; served through the Mexican war; made brevet captain for gallantry at Molino del Rey Sept. 8, 1847; became major and lieutenant-colonel of cavalry 1861; participated in the battles of Shiloh and Corinth; was made brevet brigadier-general Mar. 30, 1865, and colonel of 6th Cavalry July 31, 1866.

Oakes (URIAH), D. D., b. in England in 1631; came to Massachusetts 1634; graduated at Harvard College 1649; published at Cambridge a volume of mathematical calculations; became a clergyman at Fitchfield, England; was silenced for nonconformity 1662; afterwards preached to another congregation; returned to Massachusetts; became pastor of the church at Cambridge Nov. 8, 1671; took charge of Harvard College Apr. 7, 1675, and was formally installed president Feb. 2, 1680. D. July 25, 1681.

Oak'field, post-v. and tp., Audubon co., Ia. Pop. 405.

Oakfield, post-v. and tp., Kent co., Mich. Pop. 1092.

Oakfield, p.-v. and tp., Genesee co., N. Y., is seat of Carey Collegiate Seminary (Protestant Episcopal). P. 1471.

Oakfield, post-v. and tp., Fond du Lac co., Wis., on Horicon Lake, and on the Green Bay and Lake Superior line of the Chicago and North-western R. R. Pop. 1361.

Oakfield Plantation, a v. (OAKFIELD P. O.) of Aroostook co., Me. Pop. 559.

Oakfus'ka, tp. of Tallapoosa co., Ala. Pop. 417.

Oak Galls. See GALL INSECTS and GALL-NUTS.

Oak Glen, tp. of Steele co., Minn. Pop. 344.

Oak Grove, tp. of Calhoun co., Ala. Pop. 520.

Oak Grove, tp. of Benton co., Ind. Pop. 1239.

Oak Grove, post-v. and tp., Anoka co., Minn. P. 198.

Oak Grove, tp. of Oregon co., Mo. Pop. 1081.

Oak Grove, tp. of Seward co., Neb. Pop. 213.

Oak Grove, tp. of Wake co., N. C. Pop. 2075.

Oak Grove, post-v. and tp., Dodge co., Wis. Pop. of v. 80; of tp. 2105.

Oak Grove, a v. and tp., Eau Claire co., Wis. Pop. of v. 376; of tp. 895.

Oak Grove, tp. of Pierce co., Wis. Pop. 839.

Oak'ham, post-v. and tp., Worcester, Mass. Pop. 860.

Oak Har'bor, post-v. of Ottawa co., O., on the Northern division of the Lake Shore and Michigan Southern R. R., has 1 union school, 3 churches, a fire department, 4 saw and two planing mills, 1 stave manufactory, 1 weekly newspaper, and repair-shops. It is 26 miles E. of Toledo. Pop. about 1400. G. GOSLINE, ED. "PRESS."

Oak Hill, post-v. of Scarborough tp., Cumberland co., Me., on the Eastern and Maine Central R. R.

Oak Hill, post-v. and tp., Crawford co., Mo. Pop. 707.

Oak Hill, p.-v. and tp., Granville co., N. C. P. 2183.

Oak'ington, a v. of Hall's Cross-roads tp., Harford co., Md. Pop. 158.

Oak'land, county in the S. E. of Michigan. Area, 900 square miles. It is level and fertile. Live-stock, grain, wool, hay, and dairy products are the agricultural staples. The manufactures include carriages, flour, saddlery, cooperage, castings, etc. The county is traversed by the Holly Wayne and Monroe and the Detroit and Milwaukee R. Rs. Cap. Pontiac. Pop. 40,867.

Oakland, p.-v. and tp., Lauderdale co., Ala. P. 2887.

Oakland, post-v. and tp., cap. of Alameda co., Cal., 6 miles E. of San Francisco, with which it is connected by steamboat and rail, is the W. terminus of the Central Pacific R. R. The city is divided into East and West Oakland by an estuary of San Francisco Bay 40 rods wide. It contains academies, seminaries, and graded schools, 2 libraries of 6000 volumes, 3 street railways, 17 churches, 2 savings banks with an aggregate capital of $2,500,000, 2 Chinese missions, 4 benevolent societies, rhetorical, harmonic, protective, and horticultural societies, a paid fire and police department, 4 daily, 2 weekly, and 2 monthly papers, 16 incorporated companies with a capital of $6,000,000, and other business-houses. Oakland has 2 flouring and 2 planing mills, 2 potteries, marble and iron works, a cordage-factory, 3 tanneries, a jute-factory turning out 5,000,000 sacks annually, metallurgical works, smelting and refining works, a quartz-mill, 1 fruit-preserving establishment, manufactories of windmills, carriages, and other commodities. The city is supplied with water and gas, and is governed by a mayor and city council. Pop. of v. 10,500; of tp. 11,104.

Oakland, post-v. of East Oakland tp., Coles co., Ill., on a branch of the Embarras River and on the Illinois Midland R. R.

Oakland, tp. of Schuyler co., Ill. Pop. 1026.

Oakland, tp. of Franklin co., Ia. Pop. 319.

Oakland, tp. of Louisa co., Ia. Pop. 604.

Oakland, post-v. and tp., cap. of Garrett co., Md., 243 miles W. of Baltimore, on the Baltimore and Ohio R. R., has 1 woollen-mill, 2 newspapers, several saw-mills, and stores. It is a resort for summer tourists. Pop. 1396. C. T. ABELL, ED. "GAZETTE."

Oakland, tp. of Oakland co., Mich. Pop. 1086.

Oakland, post-v. and tp., Freeborn co., Minn., on the Southern Minnesota R. R. Pop. 412.

Oakland, post-v. of Yalabusha co., Miss., on the Mississippi and Tennessee R. R., is the seat of Oakland College (Presbyterian), founded in 1830.

Oakland, post-v. and tp., Burt co., Neb. Pop. 227.

Oakland, tp. of Chatham co., N. C. Pop. 1593.

Oakland, a v. of Clear Creek tp., Fairfield co., O. Pop. 152.

Oakland, post-v. of Douglas co., Or., on the Oregon and California R. R.

Oakland, tp. of Butler co., Pa. Pop. 926.

Oakland, tp. of Susquehanna co., Pa. Pop. 1106.

Oakland, tp. of Venango co., Pa. Pop. 1082.

Oakland, post-v., cap. of Mason co., Wash. Pop. 59.

Oakland, p.-v. and tp., Jefferson co., Wis. P. 1071.

Oak Lawn, tp. of Greenville co., S. C. Pop. 995.

Oak′ley, post-v. and tp., Macon co., Ill., on the Toledo Wabash and Western R. R. Pop. 1137.

Oakley (Thomas Jackson), LL.D., b. in Dutchess co., N. Y., in 1783; graduated at Yale College 1801; became a lawyer at Poughkeepsie, N. Y.; became surrogate of Dutchess co. 1810; a member of Congress 1813–15 and 1827–29; member of the New York assembly 1815–16; attorney-general of the State 1819; appointed judge of the superior court of New York City 1828, and became chief-justice 1846. D. in New York City May 12, 1857.

Oak Park, post-v. of Cook co., Ill., on the Omaha and California line of the Chicago and North-western R. R., 8 miles W. of Chicago.

Oak Ridge, post-v. of Cape Girardeau co., Mo., 20 miles N. W. of Cape Girardeau City, has a high school, 2 churches, 1 flouring-mill, a good hotel, 1 newspaper, and stores and mechanical shops. Pop. about 300.

D. T. Stanley, Ed. "School Record."

Oak Ridge, post-v. and tp., Guilford co., N. C. Pop. 1022.

Oak Run, tp. of Madison co., O. Pop. 456.

Oak′um, the fibre of old tarred or untarred rope, used chiefly for calking ships. It was once always picked by hand, but a number of machines have been invented to perform the work.

Oak′ville, post-v. of Trafalgar tp., Halton co., Ontario, on Lake Ontario, at the mouth of Sixteen-mile Creek, which makes a good harbor, and near the Grand Trunk Railway, 22 miles E. by N. of Toronto. It is in a good agricultural region, and exports much produce. It has some shipbuilding. There is 1 weekly newspaper. Pop. of sub-district, 1684.

Oakville, post-v. and tp., Lawrence co., Ala. Pop. 1709.

Oakville, post-v., cap. of Live Oak co., Tex., 85 miles S. W. of San Antonio, has a good school, churches, 1 newspaper, a Masonic hall, 3 hotels, and stores. Pop. about 400.

E. Lawley, Ed. "Oakville Tribune."

Oak′wood, post-v. and tp., Vermilion co., Ill., on the Indianapolis Bloomington and Western R. R. Pop. 2364.

Oan′nes, the man-fish god of the Babylonians, resembling Dagon of the Philistines. He is said to have issued from the Persian Gulf, and to have founded the civilization of Lower Chaldæa. As represented by art, a man's head was under that of the fish, and a woman's feet were joined to its tail.

R. D. Hitchcock.

Oar, the long lever of ash, beech, or Norway fir by which vessels are rowed. Long oars for heavy vessels are called *sweeps;* those for sculling a boat are called *sculls.* The part of the oar which dips into the water is called the *blade;* the other end is the *handle;* next to this comes the *loom.* (For the use of the oar see Rowing.)

O′asis [from the Coptic word *ouahe,* a "resting-place," or simply an "inhabited place"] is a word now used as a general term denoting any cultivated or cultivable spot in a desert, but was by the ancients applied only to the four spots of this character found in the Libyan desert, along the Egyptian frontier. These four oases are—(1) Oasis Ammonia, the modern *El Siwah,* the first discovered, though the most distant from the Nile, situated in lat. 29° N., lon. 26° E., 6 miles long, 3 miles broad, and containing the ruins of the famous temple and oracle of Ammon, and the celebrated Fountain of the Sun, whose waters are "warm in the morning and evening, but cool at noon." (2) Oasis Magna, the modern *El Kargeh,* 80 miles long, 10 miles broad, stretching 90 miles W. of the Nile, from lat. 25° to 26° 6′ N., and abounding in ruins of the Greek, Roman, and early Christian period. (3) Oasis Parva, the modern *El Kasr,* five days' journey S. E. of El Siwah. (4) Oasis Trinytheos, the modern *El Dakleh,* situated in lat. 28° N., and containing several artesian wells. The history of these oases is very obscure, but is of great importance. The gigantic ruins show that they must have been inhabited very early, and attained, somehow, a prominent place in ancient civilization. They are never spoken of with indifference by the ancients. There was something about them which fired the imagination of the writers. Alexander's visit to the oracle of Ammon was considered as one of the greatest events of his life. Later, the Roman emperors used them as places of banishment—Juvenal was sent hither—and the Christians in their sectarian strifes often used them as places of refuge; Athanasius lived here, also Nestorius. At present they are possessed by a vigorous tribe of Arabs subject to Egypt, and contain several towns, of which *El Kargeh* is the most noticeable. With regard to the formation of these oases the ancients seem to have entertained very wrong ideas. They considered them as islands in a sea of sand, but they are rather lakes on a plateau. They are always formed by depressions in the surface, in which a layer of sand and clay is capable of retaining the water gathering at the bottom. Their "blessedness," although generally described with glowing colors, is comparative only. Their soil is often rich, and produces wheat, rice, maize, millet, dates, and other fruits, but as often it has a swampy character. They cannot be visited during summer and autumn, on account of the unhealthiness of their atmosphere.

Oasis, post-v. and tp., Waushara co., Wis. Pop. 634.

Oat, or **Oats** [from the Ang.-Sax. *ata,* "food"], a genus of grasses, *Avena,* containing many species, and generally characterized by having the spikelets in loose panicles, the glumes as long as the florets, the paleæ firm and almost cartilaginous, and the outer one of each floret provided with an awn, which is twisted at the base, but this generally disappears in cultivation. The cultivated oat (*Avena sativa*) is an annual, though the genus contains several perennial species, and is characterized by a very loose panicle, spreading on all sides, having two or three fertile florets in each spikelet, but not more than one floret awned. It is probably a development of the wild oat (*Avena fatua*) found in Europe, where it is considered a weed, and now wild in California, where it often spreads over large tracts of land and yields a good hay. The wild oat is characterized by having the inner palet and the grain covered with hair, and the outer palet provided with a very long awn, twisted near the base and bent in the middle. Experiments made by Prof. J. Buckman at the Royal Agricultural College, England, have shown that seeds of this species, when gathered ripe and sown next spring, produce a grain differing considerably from the mother-grain; and when this difference is further developed a grain is produced which has a strong resemblance to certain varieties of the cultivated oat. The most remarkable of these varieties are the potato oat, the black Poland oat, the naked oat (much esteemed in Ireland), the Tartarian or Hungarian oat, etc.; but the richest and most perfect variety is probably that raised in Scotland. The oat is decidedly a northern plant, though it does not reach so far to the N. as barley. It succeeds best in the northern part of the temperate zone; when brought farther S. and raised under a hotter summer, it degenerates very rapidly. The weight of a bushel of American oats varies between 30 and 35 pounds; that of a bushel of Scotch oats, between 40 and 50 pounds. The entire production of oats in the U. S. amounted in 1870 to 282,107,157 bushels, of which 42,780,851 bushels were raised in Illinois, 36,478,585 in Pennsylvania, 35,293,625 in New York, 25,347,549 in Ohio, etc. The awn or beard of all species of oat twists or untwists hygrometrically with varying humidity or dryness. This in some long-awned species, such as *Avena sterilis* (the animated oat), produces such free and active movement that it seems as if alive. Several species of oats are useful, not for their grain, but as fodder, such as the downy and the yellow oat-grass.

Oates (Titus, *alias* Ambrose), b. at London, England, about 1620; educated at Merchant Taylors' School and at Cambridge; took orders in the Church of England; held benefices in Kent and Sussex; became a chaplain in the navy; was dismissed from that post on a charge of disgraceful conduct; professed conversion to Roman Catholicism; became a Jesuit; resided some months in the colleges at Valladolid and St. Omer; was expelled from both institutions for alleged misconduct; returned to England 1678, and gave information to the authorities of the existence of a "Popish plot" for the extirpation of Protestantism in England, accusing several of the Roman Catholic nobility and gentry of participation in the pretended conspiracy. The admitted zeal for Roman Catholicism displayed by James, duke of York, and the suspected inclination of King Charles II. to the same faith, gave color to the charge, and the murder of Sir Edmondbury Godfrey, the magistrate before whom Oates's testimony was taken, produced conviction in the popular mind. Oates thereupon developed his original testimony into a circumstantial account of the intended burning of London and the shipping in the Thames, a massacre of Protestants, and a landing of a French army in Ireland, adding that the pope had entrusted the government of England to the Jesuits, that the chief offices of state had already been parcelled out among the great Roman Catholic lords, that the king was to be as-

sassinated, and that the queen was privy to the plot. An unexampled excitement was the result; the houses of Roman Catholics were searched, and extraordinary precautions taken against the supposed danger. Oates was lodged in Whitehall with a pension of £1200, and had guards assigned him. The accused Roman Catholics were put on trial Nov., 1678; several were convicted and executed: and fresh victims were added from time to time for two years. After the execution of Lord Stafford, Dec., 1680, there was a revulsion of public sentiment; the bad character of Oates was exposed; the duke of York obtained a verdict of £100,000 against him for defamation (1685), and he was imprisoned as a debtor. On the accession of James II. severer measures were taken; Oates was convicted of perjury, sentenced to stand in the pillory five times a year in as many different towns during his life, to be whipped from Aldgate to Newgate, and thence to Tyburn, and to be imprisoned for life. Public sentiment being now fiercely against him, he was mobbed and nearly killed at the first pillory, and received 1700 lashes at the whipping. After the accession of William and Mary, Parliament declared the conviction of Oates illegal, he was pardoned, received a pension of £400 per annum, and survived in obscurity seventeen years longer, dying at London July 23, 1705.

Oath [Ang.-Sax., *âdh*], in law. This is an open declaration or promise before some officer or court authorized to take it, accompanied by an appeal to the Supreme Being to attest the truth or sincerity of the declaration or promise. It is essential that the oath should be authorized by law. If not, it is termed *extra-judicial*, and has no legal validity, however it may affect the conscience. The principal distinction in this branch of the law is between oaths which assert an existing fact and oaths which are promissory in their nature. An instance of the latter is an oath of office, to the effect that the appointee will discharge its duties faithfully, or that an alien on being naturalized will support the Constitution of the U. S.

The true nature of the oath has elicited much discussion. Some jurists are of the opinion that the address to the Supreme Being is in the nature of an imprecation invoking His vengeance in case the attestation is wilfully false. Others—and apparently with more reason—maintain that it is in the nature of a warning or suggestion to man that the Deity will in the administration of His government fitly punish false swearing. Perhaps the reconciliation of the opposing views is to be found in the fact that on the institution of the oath in the early periods of the law the former view prevailed, while in its modern developed condition the latter has insensibly supplied its place.

The form of the oath varies in different states and countries. When a witness is called upon to testify in a court of justice, and he does not accept the prevailing religion, he is allowed to take that form which according to his view is the most binding upon his conscience. The rule is well expressed by Lord Starr in his *Institutes of the Laws of Scotland*: "It is the duty of judges in taking the oaths of witnesses to do it in those forms that will most touch the conscience of the swearers according to their persuasion and custom, and though Quakers and fanatics, deviating from the common sentiments of mankind, refuse to give a formal oath, yet if they do that which is materially the same, it is materially an oath." (See also the very able and luminous opinion of Chief-Justice Willes in *Omichund* v. *Barker*, Willes's Reports, 538.) Accordingly, if the witness should be a Gentoo, and should think the oath only binding on his conscience upon kissing the hand or foot of a Brahman, it should be administered in that manner. However, if the legislature should prescribe that a particular form of oath should be adopted, the direction must be followed if there be constitutional power to make the provision. Thus, where an act of Parliament required that a member of the House of Commons should take an oath "upon the true faith of a Christian," it was decided that as the plain intent of the legislature was to make that an essential part of the oath, it must be followed, even though it might exclude a Jew from sitting as a member of the House.

No one can properly take an oath unless he believes in a Supreme Being who will inflict punishment in case of wilful false swearing. There has been much diversity of opinion upon the point whether it is necessary that the belief should be in punishment in a future state. The better opinion is that this is unnecessary, and that it will suffice if there be a belief of future punishment in this world. Some courts go so far as to hold that it is enough if the punishment simply consist in the disapproval of one's conscience, though the soundness of this view is open to question. It will be assumed that the witness believes in the Christian religion unless there is some evidence to the contrary. The proper evidence is his own antecedent declaration. There are some courts that allow an interrogation of the proposed witness by the judge before he is sworn to testify. Other tribunals, with better reason, deem this proceeding inquisitorial, and not in accordance with the spirit of our institutions. If former declarations are used to show disbelief, the same kind of statements made subsequently must be allowed to prove that the condition of disbelief has ceased, and that belief has taken its place. It is maintained by some that when the person is offered as a witness, and objected to, he may then affirm that he is now a believer, and thus become competent. The objection to this view is that a declaration made under such circumstances is likely to be a mere device used on the spur of the moment and for the purpose of becoming a witness.

In some of the States there is a rule that a witness is not to be excluded on the ground of his religious belief. In New York there is the following sentence in the constitution: "No person shall be rendered incompetent to be a witness on account of his opinions on matters of religious belief." (Art. I., § 4.) It has been decided in the supreme court that this provision only prevents the exclusion on the ground specified of the person offered as a witness, and that his want of religious belief may still be used to affect his credibility before the jury, and that he may be interrogated before them for this purpose. It is open to doubt whether this construction was foreseen in the framing of the constitution, as it certainly much impairs the effect of the clause. The constitution of Michigan, as interpreted by the courts, adopts a more comprehensive rule, when it establishes the proposition that a witness can neither be excluded on the ground of religious belief nor examined with regard to it for the sake of impeaching his credibility.

It is common to provide in the statutes of the respective States different forms of oaths to meet to some extent the varying religious views of witnesses, and also modes of affirmation for those who do not think it lawful to take an oath. Thus, in New York the regular mode of administering an oath is for the person who swears to lay his hand upon and to kiss the Gospels. However, if one desires he may take the oath in the following form: "You do swear in the presence of the ever-living God," and while so swearing may or may not raise his hand at his discretion. And where a person shall declare that he has conscientious scruples against taking any oath or swearing in any form he shall be permitted to make his solemn declaration or affirmation in a specified manner.

The laws of the U. S. provide that in certain cases an oath of allegiance shall be taken in a prescribed form. These are cases where any person is elected or appointed to any office of honor or profit (1 R. S., §§ 1755, 1756), or where a person petitions to be declared a bankrupt (*Id.*, § 5018), or a person prosecutes claims as an attorney or on his own account before any of the departments or bureaus of the U. S. (§ 3478). Members of State legislatures and executive and judicial officers must declare upon oath that they will support the Constitution of the U. S. (*Id.*, § 1836). So an alien on becoming naturalized must take a similar oath, and must renounce and abjure all allegiance to every foreign prince or potentate (*Id.*, § 2165). T. W. Dwight.

Oaxaca. See Oajaca.

Ob, or **Obi,** a river of Western Siberia, rises in the Altai Mountains within the Chinese dominions, and flows in a northern and north-western direction, with a tortuous course of 2000 miles, into the Gulf of Obi, an inlet of the Arctic Ocean on the northern shore of Siberia. The Ob receives from the left the Irtish, which also rises in the Altai Mountains and joins the Ob 200 miles below Tobolsk. The Ob, navigable for more than 1600 miles, forms the commercial highway between China and European Russia.

Obadi'ah, one of the minor Hebrew prophets, of whom we know absolutely nothing. His book, the shortest in the Old Testament, is a fragment. Delitsch and Keil think it the oldest of the prophetical books; De Wette and Bleek think its author was an exile at Babylon; but we have absolutely no data for forming an opinion on the time when he lived. This book contains a remarkable passage parallel to Jer. xlix. 7–22. It is impossible to say which of the two prophets made use of the other's work.

Obeid', El, town of Central Africa, the capital of Kordofan, in lat. 13° 11′ N., lon. 29° 35′ E., on the Bahr-el-Abiad, is miserably built, but has some manufactures of plated works and silverware which evince both skill and taste, and carries on a considerable trade in gums, ostrich feathers, ivory, and tamarinds. Pop. about 20,000.

O'Beirne' (Thomas Lewis), D. D., b. in Longford co., Ireland, in 1748; educated at the Catholic college of St. Omer, France; became a Protestant; took orders in the Church of England; was chaplain on Lord Howe's fleet

at the beginning of the American war; preached at St. Paul's church, New York City, 1776; was private secretary of the lord lieutenant of Ireland 1782; received livings in Northumberland and Cumberland 1783; became chaplain to Earl Fitzwilliam; bishop of Ossory 1796; was translated to the see of Meath 1798, and d. there Feb. 15, 1823. Author of a poem, *The Crucifixion*, of a *Vindication* of the conduct of General and Admiral Howe in America, of political pamphlets, and of three volumes of sermons.

Ob'elisk [from the Greek *obeliskos*, a "spit," applied to square monolith columns terminating in a pyramidal apex and placed on a pedestal before Egyptian doorways]. Obelisks were called in Egyptian *texen*, and capped (*benben*) with gold, copper, or iron. The material of which they were made was limestone, basalt, red granite, or syenite, and their four sides inscribed with vertical lines of incused hieroglyphs recording the titles and merits of the person by whom dedicated and of the deity to whom they were sacred. Occasionally, they were uninscribed, but they generally have one, and often three, lines of hieroglyphs on each side, besides pictures of the monarch adoring the deity on the apex and sides. Obelisks were the prototypes of the triumphal columns of the Romans, and used for the same purposes, erected, it appears, at the temples only in honor of illustrious monarchs. Small obelisks of limestone with sepulchral dedications are found in the tombs of the fourth dynasty, but none of the great obelisks are older than the twelfth dynasty, one of which, of Osortesen I. of that line, is still extant at San, the ancient Heliopolis. From that period (1800 B. C.) to the time of Hadrian (A. D. 138) obelisks were in use. The proportions of these monuments were that the base was one-tenth the breadth of the elevation up to the top of the apex, and the pyramidion at the summit had the same height. They were placed upon bases also tapering from below, and stood in pairs, one before each jamb of a doorway. The tallest remaining, that of the Lateran at Rome, is 105 feet 7 inches high, and the shortest, that of the Florence Museum, 5 feet 10 inches. The Greek and Roman writers considered that they represented a sunbeam, and mention those set up by the kings they call Mesphres, Sothis, and Ramses, one of whose, 120 cubits high, was said to have employed 120,000 men in its construction and erection, to secure which the son of the monarch is said to have been tied to the apex. The prophet Jeremiah speaks of those of Heliopolis, called in hieroglyphs "the city of obelisks," from their great number. The Egyptians were averse to the erection of obelisks by their foreign rulers, and positively refused the honor to Darius. Ptolemy Euergetes II. and his wife, Cleopatra, however, erected two obelisks at Philæ of red granite, 22 feet high, before the temple in honor of Isis. The mode by which they were erected in Egypt is not known. It is supposed that they were floated in boats or on rafts during the high Nile to their destination, and then raised by inclined planes of woodwork and ropes. The Romans built for those transported to Rome special rafts or flat-bottomed boats of great size, rowed by as many as 300 oars, and elevated them by cords, pulleys, and frames by the labor of thousands of men. The principal architects who replaced them on their pedestals at Rome in the papal times were Fontana, Antinori, Laurent Bernin, and Camerti, who used similar machinery for the purpose. The obelisk of Luxor was removed from Egypt in 1833, and set up in the Place de la Concorde at Paris in 1834 by M. Lebas. The obelisks at Catania in Sicily and at Arles in France are not Egyptian. The Assyrians also used obelisks of smaller sizes and proportions, terminating in tops step-shaped four sides. One of Assur-nazir-pal (B. C. 880), 9 feet 4 inches high, found in the palace of Kouyunjik or Nineveh, is of white stone ornamented at the sides with reliefs. Another, of Shalmaneser (B. C. 850), of black marble, found at Nimrood, the ancient *Calah*, 6 feet 6 inches high, has at the sides reliefs recording the submission of Jehu, and an inscription, the annals of thirty-one years of his reign. Fragments of others have been discovered, and obelisks were not unknown in India, some having been set up at Seringapatam in the last century. SAMUEL BIRCH.

O'ber-Am'mergau, a v. of Bavaria, beautifully situated on the Ammer, 46 miles S. W. of Munich, is celebrated for the performance of a mystery representing the passion and death of Christ, which takes place here every ten years. The custom originated in 1634, when the population made a vow to this effect if the village escaped from the plague, which prevailed in the vicinity. The performance requires 350 actors, who are chosen among the inhabitants themselves, lasts from 8 A. M. to 4 P. M., is repeated on twelve succeeding Sundays, and attracts generally very large audiences, as it is the only place in which mysteries are still performed in true mediæval style. (See Eliza Greatorex, *The Homes of Ober-Ammergau* (New York, 1873), and Holland, *Das Ammergauer Passionsspiel im Jahre 1870.*)

O'ber-Brem'en, a v. of German tp., Auglaize co., O. Pop. 423.

O'berlin, post-v. of Lorain co., O., 35 miles S. S. W. of Cleveland, on the Lake Shore and Michigan Southern R. R., contains Oberlin College, 2 business colleges, a telegraph school, a national bank, 1 weekly newspaper and a college semi-monthly paper, and stores. Pop. 2888.
J. H. BATTLE, ED. "OBERLIN NEWS."

Oberlin (JEAN FRÉDÉRIC), b. at Strasbourg Aug. 31, 1740; early evinced a remarkable degree of benevolence; was educated at the Strasbourg University; was ordained to the Lutheran ministry; became in 1767 pastor of Steinthal or the Ban de la Roche, a wild district in the Vosges Mountains. Here, under his unselfish and wisely-directed care, the desert soon began to blossom; deep ignorance was succeeded by general intelligence; moral darkness gave place to prevalent piety, pure morals, and a remarkable improvement in the industry and thrift of the community. The Ban de la Roche was visited by great numbers of philanthropists, to whom Oberlin's work served as a model. Died at Walbach June 1, 1826. His biography has been written in France, Germany, England, Denmark, etc., and by H. Ware, Jr. (Boston, 1845).

Oberlin (JÉRÉMIE JACQUES), brother of J. F. Oberlin, b. at Strasbourg Aug. 7, 1735; educated at the Strasbourg University, where he became librarian in 1763, professor of rhetoric 1770, and professor of logic and metaphysics 1782; published works on *Roman Rites* (1774), on the *Minnesingers of Alsace* (*De Poetis Alsatiæ Eroticis*, 1786), Latin texts for schools, etc. D. at Strasbourg Oct. 10, 1806.

Oberlin College, at Oberlin, O., was founded in 1833 by Rev. John J. Shipherd and Philo P. Stewart. It was chartered Feb. 28, 1834, as Oberlin Collegiate Institute, which name it retained until 1850, when it was changed to Oberlin College. The plan was to establish a Christian school for the liberal education of both sexes, encouraging students to assist themselves by manual labor. By 1835 there were theological, college, ladies', and preparatory departments; with the addition, since 1867, of a conservatory of music. The theological seminary has an intimate but not organic relation to the Congregational churches of the land. The seminary building contains accommodations for 60 students, besides the chapel and lecture-rooms. In the department of philosophy and the arts there are (1) the classical and scientific, or "college," course, and (2) the literary. The studies of the former are so arranged that after the freshman year the student can give a classical or a scientific character to his course by a system of elections. The literary course omits all the Greek and part of the Latin and mathematics. The department of preparatory instruction embraces (1) a classical school with a three years' course, and (2) an English school. The faculty consists of the president, 12 professors, 3 principals, and 14 lecturers, tutors, and instructors. In the preparatory schools there are about 40 teachers. Graduates from theology receive the degree of B. D.; those from college that of A. B. The productive endowment for the theological department is $30,000; for the other departments, $115,000. Scholarships rent for $9 a year, and incidentals are $9 more. The college library contains 11,000 vols.; literary societies have a library of 3600 vols. The long vacation has always been in the winter, to accommodate the large number of teachers among the students. The year ends the first week of August. Rev. Asa Mahan was president from 1835 to 1850; Rev. Charles G. Finney, from 1851 to 1866, when Rev. James H. Fairchild was appointed. The board of trustees is a close corporation of 18 members. Since 1835 no student has been rejected on account of his color; 28 persons of color have received the degree of A. B., and 21 have completed the literary course. ALBERT A. WRIGHT.

Obes'ity [Lat. *obesitas;* synonyms, *Polysarcia, Corpulence*], an abnormal deposit of adipose tissue under the integument and around the viscera. The amount of adipose tissue in the organism may be considerably augmented without giving rise to any inconvenience on the part of the individual in the way of encumbering his movements or interfering with the functions of the viscera, etc.; but such a condition would not come within the scope of this article. It is still a condition of health, and the term *obesity* should only be applied to those cases where the deposit of fat is so great as to incommode the patient. Of the causes of obesity we may mention, first, *hereditary susceptibility.* It is not at all uncommon to meet certain families in which most of the members are corpulent, and sometimes the tendency to become so may be traced through several successive generations. Inactivity and sedentary occupations exert a very material influence over the production of fat, especially when combined with a rich diet. In women the predisposition to corpulence exists in the first years of child-bearing, and again after the "change

of life;" in men, between the ages of forty and sixty. The exciting cause is generally found to be malassimilation, due to some derangement of the digestive organs. We mostly find it in individuals who indulge in a rich diet, and especially if it contains fatty matters. Articles abounding in sugar and starch and alcoholic and malt liquors seem to favor the production of fat to no inconsiderable extent. The symptoms of obesity may be enumerated as follows: Diminution of mental and bodily activity, impeded action of the viscera, the organs of respiration, circulation, and digestion. The slightest exertion will bring on panting; the blood is comparatively deficient in quality and quantity, and, as a result, the muscles become weak and flabby. The countenance becomes bloated and sallow, and the patients are liable to suffer from a variety of affections which depend on malassimilation, as gout, rheumatism, etc. Often fatty degeneration of the heart or liver coexists, and we then have the symptoms of these maladies superadded. Mr. Harvey has shown, in his late work on corpulence, that the senses of *hearing, taste, smell,* or *sight* are often absent altogether or blunted to a very annoying extent in corpulent persons. In the treatment of obesity alkalies internally and alkaline baths have long occupied a prominent place, and even at the present advanced stage of medical science we hear physicians daily prescribing small doses of soda, potassa, etc., with a view to procure a saponification of the fat in the interior of the body. Such a course of treatment is simply ridiculous. If a jockey wishes to "condition" a horse that has acquired too great a deposit of adipose tissue, does he administer small doses of the bicarbonate of soda or bathe him in alkaline water? Certainly not. The course he adopts is a well-known one, and is pursued also by professional pedestrians, gymnasts, etc. It consists of a regulated diet and systematic exercise in the open air. The case of corpulence treated successfully which has gained the greatest notoriety is that of Mr. Banting. He adopted a regular course of dieting, in which there was an absence of fatty, starchy, and saccharine matters. This should be rigidly adhered to, and in addition no alcoholic or malt liquors should be partaken of whatever. Above all other things, both body and mind should be exercised daily. EDWARD J. BERMINGHAM.

O'bi, or **Obeah,** a form of pretended witchcraft practised by persons of African descent in the West Indies, and to some extent in the Southern U. S. Obeah men and women have often a great influence over the degraded of their race. The practice is often attended with great excesses.

Obi'on, county in the N. W. of Tennessee, bounded N. by Kentucky and W. by Reelfoot Lake and River. It is level and very fertile. Tobacco, cotton, corn, and live-stock are the staple products. The county is traversed by the Mobile and Ohio, the Nashville and North-western, and other railroads. Area, 500 square miles. Cap. Troy. Pop. 15,584.

Ob'iter dictum [Lat.], a remark or suggestion made by a judge or a court in disposing of a question which is not necessary to its decision, sometimes termed a *dictum.* Such a suggestion is not regarded as authoritative when the point comes up for positive decision. A *dictum* may, however, have much influence from its reasonableness or from the high reputation of the tribunal from which it emanates. Much law is generated in this manner, one court uttering dicta and another at a later date embodying them into decisions. It is not uncommon for reporters of decisions to call attention to *dicta* in the abstracts made by them of the substance of judicial opinions. The technical way of showing that the remark is a dictum is to employ the phrase "it seems." In the early reports the equivalent expression is "*Semble.*" T. W. DWIGHT.

Oblates' [Lat. *oblatus,* "offered"], in the Roman Catholic Church, are persons of either sex associated after the manner of monks or nuns, but without solemn vows. Some oblates are secular priests; others are without orders.

Oblates of Mary Immaculate, a congregation of regular clerks, founded in 1815 by Bishop Mazenod of Marseilles. They visit the poor and the prisons.

Oblate Sisters of Providence, a sisterhood of the Roman Catholic Church, founded in 1825 at Baltimore.

Obliga'tion. The ordinary meaning of this term in the common law is a bond containing a penalty; with a condition annexed for the payment of money or the performance of covenants. It is an instrument under seal, whereby a person binds himself under a penalty to do something. The meaning of the word *obligatio* ("obligation") in the Roman law is much more comprehensive. In that system of jurisprudence it refers to the legal tie or bond which obliges to the performance of some act. According to Justinian, *Obligatio est juris vinculum qua necessitate adstringimur alicujus solvendæ rei, secundum nostræ civitatis jura.* In other words, it is the legal bond by force of which we are bound to perform an act according to the laws of the state. Such an obligation might arise either from the assent of parties according to prescribed forms, and constituting a contract, or from a delict (or wrong). This last signification of the word "obligation" sheds light upon an expression in the U. S. Constitution, "the obligation of contracts." T. W. DWIGHT.

Obliga'tion of Contracts. The U. S. Constitution (Art. I. Sec. 10) contains a clause that "No State shall pass any law impairing the obligation of contracts."

I. *What are the Contracts embraced within the Prohibition?*—All executory contracts between private individuals, whether express or implied, are clearly protected by the constitutional provision. The same is true of all grants, conveyances, and other executed contracts; and it is fully settled that statutory and other grants made by a State through its legislature or otherwise are also executed contracts, and cannot be repealed by subsequent laws. As a corollary from the general proposition, the Supreme Court of the U. S., against the strong and repeated protests of the State tribunals, has firmly established the doctrine that charters of private corporations are contracts in the nature of grants, and cannot be repealed or modified unless the power to do so has been reserved in the manner hereinafter described. This general subject of private charter involves three distinct questions: Whether the charter in its general scope, as a gift of franchises to the corporation, is a contract? Whether the special stipulations in it, not necessary to its existence, which restrict the State in the exercise of its governmental powers, are contracts? And whether any contract on the part of the State can be implied from the terms of the charter? These questions have been fully discussed and answered, and are now put at rest. In the celebrated and leading case of Dartmouth College (1819) the Supreme Court decided that such a charter is a contract between the State and the corporation, and this ruling has been reaffirmed in every subsequent judgment involving the subject-matter down to the present time. The second question has been passed upon in a no less definite manner. The collateral stipulations usually contained in charters which have received a judicial construction are of two classes—those which restrain the State's power of taxation over the newly-created corporation, and those which limit the exercise of its power of eminent domain toward that body; as illustrations, a clause in a bank-charter exempting it from taxation either entirely or beyond a specified amount, and a provision in the charter of a toll-bridge that no other bridge shall be constructed or authorized within a certain distance up and down the stream. Through a long succession of decisions the U. S. Supreme Court has uniformly upheld these collateral stipulations—has declared them contracts binding upon the State and completely protected by the constitutional guaranty. In opposition to this view it has been contended that the States cannot thus bargain away their highest governmental functions; but the dissent of the State tribunals has, for the present at least, been entirely overcome. Whether a State may alienate its police power by contract has not yet been finally determined; so far as the State courts have spoken, they have answered the question with an emphatic negative. In the third place, it is the settled doctrine that no contract can be implied from the charter; in order to be binding upon the State the agreement must plainly appear in the express language of the instrument. The following conditions, relations, and arrangements are not contracts within the meaning of the constitutional prohibition: Marriage, although often called a contract, is not, according to the decided weight of authority, protected or affected by the provision. It is also established beyond a doubt that all arrangements which are political in their nature, and to which the State is a party, are not contracts, and do not fall within the guaranty. Of these the most important are the charters of municipal corporations. Over such corporations and their charters the legislature, unless restrained by the State constitution, has complete power. Public offices, licenses to carry on particular trades, and the like, statutory permission to sue the State, grants of authority to establish lotteries, are not contracts between the State and the individuals holding the privilege, and may therefore be abolished or changed by subsequent legislation. It should be observed, however, that when the prior power to do so has been reserved by a State, it may to a certain extent interfere with contracts made while such reservation is in force.

II. *What is the Obligation of Contracts?*—The true interpretation of this phrase has been finally determined by the national court of last resort. The principal question which had been at issue was, whether the obligation includes the remedy given by the law to enforce a contract, as well as the rights and duties of performance arising from its very terms; and the doctrine is now most right-

eously established that it does. In a recent judgment of the U. S. Supreme Court the results of the prior decisions were summed up as follows: "These propositions may be considered consequent axioms of our jurisprudence. The laws which exist at the time and place of making the contract and where it is to be performed enter into and form a part of it. This embraces alike those which affect its validity, construction, discharge, and enforcement. Nothing is more material to the obligation of a contract than the means of its enforcement. The ideas of validity and remedy are inseparable, and both are parts of the obligation which is guarantied by the Constitution against impairment. The obligation of a contract is the law which binds the parties to perform their agreement. Any impairment of the obligation of a contract—the degree of the impairment is immaterial—is within the prohibition of the Constitution." The obligation is not simply what the parties have in terms agreed; it is the legal effect given to those agreements by the whole of the existing law applicable to the contract—the rights and duties which the law creates from the fact of the contract being made.

III. *What State Laws impair the Obligation of Contracts?*—Three general principles must furnish the correct answer to this question in each particular instance of State legislation. (1) The prohibition is not against destroying, but impairing. Destroying the obligation of course impairs it, but impairing does not necessarily destroy. (2) In order that a statute may impair their obligation it must operate upon contracts existing at the time of its passage; and so far as it purports to accomplish this result it is void. (3) When a legislature has passed laws affecting contracts, such as insolvent, exemption, stay, appraisement, redemption, limitation laws, and the like, or when it has reserved in prior general statutes or otherwise, the authority to repeal or modify the charters of corporations, the operation of such statutes, and the legislative acts done under such reservation, do not impair the obligation of contracts subsequently made or of charters subsequently granted. All laws which can impair the obligation of contracts must apply either to the very terms of the agreements, or to the remedy by which they may be enforced. With the first class there is no difficulty. They are so plainly prohibited that, with two notable exceptions, they have seldom been enacted. These exceptions are statutes providing for the discharge of insolvent debtors and those repealing or altering private charters. Insolvent laws cannot operate upon past contracts, but may be valid in respect to those made subsequent to their passage. Nothing additional need be said concerning the repeal or modification of charters. The exercise by a State of its functions of taxation, eminent domain, or police, although contracts may be indirectly affected thereby, does not fall within the constitutional guaranty, since all private rights of property are held subject to these powers. In relation to the second class of laws the following fundamental principles are now settled: Statutes which deal simply with the modes of procedure whereby the real remedy is obtained do not affect the obligation. Statutes which act upon the remedy itself—the relief given by the law when the contract was made—and take away, diminish, or render it of substantially less value, do impair the obligation; but they are valid so far as they apply to contracts made after their passage. Among such laws the most important and common are those staying execution or judgment; those requiring property to be sold on execution at an appraised value or to be accepted by the creditor at such valuation; those exempting the debtor's property from liability; those authorizing the judgment-debtor to redeem his property; statutes of limitation which do not leave a reasonable time within which to sue, and the like. These various classes of statutes, passed in aid of debtors, have been sustained by many State courts, but the principles established by the U. S. Supreme Court plainly and inevitably condemn them all so far as they purport to operate retrospectively upon existing agreements. How far the power of a State legislature extends, under the usual reservation of authority over charters, has not been fully determined. A State cannot, under color of such a reservation, impair the validity of all contracts, and thus completely evade the inhibition, nor can it abrogate agreements made between private persons and corporations, even though the latter are municipal. The franchises conferred upon a private corporation may be revoked or changed, but how much further a legislature may proceed by virtue of its reserved power of repeal and amendment remains to be determined by the highest court of the nation. JOHN NORTON POMEROY.

Oblique′. In music, the motion or onward progress is said to be "oblique" when one of the parts ascends or descends, while another part, with which it is compared, remains stationary.

Ob′long, post-v. and tp., Crawford co., Ill. Pop. 1490.

O′boe, or **Hautboy** [Fr. *hautbois*], a musical wind-instrument of an elongated conical form and with a high piercing tone, ranging from C below the treble clef to G, the fourth line above the staff. It was formerly used only in military music, but is now, especially since Weber and Meyerbeer, much used in all compositions for orchestra.

Ob′olus (Eichwald) and **Obolella** (Billings), small discoidal shells of the family Lingulidæ amongst the Brachiopoda, so named from their resemblance in form to a small Greek coin. Several species of the former occur in both Upper and Lower Silurian rocks, but the latter has only been found in the Potsdam sandstone at the base of the series. EDWARD C. H. DAY.

Obolus [Gr. ὀβολός, fr. ὀβελός, a "spit"], a Greek coin, first made of iron and copper in the form of the head of a spit, but afterwards struck of silver and in the ordinary round shape. The obolus was one-sixth of a drachm, and in value equal to $1\frac{5}{8}d$.

Obooki′ah (HENRY), b. in Hawaii in 1792; came on a merchant vessel to New Haven, Conn., 1809; was placed in an academy; educated for the ministry; translated the book of Genesis into Hawaiian, and d. at Cornwall, Conn., Feb. 17, 1818. He was the cause of the establishment of American missions in the Sandwich Islands.

Oboyan′, town of Russia, government of Koorsk, on the Pola, has a considerable trade in corn, cattle, wax, bristles, and hemp. Pop. 5000.

O'Bri′en, county in the N. W. of Iowa. Area, 576 square miles. It is undulating, fertile, and adapted to grain-culture. Timber is deficient, the streams abound in fish, and the fertile prairies are resorted to for game. Cap. Pringhar. Pop. 715.

O'Brien, post-v. of Liberty tp., O'Brien co., Ia., on Little Sioux River. Pop. 79.

O'Brien (FITZ-JAMES), b. in Ireland in 1829; came to the U. S. in 1850; became a journalist and writer for magazines; contributed some brilliant sketches and poems to the *Atlantic Monthly;* volunteered into the New York 7th Vols. Apr., 1861; became a member of Gen. Lander's staff; displayed intelligence and courage as a soldier; was wounded in a skirmish Feb. 16, and d. in Virginia Apr. 6, 1862, from lockjaw resulting from a surgical operation.

O'Brien (Capt. JEREMIAH), b. at Cork, Ireland, 1740; settled at Machias, Me., before the Revolution, and was the leader of the party which captured the British armed schooner Margaretta in Machias Bay, May 11, 1775, the the first act of hostility by sea during the war. He received a commission as captain of privateers, and took several British vessels; was captured and confined a year in England; afterwards collector at Machias, where he d. Oct. 5, 1818.

O'Brien (WILLIAM SMITH), b. at Dromeland, county Clare, Ireland, Oct. 17, 1803, son of a baronet of ancient lineage; educated at Harrow and at Trinity College, Cambridge; entered Parliament for the borough of Ennis 1826. Though at first a Tory and warm opponent of O'Connell, he was returned in 1832 as an advanced Liberal for the county Limerick, which he represented thirteen years; was active in support of Catholic emancipation, and became a prominent leader in the agitation for the repeal of the legislative union between Great Britain and Ireland. Confined for a few days in May, 1846, for refusing to serve on committees of the House of Commons, he became identified with the revolutionary party in Ireland, where it was proposed to establish a republic; went to Paris Apr., 1848, as a representative of the Irish Confederation to solicit aid from the French republic; aided in convoking an Irish national convention (May), which was not allowed to meet; was tried for sedition in the same month, but acquitted; attempted a rising among the peasantry at Mullinahone, in the S. of Ireland, July, but was compelled to flee; was captured at Thurles Aug. 5; tried and convicted by a special commission at Clonmel, with T. F. Meagher and MacManus, on a charge of high treason (Oct. 9); sentenced to be hanged, drawn, and quartered; was transported for life to Tasmania July, 1849; faithfully observed a promise not to try to escape; was pardoned 1856; travelled in the U. S. 1859; published a manifesto to the Irish in America in favor of the seceding States 1861, and d. at Bangor, North Wales, June 17, 1864.

Obsequies. See FUNERALS.

Observan′tine Friars and Nuns [*Fratres strictioris observantiæ*]. The primitive rule of St. Francis, like that of many other orders of monastics, having been modified by various popes on account of the extreme severity of its discipline, there arose within the order a new party desirous of returning to the austere rule of former days.

Certain followers of the severe rule in 1368, under Paoletto di Foligno, were organized as a separate congregation, called "Brethren of the Stricter Observance," or Observantines; these are now, as they have long been, far more numerous and influential than the Conventuals, or followers of the mitigated rule. The Capuchins and other congregations follow a still severer rule, and are called "Brethren of the Strictest Observance."

Observ'atory [Lat. *observare*], **Astronomical.** By observation, in the scientific or otherwise philosophical sense, is to be understood an attentive and scrupulous notice of phenomena; and an observatory is a place fitted for making such observations. As astronomy is the oldest of the physical sciences, so astronomical observations in some form have been early in use, previously even to the device or the arrangement of any special place for making them. Among the simple instruments first employed was the gnomon—*i. e.* a perpendicular post of some determinate height, by the measurement of which, and of the length of its shadow, the sun's angular distance from the zenith was determined. Observations of some sort, and even some sort of observatories, would seem to have been early in use in China. The great Egyptian pyramids are, as is well known, so placed that the outlines of their bases mark the four cardinal points, N. and S., E. and W.; and of nine of these pyramids still existing at Gizeh, the six largest have the narrow passages by which alone they can be entered opening in their northern sides, and inclined downward at nearly the same angle in every case. From the mean of the measurements of Col. Vyse it results that this angle is 26° 47′, "and of the two pyramids of Abousseir also, which alone exist in a state of sufficient preservation to admit of the inclination of their entrance passages being determined, one has the angle 27° S., the other 26°." At the bottom of every one of these passages, therefore, the *then* pole-star must have been visible at its lower culmination—a circumstance which can hardly be

FIG. 1.

Tycho's Observatory.

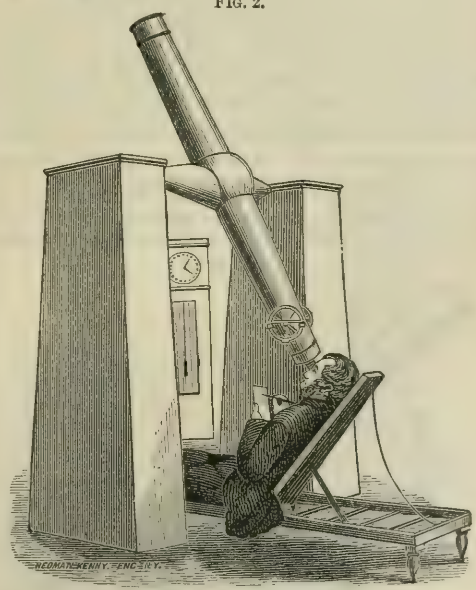
supposed to have been unintentional, and was doubtless connected (perhaps superstitiously) with the astronomical observation of that star, of whose proximity to the pole at the epoch of the erection of these wonderful structures we are thus furnished with a monumental record of the most imperishable nature." (Sir J. Herschel, *Outlines of Astronomy* (319 and 320).) The star here spoken of is *α* Draconis, which at the epoch of the erection of the Great Pyramid must have had at its lower culmination an altitude not far from 26° 16′.

After the death of Alexander the Great, Egypt, in the division of his empire, fell to the lot of Ptolemy Soter, himself an eminent patron of science. His son, Ptolemy Philadelphus, presented to the scientific men of Greece, who flocked to his kingdom, a vast edifice located at Alexandria which contained an *observatory*, and also the famous library collected, with great care and expense, by Demetrius of Phaleria. Thus was founded the Alexandrian school. Its first observers were Aristillus and Timocharis, about 300 years before the Christian era. Their observations were 150 years afterward made use of by Hipparchus in his determination of the precession of the equinoxes. These astronomers were succeeded by Aristarchus of Samos (about 281 B. C.), and he again by Hipparchus of Bithynia (about 150 B. C.), as already intimated, who would have been a man distinguished in any age. He, if any one, is regarded as the father of the veritable science of astronomy. After Hipparchus in the Alexandrian school came Ptolemy, who, in his great work, the Μεγάλη Σύνταξις—styled by the Arabs *Almagest*—has collected and discussed what seemed to him valuable in the acquisitions of his predecessors, in so far as he could attain unto them. Our space admits of but a bare mention of the ancient observatories of the Arabs and others—viz. two at Cairo; one at Bagdad; that at Meragha, under the charge of Nazir-ed-Deen; and that of Olug Beg at Samarcand.

After the revival of letters in Europe the first regular observatory, according to Weidler, was that erected by William, landgrave of Hesse, at Cassel in 1561. Under the patronage of Frederick III., king of Denmark, Tycho Brahe constructed and maintained his observatory at Uranienborg, on the island of Hveen, in the Baltic, near Copenhagen. Tycho commenced his observations there in 1582, and he continued them in the same place till 1593. Driven thence by official jealousy and interference, he afterward formed the acquaintance of Kepler, to whom he furnished the valuable observations afterward made use of by Kepler in the discovery of his famous three laws. Tycho died in 1601. The instruments which he employed were of vast size, and they were subdivided with more care than had heretofore been usual. (Tycho's observatory is represented in Fig. 1.) It was in Denmark also that was established the earliest *national* observatory of modern Europe—viz. the observatory of Copenhagen, which was commenced in 1637, though it was not completed till 1656. The first astronomer appointed to the directorship of the observatory was Longomontanus, himself the pupil of Tycho Brahe.

The telescope was invented in 1609, and in 1640 Gascoigne applied the telescope to the quadrant and the

FIG. 2.



The Transit Instrument.

micrometer to the telescope. The Royal Observatory of Paris was constructed in 1667–71. The Greenwich Royal Observatory was established in 1675, and it began its operations in 1676. The Tusculan Observatory in Copenhagen was built in 1704 for Römer, the discoverer of the velocity of light. Peter the Great caused an observatory to be constructed at his capital in 1725; the observatory at Dorpat was in active operation in 1811; and in 1839 the observatory at Pulkowa, near St. Petersburg, was erected by the order of the emperor Nicholas. The observatory at Königsberg dates about 1813, and that at Berlin about 1834. The observatory at the Cape of Good Hope was in existence in 1821. Not to mention others here, the Royal Observatory of Edinburgh was in use about 1825; the observatory at Sydney (formerly at Paramatta) in Australia dates from 1820; the U.S. Naval Observatory dates from 1842. (Extensive lists of public and private observatories, with their geographical positions, are annually published in the English *Nautical Almanac* and in the American *Ephemeris and Nautical Almanac.*)

Among the most useful instruments employed in the modern observatory are the transit instrument, the equa-

torial, and, as timekeepers, the clock keeping sidereal and that keeping mean solar time. (For distinction of solar and sidereal time see article MOON.) The transit instrument is so constructed and mounted as to move accurately in the plane of the meridian. It is furnished with several levels and a circle for measuring altitudes. The front of the eyepiece of the telescope is a reticule—*i. e.* an arrangement of actual spider's-lines, or else of very fine wires or tubes (see MICROMETER), of which, commonly, at least five are vertical and one horizontal, the vertical lines or wires being placed symmetrically, so that one of every corresponding pair of them is at the same distance on the one side of the middle one that the other is on the other. The middle one of the five is adjusted to be and to move in the plane of the meridian; and the apparent transit of a heavenly body taking place, as respects the vertical pairs, at one is as much earlier as at the other it is later than the middle time, the mean of all the five times of transit should coincide with that of the middle spider-line or wire. The position of an observer while taking observation of a transit is shown in Fig. 2.

The practice of observing transits across five vertical wires was first introduced by Dr. Maskelyne, the English astronomer-royal at Greenwich, who was also the first to note transits to tenths of a second. When the altitude circle of the transit instrument is greatly enlarged, it is then known as a meridional or transit circle. Among the finest examples of this are those in the Royal Observatory at Greenwich, that in the U. S. Naval Observatory at Washington, and that in the Dudley Observatory at Albany, N. Y.

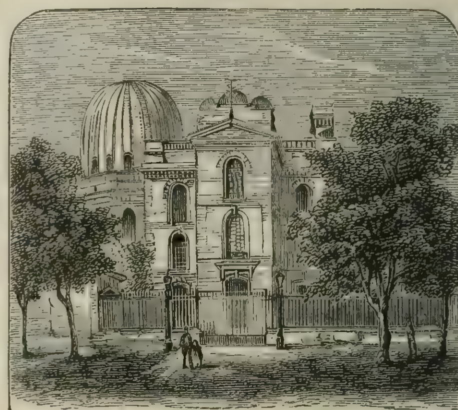
In the equatorial instrument the telescope is mounted on an axis pointing to the pole of the heavens, and in its rotation around that axis the telescope thus mounted will mark out and follow the apparent diurnal course of a heavenly body in the equinoctial (*i. e.* the great celestial equator) or a parallel to the same. Fig. 3, here inserted, is a representation of the great equatorial at Washington, the telescope of which has an aperture of 26 inches, and a focal distance of object-glass of 33 feet. The equatorial instrument at Chicago, Ill., has an aperture of 18 inches; and that of the observatory at Cambridge, U. S., has an aperture of 14.95 inches, and a solar focus of 22 feet 6 inches. The equatorial instrument, like other instruments employed in careful measurements, is armed with a micrometer, which, as its name implies, is an instrument for the measurement of small quantities—of small angular quantities when it is used for astronomical purposes. With the micrometer the angular distance of any planetary body from a neighboring fixed star of ascertained position is determined.

FIG. 3.

The Washington Telescope: A, section of objective; *a*, front of telescope, crown glass; *b*, flint.

For the more accurate observation of transits or other observations of a like kind, it is now not unusual to connect with the timekeeper an apparatus for alternately joining and breaking the circuit of an electro-magnet, and thus marking every alternate second on a paper band which is unwound at a uniform rate. Then the precise moment of a transit is indicated on the same band of paper by a breaking of the circuit, by means of a key under the control of the observer. This arrangement permits the second-spaces on its record to be subdivided into 100 parts, and thus observations noted to hundredths of second. And, in addition to this, the arrangement admits of a largely increased number of the parallel wires in the telescope, as was indicated by the late Sears C. Walker. This method of observation is known as the American method, it having been first introduced under the superintendence of, and in connection with, the American Coast Survey arrangements. The first attachment to a clock-pendulum for forming and breaking circuit was that devised by the late John Locke, for which he was rewarded by Congress.

FIG. 4.



Observatoire National, Paris.

Of all the various astronomical observatories, national or otherwise, that at Greenwich, as it is one of the oldest, is also one of the most, if not *the* most, memorable. The observations of its astronomer-royal, Bradley (1750–62), furnished Bessel with the material which he made use of in the determination of his *Fundamenta Astronomiæ pro anno 1755, deducta ex observationibus viri incomparibilis, James Bradley in specula Grenovicensi per annos 1750–62, institutis.* (Bradley is the well-known discoverer of aberration and nutation.) For more than half a century Dr. Maskelyne was astronomer-royal at Greenwich. His observations were mainly those of the sun, moon, and planets, and a select number of stars. When the French astronomers issued new tables of the sun and moon, a number of copies were sent to Dr. Maskelyne, who in the note of presentation was characterized as being the author of the most precious collection of observations then existing. Dr. Maskelyne died in 1811. The present astronomer-royal, Sir George B. Airy, has introduced into the observatory a practice which he began when astronomer at Cambridge—viz. that of reducing all observations as soon as they were made. Upon his recommendation the lords commissioners of the admiralty defrayed the expenses of reducing all the observations of the moon and planets made at Greenwich from 1750 to 1830. Quite recently, M. Leverrier, in his communication to the French Academy on a comparison of the theory of Saturn with observations, makes the statement that the tabular comparison which he gives is entirely based upon the Greenwich observations, the only observatory at which a series is found extending without interruption for 120 years—from 1751 to 1869.

Our limits do not permit us to speak particularly of the labors of Struve at Dorpat, of Bessel at Königsberg, and those of other astronomers. But mention should at least be made of the observations of Sir William Herschel at his own observatory at Slough, where he discovered the planet Uranus in 1781, and of his extended observations of planets, their satellites, the binary stars, and nebulæ, as also of the labors of his even more distinguished son at his station for eight years at the Cape of Good Hope, the results of which appear in his volume of *Cape Observations.* The observations of the late earl of Rosse at his observatory (now located at Birr Castle, Ireland) with his great reflector—viz. observations of clusters and nebulæ—deserve more than a passing notice. On the night of Sept. 19, 1848, an eighth satellite of Saturn was detected simultaneously (within the same hour) by Mr. William C. Bond at the Cambridge (U. S.) Observatory and Messrs. Dawes and Lassell, observing together, in Mr. Lassell's observatory at Starfield, Eng.; and at the Cambridge (U. S.) Observatory Nov. 11, 1850, Prof. George P. Bond discovered the dusky ring of Saturn. The planet Neptune was discovered at the National Observatory at Berlin by M. Galle, Sept. 23, 1846.

The U. S. Naval Observatory at Washington has always shown great activity, and the results of its labors are not only to be learned from its published observations, but also from the publications with which it has enriched the volumes of the *Smithsonian Contributions to Knowledge.* The observatories at Hamilton College, Clinton, N. Y., and that at the University of Michigan at Ann Arbor, have become noted for the discovery of minor planets, Prof. Peters being the observer at Clinton, and Prof. Watson at Ann Arbor. S. ALEXANDER.

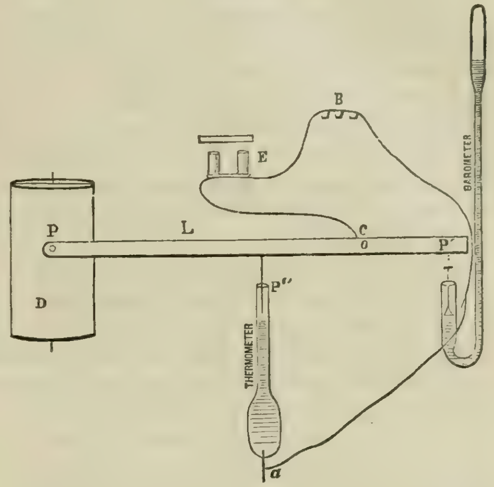
Observatory, Meteorological. The usefulness of automatic meteorological instruments cannot be overestimated, since it is only from the study of continuous and minute changes that the meteorologist can ever hope to discover the laws appertaining to the ever-changing phenomena of the atmosphere. A meteorological observatory, fully equipped, should be provided with instruments capable of registering the following: Pressure; temperature; moisture; direction of the wind; velocity of the wind; rainfall; evaporation. Automatic mechanism for the registration of the direction and the velocity of the wind and the fall of rain has long been in successful operation, since in all of these cases there is sufficient *mechanical* force to operate mechanism without introducing a serious error in the results. But the automatic registration of pressure and temperature is a more difficult problem, and it is only within a recent period that meteorologists have succeeded in devising methods and mechanism of sufficient delicacy to meet the demands of modern science.

Methods.—The methods of registration employed by meteorologists may be divided into four general classes: (1) Records made mechanically by force derived directly from the changing medium; (2) Continuous records made photographically on a moving sheet of paper; (3) Discontinuous records made at stated intervals by means of electro-magnetism; (4) Continuous records similarly made, together with results printed in ordinary numbers at definite intervals. For the mechanical registration of the barometer numerous devices have been contrived. In case a siphon is employed, the recording pencil is moved by means of a float resting on the surface of the mercury in the open leg, and made to press against the paper at definite intervals. All instruments of this class are simply modifications of the wheel barometer. Since the record on the recording sheet has a scale several times greater than the fluctuation of the column, the *mechanical* force controlling the pencil is less than five grains for a change of pressure of one-hundredth of an inch in a tube of one inch. Hence, owing to the friction and inertia of the float-mechanism, such machines can only give approximate results. In case a cistern barometer is employed, the tube is suspended on a lever, with the lower end resting in a fixed cistern of mercury. As the pressure varies, the lever on which the tube is balanced changes its inclination, and by attaching a registering pencil the fluctuations are recorded on a moving cylinder. The same objection as in the preceding case is applicable to this form of apparatus, since the registering point is urged forward by the weight of a section of the fluctuating column corresponding to the change to be recorded. In this case, however, the mechanical force is double that for a siphon of the same area, but the inertia is increased a hundred fold. The mechanical registration of temperature has been accomplished by the use of a metallic thermometer, consisting of a combination of brass and steel rods, a spiral composed of two metals, or a single wire of considerable length. Records from metallic thermometers, however, are of but little scientific value, since it is nearly impossible to maintain a fixed zero of reference.

Photographic Registration.—The registration of the barometer and wet and dry thermometers has been accomplished with sufficient precision by means of photography; but owing to the great labor and expense requisite for securing the records and measuring up the photograph sheets, it may readily be imagined that this method can never be generally adopted by meteorologists.

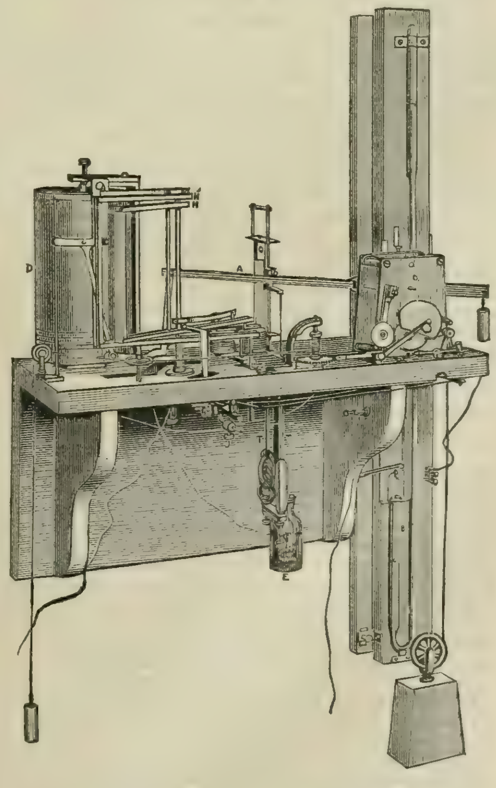
Meteorograph of G. W. Hough.—The method of registration at definite intervals by means of electro-magnetism was first proposed by Wheatstone, but was never put in practical operation by him. It has been applied, however, in various ways by meteorologists to the registration of nearly all atmospheric phenomena. The following diagram (Fig. 1) exhibits the method of Prof. G. W. Hough of Albany for registering the barometer and thermometer on a single sheet. D is a revolving drum, six inches in diameter and seven inches in height, covered with a sheet of ruled paper; L is an iron bar, 24 inches in length, mounted on an axis, passing through the point *c*; P is a steel pen attached to the end of the lever, projecting over the centre of the drum; P′ and P″ are platinum wires attached to the lever 3 inches on either side of the axis *c*; P′ is over the shorter leg of a siphon barometer, and P″ passes into the end of an open mercury thermometer. Now, if L be elevated at the end P, the wire P′ will touch the top of a float in the shorter leg of the siphon barometer. If, then, a battery B and electro-magnet E be arranged as in the diagram, when contact is made with the float the circuit will be closed, and E will operate. At this moment a blow struck on the pen P by a hammer unlocked by E will indicate the height of the barometer. When the lever L is depressed till P″ touches the surface of the mercury

FIG. 1.



in the thermometer, the circuit will be again established, and the pen P will record the thermometric height. The thermometric record cannot be as accurate as that of the barometer, since the magnetic circle is not so certainly completed when platinum touches fluid mercury as when it touches polished platinum. However, in a thermometric scale of two or three inches for 100° F., the error will ordinarily be only a small fraction of one degree. The diagram above represents a meteorograph constructed for the U. S. Signal Service, which registers hourly the barometer and wet and dry bulb thermometers.

FIG. 2.



The ingenious meteorograph constructed by Father Secchi of Rome records on ruled sheets of paper the indications of the following instruments: On one sheet the barometer, thermometer, direction and velocity of the wind, and the time and duration of rain; on another the barometer, wet and dry thermometers, and the quantity of rain. Besides the records on the sheets, the total wind, as well as the total for different directions, is indicated by dials. The whole apparatus is about 8 feet high, 3 feet wide, and 6 feet in length at the base. The barometer is a steel tube of large cross-section, contracted in the middle portion, and suspended on a lever arm over a fixed cistern of mercury. A pencil connected with the arm is continually pressed against the moving sheet and traces the fluctuations of the column. The thermometer is a brass or composition rod about 0.2 inch in diameter and 60 feet in length, attached at one end to the outside of the building and at the other to a bent lever, and extended by means of a heavy weight suspended from an arm of the lever. By suitable mechanism the changes in the length of the rod are transmitted to a pencil pressing on the sheet and tracing the fluctuations of the temperature. The psychrometer consists of two mercury thermometers of the same dimensions, open at the top. A sliding bar holding two platinum wires, which enter the open ends of the tubes, is attached, by means of a fine brass wire, to a carriage carrying a recording electro-magnet. Every fifteen minutes the clock gives motion to the carriage sufficient to cause the platinum wires to descend from the top to the bottom of the tubes and return. So soon as the wire touches the mercury in the dry thermometer, the circuit is closed and a pencil begins to trace a line on the sheet, which continues until the second wire touches the mercury in the wet thermometer, when the circuit is opened by causing it to pass through a relay magnet, thereby interrupting the record of the pencil. The length of the line, therefore, will indicate the difference between the wet and dry thermometers. The time of the beginning of rain is shown by causing the circuit through a recording magnet to be closed and broken by the revolution of a small water-wheel placed under the eaves of the building, while the total amount of water is measured and recorded by receiving it in a cylindrical vessel, in which is inserted a float in connection with the recording pencil. The direction of the wind is shown by the markings of four electro-magnets placed side by side, indicating respectively N., S., E., W. The frequency of the markings made by any two of the magnets indicates approximately the true direction. The velocity of the wind is shown on the sheet by the distance traversed hourly by a recording pencil in magnetic connection with Robinson's anemometer. A seconds pendulum clock of large dimensions, including a striking train, gives motion to the recording tables and psychrometer carriage. The electro-magnets are operated by 60 cells of the sulphate of copper (sand) battery.

Prof. Hough has also devised a variety of meteorological instruments designed to print periodically, in common type, records of the barometer, the thermometer, the anemometer, and the evaporator and rain-gauge. Descriptions of these varieties of apparatus may be found in full in the publications of Dudley Observatory at Albany. The printing barometer gives hourly the barometric pressure to a thousandth of an inch. It gives also a record of the total disturbance or fluctuation of the column for two entire days and for each hour successively, and curves of pressure, showing the changes in the height of the column continuously. The printing thermometer prints hourly the thermometric record to the tenth of a degree F., and gives also a continuous curve of temperature. The evaporator gives hourly the height of the water in the evaporating vessel, and indicates changes to one thousandth of an inch in its height. The anemograph gives the direction and the velocity of the wind for every hour. Besides these recording meteorological instruments, others have been devised by Mr. Hipp of Neufchatel, Switzerland; Mr. Gros-Claude of Geneva; Messrs. Hasler and Escher of Berne, Switzerland; J. Salleron of Paris; Prof. Wild of Berne; Dr. J. Gibbon of the U. S., and many others. These inventors have generally confined themselves to particular instruments, the barometer, thermometer, or the wind-gauge, but some have combined several instruments in the same apparatus.

GEORGE W. HOUGH.

Obsid'ian [Gr. ὀψιανός], a volcanic rock belonging to the trachyte group, and composed of alumina and 80 per cent. of silica. When pure it is a perfect volcanic glass of dark color, and in this form is much used by savage races for the manufacture of stone implements; it also occurs porphyritic from an admixture of crystals of minerals. When the same kind of lava from which obsidian is formed becomes very vesicular, it gives rise to *pumice*.

EDWARD C. H. DAY.

Obstet'rics, Obstet'ricy, or **Tocol'ogy** [Lat. *ars obstetricia, ob* and *stare*, to "stand before;" Gr. Μαιεία; Fr. *art des accouchements, science obstétricale;* Ger. *Geburtshülfe, Entbindungskunst*], the branch of medical science embracing the knowledge of the processes accompanying the reproduction of the human species, the assistance to be rendered the mother before, during, and after labor, both natural and irregular, and the care to be taken of the child during the first weeks of its life; also called **Midwifery** [Sax. *mid*, "with," and *wif*, "wife"], particularly in Great Britain. Although nature has adapted woman to bring forth children without any other assistance than that afforded her by her own inherent powers, still, from the very earliest ages, it has been found agreeable and beneficial to a woman in labor to offer her sundry more or less important services in her hour of need, by which present discomforts might in a measure be removed or possible future accidents averted. The earliest records which we find of such assistance show it to have been rendered exclusively by women. Thus, the Jews employed women, called *mejelledeth;* the Greeks first made use of old female nurses, who lived in the house and took care of the children. These nurses were called *mæa* (grandmother, nurse), and subsequently, when their practice rose to the dignity of a profession, they were known as *mæeutriæ*. A special tutelary divinity (Eileithypia or Arthemis) protected the art. These women appear, however, to have been unlucky in their practice, for at an early period a law was passed in Athens prohibiting women from practising physic in any of its branches. As early as the time of Hippocrates (about 400 B. C.) we therefore find men (*mæeutai, mæeuteres*) called in as assistants in difficult cases; and somewhat later, Herophilus is mentioned as a teacher of obstetrics at Athens. In the writings attributed to Hippocrates is found the first evidence of scientific research into and rational understanding of the phenomena of childbirth. Among the Romans, women (*obstetrices*) likewise assisted in confinements; but the emperor Augustus is reported to have called the physician Antonius Musa to attend the empress Livia in a difficult labor, and this precedent has been followed in many countries even to the present time. At the time of Pliny the royal law (*lex regia*) already provided for the performance of Cæsarean section after the death of women during pregnancy and labor. Celsus and Rufus Ephesus, during the first century of the Christian era, and Galen, Ætius, and Paulus Ægineta some 500 years later, wrote works on obstetrics. During the Middle Ages medical science remained at a stand-still in Europe, but among the Arabs and Persians considerable progress was made in obstetrics, which was practised by women alone, physicians being called in only as consultants. The writings of Rhazes of Bagdad (A. D. 800), Avicenna of Ispahan (A. D. 900), and Abulcasem (A. D. 1100) became celebrated and were generally accepted throughout Europe as well as in the East. Up to the sixteenth century very indefinite ideas had existed as to the shape and capacity of the bony canal (pelvis) through which the child has to pass in order to be born; in 1543 Andrew Vesalius gave the first correct description of the normal pelvis, and 200 years later (1754) Levret in France and Smellie in England (1751) completed the description by stating the exact dimensions of the various diameters of the pelvic cavity. The great surgeon Ambroise Paré (1550) was, however, the first actual exponent of modern scientific obstetrics—"the famous restorer and improver of midwifery," as Smellie aptly calls him. He first recommended turning the child by the feet. His successors Guillemeau, and especially Mauriceau, worthily developed and improved on the teachings of Paré. That most valuable of obstetrical instruments, the forceps, was discovered by an Englishman, Paul Chamberlen, about 1647; it has since been greatly modified and improved. In Germany the first scientific work on obstetrics was published by Eucharius Rösslin in 1513; and in 1690, Justine Siegemund, court-midwife at the electoral court of Brandenburg, became celebrated through her book on midwifery. Although numerous careful observations and studies had been made by Smellie and Ould (1742) in England, who described the manner of the entrance of the child's head into the pelvis, by Levret (1747), Solayrés de Renhac (1771), Baudelocque (1781), Madame Lachapelle (1795) in France, and Boër (1791) and Schmitt (1804) in Germany, Naegele the elder (1819) was the first to give a clear, systematic, and tolerably correct explanation of the mechanism of labor; that is, of the manner of passage of the various parts of the child through the pelvic canal. From him dates, in a great degree, the present elevated condition of obstetrical science; for on the accurate comprehension of this mechanism depends in a large measure the correct appreciation of the means to be employed in abnormal cases. Among the more important improvements in the art and practice of obstetrics during the present

century are the following: The use of the ear (auscultation) to detect the presence of a living child in the womb; the perfection of the knowledge of the mechanism of labor; the induction of premature labor; the more frequent use of the forceps and the less frequent employment of craniotomy (perforation of the child's head); the substitution of turning and extraction by the feet for forceps and craniotomy in many cases of pelvic deformity; the employment of chloroform in natural labor. Obstetrical science and practice have long been taught at all medical universities, and in some countries (Austria) physicians are required to take degrees as master or doctor in obstetrics in addition to the ordinary degree of doctor in medicine and surgery. Hospitals for the accommodation of women during the lying-in state—so-called lying-in hospitals—have been instituted in many cities of Europe, and in a less degree in the U. S. They are almost invariably connected with medical schools, and afford excellent opportunities for the study of the obstetrical art. The largest lying-in hospital at present is in Vienna, in which about 10,000 women are confined annually; others are at Paris, Berlin, Dublin, etc. Societies devoted solely to the advancement of the department of obstetrics—obstetrical societies—exist in London, Berlin, Edinburgh, Dublin, New York, Philadelphia, Boston, and other cities. Journals containing only articles on obstetrical topics are published in Germany, France, Great Britain, and the U. S. On the European continent, and to a certain degree in Great Britain, women in labor are attended only by midwives (*sâge-femmes*, *Hebammen*), who are taught in special schools to perform the minor duties of an obstetrician, such as to separate the child from the mother by tying and dividing the umbilical cord, removing the afterbirth, and caring for the comfort of the mother and the child. Physicians are called in only in difficult cases. In the U. S., however, and among the better classes of Great Britain, the safer plan is followed of entrusting every confinement, whether natural or abnormal, to the care of an educated physician, who is assisted by a competent nurse, and who, in case of need, may be able to foresee and prevent accidents which the superficial and inferior teaching of a midwife would incapacitate her from perceiving or avoiding. At the present time an obstetrician, in the true sense of the word, can no longer be a simple looker-on at a process which Nature is entirely competent to complete herself, or a mere mechanical assistant to that process: he must be a man of scientific education, well endowed with physical and moral power, patience, and determination, thoroughly conversant with the physiology and pathology of the function which he is called upon to superintend. On his wisdom alone often rest the lives of two persons and the happiness of a family; he must be both physician and surgeon, and his intellectual culture and ability must be on a par with the important relation which his department holds to society. Among the men who have become prominent as teachers and writers or as practitioners of obstetrics during the past generation may be mentioned: in the U. S., Dewees, Meigs, Hodge, Eliot (all died within a few years), Barker, Goodell, Thomas, Isaac E. Taylor; in Great Britain, Sir James Simpson (d. 1870), Mathews Duncan, McClintock, Leishman, Churchill, Braxton Hicks, Barnes; in France, Cazeaux, Dubois, Depaul, Pajot; in Germany, Scanzoni, Credé, Martin, Carl Braun, Spiegelberg, Schroeder, and many others.

The study of obstetrics is divided into three chapters: 1, The anatomy of the organs taking part in the process of reproduction in the female; 2, the functions of those organs during reproduction: their physiology; 3, the disorders and diseases affecting these and other organs during the same period: their pathology.

1. *Anatomy.*—In the bony receptacle (pelvis) at the end of the trunk are situated the female generative organs, viz. the two ovaries, containing the female germs or ova; between them the womb or uterus, to which they are attached; on either side also the two Fallopian tubes, opening into the uterus; finally, the vagina or passage leading from the mouth of the womb to the external organs. The breasts, although coming into function only after the birth of the child, are generally included in this list.

2. *Physiology.*—The functions of these organs are menstruation, conception, gestation or pregnancy, labor or parturition, and lactation. They are limited to a certain period of life, generally beginning with the twelfth to the fifteenth year and continuing till the forty-fifth or forty-eighth year. The youngest authentic case of parturition on record occurred at the age of nine years, the oldest at fifty-four years. Menstruation and reproduction are generally coincident, although cases are reported in which repeated impregnation took place without menstruation having ever occurred. Conception having taken place, the impregnated ovum passes through one of the Fallopian tubes to the uterus, where it becomes attached and grows and develops (its nourishment being derived from the mother through a convolution of vessels called the afterbirth or placenta, from which a cord of vessels, the umbilical cord, runs to the abdomen of the child), until at the end of a period varying from 275 to 280 days it is ready to be expelled by the contractions of the powerful muscular fibres of the womb (labor-pains). In occasional rare cases the term of pregnancy may be prolonged to 300 or 306 days; but most statements of this kind by women are not reliable and usually depend on errors of reckoning. The signs of pregnancy are manifold. The chief symptoms are: Cessation of the menses, nausea, particularly in the morning, enlargement of the abdomen and the breasts, discoloration of the space around the nipple; later, the movement of the child (or fœtus) and the pulsations of the child's heart, audible only to a practised ear applied to the abdomen. A physical examination of the abdomen and genital organs will at all times reveal the state of affairs; still, only in exceptional cases is it possible to decide upon the existence of pregnancy before the beginning of the third month. Enlargement of the abdomen from dropsy, ovarian and other tumors, may simulate pregnancy. The part of the child presenting itself at the mouth of the womb during pregnancy or labor is called the presentation. During pregnancy the child frequently changes its position voluntarily; during labor, however, the part originally presenting generally remains. The most frequent position of the child in the womb is the longitudinal, corresponding with the long axis of the mother, and by far the most common presentation is that of the head (96 in 100), generally the crown or vertex, seldom the face (1 in 200); much less frequent is the presentation of the other extremity of the child, the breech or feet (3 in 100). A transverse presentation, when the long axis of the child crosses the long axis of the mother, is met with about once in 200 labors, and always requires artificial rectification. Labor or parturition is the act of delivery of the fœtus and its appendages (the placenta and the membranes enclosing the child) through the natural passages. It may be divided into three stages: 1. From the first pains till the complete dilatation of the mouth of the womb; 2. The birth of the child; 3. The expulsion of the afterbirth and membranes. *First stage.*—At the end of pregnancy labor is ushered in by so-called premonitory pains, resulting from the commencing contractions of the womb and lasting an indefinite time, several hours or days. A mucous, slightly bloody discharge accompanies these pains, which gradually become more severe; the mouth of the womb becomes fully dilated, and the bag of waters (in which the child floats) is protruded. *Second stage.*—The bag ruptures, the waters are discharged, the pains become still more severe, the presenting part of the child passes through the pelvic canal, always adapting its longest diameter to the longest one of the pelvic cavity, and is expelled through the external orifice, being rapidly followed by the remainder of the child's body. The *third stage* comprises the delivery of the placenta and membranes, which generally takes place within thirty minutes. The average duration of labor in first confinements is twelve hours, although eighteen to twenty-four hours would not be considered abnormal; women who have had children are generally delivered more rapidly, within six or eight hours. After labor the lying-in state commences, during which the function of lactation is inaugurated, and the womb gradually returns to its natural size and configuration before conception, which latter event ordinarily takes place within six weeks. The child, having been separated from its connection with the mother by the ligation and division of the umbilical cord, is washed, dressed, and applied to the breast as soon as the mother has recovered from her exertions. By an early application of the child the febrile excitement known as "milk-fever," ordinarily occurring on the third or fourth day, with the flow of milk into the breasts, is in a great measure avoided. The period which a woman after labor is confined to her bed varies in different countries: while in civilized communities seven to ten days is considered the proper time, in the East and among savage races the mother resumes her daily avocations immediately after delivery, and among the lower classes in Europe and this country puerperal women very frequently leave their beds on the third or fourth day without evil consequences.

Pathology.—Pregnancy does not always last the stated time of 280 days, but is often interrupted at an earlier period, either by causes depending on disease of the mother or of the fœtus and its appendages, or by accident or intention. Such interruptions may occur at any time, and during the first six months are called abortion or miscarriage, during the last three premature delivery. A fœtus born before the twenty-eighth week is ordinarily not viable, although several instances have occurred in which children born as early as the twenty-sixth week were by

extraordinary care raised to maturity. The danger to the life of the mother from abortion may at times be great, either from uncontrollable loss of blood or from inflammation of the uterus or bowels (peritonitis). This is particularly liable to be the case when the abortion has been forcibly induced, as by sudden shock or with a criminal purpose. Tardieu relates thirty-four cases of criminal abortion, in which the death of the mother resulted in twenty-two. The danger is greatest during the third, fourth, and fifth months; during the first two months the impregnated ovum often escapes almost unperceived. A common cause of abortion is disease of the placenta. The physiological discomforts of pregnancy, such as nausea, neuralgic pains, constipation, may occasionally become so aggravated as to be actual sources of danger, and the pregnant woman is liable to dropsy, hemorrhoids, congestion of the kidneys, and numerous other complaints. Occasionally the impregnated ovum does not pass into the uterus, but becomes attached in the Fallopian tube or drops into the abdominal cavity and develops there. This condition is called extrauterine pregnancy (tubal or abdominal), and generally ends fatally about the third or fourth month by rupture of the tube or peritonitis. In rare cases the child has been retained until term and removed by operation alive or dead, or it has died and been discharged piecemeal through the bowel, vagina, etc.

Labor is either natural or preternatural—natural when nothing occurs to mar the progress of the unaided birth of the child and appendages, preternatural when the assistance of art, either manual or instrumental, is required. The causes of preternatural labor may lie either in the mother or the child. *The mother.*—Deformities of the pelvis or of the soft genital organs, rupture of the uterus, vagina, or the external parts (perineum), flooding (either during labor, when the placenta is situated over the mouth of the womb and is detached during dilatation of that orifice—placenta prævia—or after labor from the open vessels of the normal placental attachment), convulsions, inversion of the uterus. *The child.*—Too large size, monstrosity, abnormal presentation, transverse or oblique (requiring manual or instrumental interference), compression and protrusion of the umbilical cord (dangerous to the life of the child, but not to the mother, and not impeding delivery), too firm attachment of the placenta. The operations which may become necessary during pregnancy or labor are: The induction of abortion, when the preservation of the life of the mother renders it imperatively necessary that the pregnancy be interrupted, and of premature delivery, when the birth of a fully-developed child at term is impossible on account of pelvic deformity; Cæsarean section, the removal of the child and appendages through an incision in the abdomen and uterus, in cases where the pelvic deformity is so aggravated as to preclude the natural or instrumental delivery of even a mutilated child by the natural passages; the child is generally born alive, the mother usually succumbs (62 per cent.), but cases are on record in which the operation has been successfully performed on the same woman as often as four times; the extraction of the child with the forceps; version or turning, and manual extraction by the feet, when it is desired to change the position of the child and accomplish rapid delivery; craniotomy, the perforation of the head and removal of the brain of the living or dead child to enable the passage of the diminished head through the contracted pelvis, thus sacrificing the child for the sake of the mother, etc. Of the dangers which assail the woman after delivery the most frequent are sore nipples and inflammation of the breasts—the most dangerous and fatal, childbed or puerperal fever. The latter is an inflammatory, infectious disease, the exact nature of which is still a matter of dispute. The mortality from it is greater than from all other puerperal accidents combined. The general mortality during parturition has decreased during the last thirty years from year to year, in consequence of the improvement in the study and practice of obstetrical science. According to a compilation by Winckel (*Path. and Therap. of the Puerperal State*, 1869) from more than a million labors, it averages about 6 in 1000 cases in private practice, and 30 in 1000 cases in lying-in hospitals, the large mortality in the latter institutions being mainly due to the epidemics of puerperal fever breaking out in them from time to time, the disease being rendered particularly virulent by the generally poor physical condition of the patients and the necessary crowding to which they are more or less subjected. PAUL F. MUNDÉ.

Ocala, post-v., cap. of Marion co., Fla., 5 miles from Silver Spring, has 5 churches, 1 newspaper, 2 hotels, and repair-shops; is the centre of the orange belt of the Peninsula. Pop. 600. F. E. HARRIS, ED. "BANNER."

O'Cal'laghan (EDMUND B.), M. D., LL.D., b. at Mallow, Ireland, about 1804; studied two years at Paris; went to Quebec 1823; was admitted to the practice of medicine 1827; became a member of the provincial assembly of Lower Canada 1836; editor of the Montreal *Vindicator* 1834–37; figured in the revolutionary movement of 1837, in consequence of which he removed to New York; became a diligent student of the early history of New York, especially of Dutch and French sources; published a valuable *History of New Netherlands* (2 vols., 1846–48), edited the *Documentary History of New York* (4 vols. 4to, 1849–51), *Documents relating to the Colonial History of New York* (11 vols., 1855–61), and numerous other translations from MSS. in foreign languages or reprints of rare historical documents. For some years he was employed in the office of the secretary of state at Albany.

Oc'cam (or **Ock'ham**), WILLIAM OF, a Scholastic philosopher, b. at Occam in the county of Surrey, England; d. in Munich, Bavaria, in 1347, at an advanced age. He was educated first at Oxford, and, after he became a Franciscan, in 1319, at Paris under the famous Duns Scotus. He rejected the realism of his master, and became the most eminent of Nominalists. Throughout his life, consistent with the strictest tenets of his order, he strenuously contested the pretensions of the pope to political power and secular possessions, first taking the side of Philip the Fair against Boniface VIII., and subsequently opposing John XXII., by whom he was summoned to trial before an ecclesiastical court at Avignon, whence he took refuge in 1328 with the emperor Louis of Bavaria, just then in the midst of his struggle with the pope. He promised his pen in support of that monarch in return for his own protection ("*Tu me defendas gladio, ego te defendam calamo*"). No other scholar since the days of Abelard had applied himself so zealously to logic. His skill in handling logical weapons, his acuteness in making distinctions, his fertility in inventing reasons, gave him the name of *Doctor invincibilis*. His careful discrimination between the logical, real, and grammatical significance of terms enabled him to silence his opponents. The hypostatic entities of the Schoolmen before him were disposed of by his doctrine of the subjective nature of thought. His favorite principle was, "Entia non sunt multiplicanda præter necessitatem." In his *Centilogium Theologicum* the greater part of his hundred demonstrations attempt to prove that theological dogmas, such as the existence, unity, or infinity of God, the Trinity, creation, incarnation, transubstantiation, etc., involve contradiction of logical principles, are irreconcilable with reason, and to be accepted only by faith. This doctrine struck a fatal blow at Scholasticism. That form of philosophy had arisen solely out of the necessity which was felt of proving the rationality of the dogma. If the objects of faith could not be proved by philosophy, nor even reconciled with reason, Scholasticism had no task to fulfil except the negative one of destroying what illusions it had already created. Its decline was rapid. The chief works of Occam are—(*a*) *Tractatus Logices*, (*b*) *Quodlibeta Septem*, (*c*) *Super quatuor libros Sententiarum*, (*d*) *Expositio Aurea super totam Artem Veterum*. Besides these there were commentaries and polemics. WILLIAM T. HARRIS.

Occa'sional Caus'es, Doctrine of, was invented by the Cartesians to explain the action of mind and matter upon each other. Their theory was that God, the First Cause, on the *occasion* of certain volitions within the mind, produces certain actions or motions of the body; since, said they, the soul, a thinking substance, cannot act upon matter, which is pure extension. This doctrine was first fully set forth by Geulincx.

Occipital Bone. See OSTEOLOGY, by PROF. E. D. COPE.

Oc'com, or **Occum** (REV. SAMSON), a celebrated Presbyterian Indian preacher of the Mohegan tribe, b. in New London, Conn.; educated at the Rev. Ebenezer Wheelock's Indian school at Lebanon; in 1766 accompanied Rev. Nathaniel Whitaker, D. D., who was sent on a mission to Scotland, England, and Wales to raise funds for the establishment of schools for the education and christianization of the North American Indians. Being the first preacher of these aboriginal tribes who had visited Great Britain, he created a sensation, and drew large audiences everywhere. He officiated in George Whitefield's chapel in Tottingham Court before an immense audience, and greatly contributed to the success of Dr. Whitaker's mission. The projected school subsequently became Dartmouth College, N. H. After his return to America he continued in the ministry, preaching chiefly to the Indians, until his death, probably in 1792. He wrote an account of the Montauk Indians, published by the Massachusetts Historical Society (1st series, x. 106); and wrote the Hymn, *Awaked by Sinai's Awful Sound*. A. H. STEPHENS.

Occonee'chee, tp., Northampton co., N. C. P. 1944.

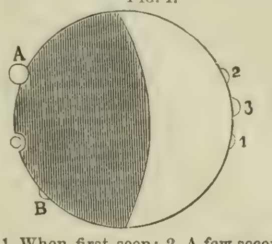
Oc'coquan, post-v. and tp., Prince William co., Va., on the Occoquan River. Pop. of v. 228; of tp. 891.

Occulta'tion [Lat. *occultare*, "to conceal"]. So far as the etymology would indicate, the word occultation might be applied astronomically to designate the concealment of any heavenly body, but usage has confined its application to the eclipse of planets or of fixed stars, the moon being in most cases the eclipsing body. Very rarely a *planet* occults a star; and the occultation of a planet by another planet is almost unexampled in the history of astronomy. Yet Mercury was occulted (or, we might rather say, eclipsed) by Venus May 17, 1737, and we have reports of similar concealments of Mars by Venus Oct. 3, 1590, and of Jupiter by Mars Jan. 9, 1591; but as these were before the invention of the telescope, the supposed eclipses may have been only near appulses. No little interest attaches to the careful observation of occultations, whether of stars or planets, by the moon, inasmuch as from the phenomena presented at the immersion or emersion of the star or the planet some indication may be looked for either of the existence or else of the absence of a lunar atmosphere; *i. e.* of an atmosphere of sufficient density or extent either to refract or to absorb light. With respect to a *diminution of light*, Mr. Ramage of Aberdeen says that "previously to his observation of the occultation of Jupiter, Apr. 5, 1824, there were several occultations of fixed stars of the seventh and smaller magnitudes, which instantly disappeared on coming into contact with the dark limb of the moon; one of them, however, on entering upon the extreme edge of the cusp, very near to the juncture of light and darkness, and on *reappearing twice* from between the tops of lunar acclivities, presented an evident diminution of light." (*Memoirs of the Royal Astronomical Society*, vol. ii. p. 87.) The effect of the glare of moonlight would seem in this instance to have been nearly excluded, so that there is some probability of the diminution of light being real. The telescope employed was a 25-foot reflector. (For occultations of Saturn and Uranus, see the *Memoirs* quoted, vol. vi. p. 187, vol. ii. p. 91; and of five stars, vol. iii. p. 335.)

Next as to the phenomenon of *an apparent projection* of a star or some portion of a planet on the moon's disk (as if between the moon and the earth), or that of *a seeming adhesion* to the disk, at the time of immersion or of emersion. In the third volume of the *Memoirs of the Royal Astronomical Society*, Mr. (afterwards Sir James) South has specified and tabulated a variety of instances of these phenomena. At the close of his statement he remarks that "on referring to this table it will be seen that upwards of twenty stars have from time to time been observed as exhibiting peculiarities at or on the moon's limb prior to immersion behind it or emersion from it; it will be found also that the anomalies are not confined to stars of a certain magnitude or color, nor are they governed by any particular age of the moon." The tabulated arrangement here referred to has been largely extended and classified by Prof. (now Sir George B.) Airy as follows:

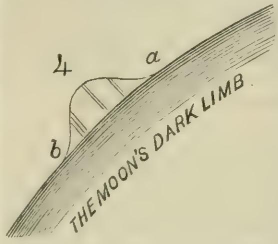
A. Where there is a distinct record of observed projection; B. Where there is a record of hanging on the limb in a form which negatives projection; C. Where there is a distinct record of no projection or hanging; D. Where accounts at the same place or in the same vicinity are contradictory, some being of Class A or B, while others are of Class C (*Memoirs*, vol. xxviii. p. 176). Prof. Airy's list extends to 233 occultations. The following are among very curious instances of projection: At the occultation of Jupiter, already alluded to as observed by Mr. Ramage of Aberdeen, Apr. 5, 1824: "On the approach of Jupiter's satellites no diminution of their light was perceptible. On coming into contact with the moon's limb they did not disappear instantly, like fixed stars, but formed an indentation or notch in the limb, as if imbedded in it, but at the same time *separated from it by a fine line of light.* This indentation continued visible till about half their diameters were immersed, when it disappeared. All the satellites presented this phenomenon, which is represented in the figure" (which is here reproduced with a part of another figure combined), "but the fourth and third with the greatest distinctness. On Jupiter's approach, no difference in his light or shape was perceptible; after the contact had taken place, he appeared to exhibit no deficiency of disk, but, on the contrary, presented a complete figure, as if placed between the moon and earth (see Fig. 1, A): this appearance continued for a few seconds. When nearly altogether immersed, his retiring limb was seen considerably elongated, as if forming a segment of a much larger sphere" (as seen at B). "When Jupiter's satellites are viewed through this reflector" (25-foot reflector), "even with low magnifying powers, they always exhibit planetary disks, and thus allow a short time for observing any phenomena of the above kind; whereas a fixed star, appearing only as a point of light, vanishes instantly on coming in contact with the moon's limb." Observation of the occultation of Jupiter by Capt. (afterward Sir John) Ross: "Capt. Ross, who, from the state of the weather, could not distinguish the immersion, was fortunate enough to observe the emersion, of the planet, which put on the several appearances represented (at 1, 2, 3) in figure." The following is from Mr. Compfield of Northampton, England, describing the occultation of Jupiter (telescopes Newtonian and Gregorian; apertures, between 7, 8, and 9 inches respectively): "The appearance was evidently an elongation of Jupiter when in apparent contact as nearly as I can delineate in this form, which I should not have mentioned had it not been recently affirmed positively that the moon has no atmosphere: *a* and *b*, Fig. 2" (reproduced here), "were evidently adhesions or prolongations of the light of Jupiter at the points of contact; and when nearly disappearing behind the moon, the figure of the section was elongated, so as to deviate greatly from a circular of the same diameter as the planet." These last three accounts of observations are all from the *Memoirs*, vol. ii., pp. 87–89.

FIG. 1.



1, When first seen; 2, A few seconds after; 3, When half the diameter became visible; 4, When wholly seen.

FIG. 2.



In view of these and similar anomalies, E. Neisson, Esq., in his discussion of the limit of a possible lunar atmosphere (*Monthly Notices of the Royal Astronomical Society*, Nov., 1873), says: "There can be no question but that the main circumstance limiting the density of any possible atmosphere is the refraction of the rays of light it would cause. From what we know on the subject, as there can be no doubt but that it must be of comparatively small density, it is evident that we have only to deal with the horizontal refraction, as the refraction must practically vanish for any beyond very low altitudes." Regarding the different values given by the telescopic and occultation determination of the semi-diameter of the moon as affording the process best adapted to detect the horizontal refraction, from an elaborate investigation founded on such data, he concludes that the horizontal refraction of the moon's atmosphere has different values in accordance with the great vicissitudes of temperature to which the moon is subjected and the action of her feeble gravity. (See MOON.) The mean value of Mr. Neisson's results for the horizontal refraction does not differ much from one second. Mr. Neisson, moreover, remarks that "it will also be apparent that for the density of the supposed atmosphere no distortion of a star could possibly occur, and the same applies to the occultation of a planet such as Jupiter or Saturn; the maximum effect would be to increase the size of the planet by about one-thousandth, but in no case to distort it." He makes, moreover, the maximum effect of irradiation to be 0.5″. The very short duration of the effect of the lunar refraction also comes in, and that would render that effect in such a fashion the more difficult to observe. An atmosphere of great rarity, controlled in its extent by a feeble gravity, and often of very low temperature — itself would *therefore* be the more extensive, and its existence under those circumstances be consistent with some absorption of light, such as was observed in the instances of the fixed stars. Along the rough edge of the moon, moreover, the phenomena of diffraction and other effects must take place on an extensive scale, and the *angular* displacement due to them be sensible even at the distance of the earth. The peculiar action thus arising, as to its influence on the light of the body occulted, may be *specific*, arising especially in some peculiarity of the light as it *issues from its source.* Guided by what we know of the changes which may be experimentally made in the exaltation or degradation of luminous vibrations, we may well conceive of this difference at the very origin of the light at the surface of a star, or even also of that which comes from near the border of the sun's disk in *annular or in total eclipses of the sun.* The action in this latter case seems to be analogous to that on the light of the fixed stars or that of the planets, after the manner already specified. Accordingly, the author of this article, in his

memoir presented at the hundredth anniversary of the American Philosophical Society in May, 1843, referred what are styled "the Baily beads" to an action similar to that which produces *the projections and adhesions* of stars in occultations, the rounded, bead-like portions being the result of so many *projections*, and the filamentous connections of those portions indicative of intermediate *adhesions*. Then the projections were themselves referred to an action producing a bending of the *starlight* the *negative* of that which would be due to refraction, denominated by the author *the distortion inward;* but local and efficient on light (starlight or border sunlight; *i. e.* light from near the border of the sun's disk), which light was *specifically* subject to such action, from a cause (as heretofore stated in this article) originating at the surface of the star, or near the border of the sun's disk. That the action was specific is confirmed by the various observations of the annular eclipse of Sept. 18, 1838, the peculiar phenomena in question being especially manifest when viewed with screens of some particular color, through the red screens above all.

When the time of immersion or that of emersion has been carefully observed, and the corrections dependent on the moon's distance and the hour of the day applied (for parallax), the difference of that time and that by computation, for the first meridian, gives the longitude of the place of observation. STEPHEN ALEXANDER.

Occupa′cia, tp. of Essex co., Va. Pop. 3270.

Oc′cupancy, in law. This is one of the modes of obtaining title to property, both real and personal. The notion that title can be obtained in this manner is derived from the Roman law. In that system it was supposed that occupancy was a mode of ownership derived from the law of nature, and was particularly applicable to those things which by general rules belong to no one (*res nullius*), but are open to all. It was deemed to be natural that the things which God had created for particular persons, and which had not as yet passed into the possession of anybody, should belong to those who were the first to discover and make use of them. Accordingly, those who first entered into lands which were not inhabited, and took possession of them, became justly masters of them. So if fish were taken from the sea and birds from the air.

The theory of the Roman law, that the rule of occupancy is to be derived from the law of nature, has not only had its effect upon the private law of modern times, but has exercised great influence in forming the rules of international law. The rule that capture in time of war gave title to the captor is probably to be referred to the idea that the belligerents stood towards each other in a state of nature, when the one, being under no duty to respect the property of the other, could lawfully retain whatever he could seize upon and had sufficient power to hold. But its leading effect is to be found in the recognition by the nations of modern times of the principle that the discovery of uninhabited lands, or of what was deemed equivalent, inhabited only by savages, gives sovereignty to the nation to which the discoverer belongs, provided the discovery is followed up by exploration and settlement. Here, again, the notion seems to have been that the respective nations were related to each other as individuals would be in a "state of nature" and outside of the pale of society. However convenient this assumption may have been, it would seem to be a pure fiction. Mr. Maine in his work on *Ancient Law* has made it highly probable that the earliest form of ownership was that held by village communities, and was not of an individual, but of a corporate nature, and that it was only after a course of experience that separate ownership of property emerged from the common ownership of the village or corporation. It is impossible to deny that the development of the theory of the Roman jurists has led to great confusion and uncertainty. It has been extremely difficult to determine what kind of occupancy gave a secure title to the nation of the discoverer, and how completely and how soon it must be followed by exploration and settlement. (See Maine's *Ancient Law*, ch. viii.)

When reference is had to individual title to land within the boundaries of any particular nation, it may be observed that there was but little room for the theory of title by occupancy after the feudal system had become fully established. (See FEUDAL SYSTEM.) Under that system the title to land was supposed to be vested in the king, who parcelled it out to inferior owners upon certain conditions, who in turn, by the process of subinfeudation, could parcel it out to others. The entire land of the state thus became vested in ownership, and there was in general no mode of acquiring it except from the former owner, unless by the doctrine of "adverse possession" or "disseisin." (See DISSEISIN.) This is not to be confounded with title by mere occupancy. In the latter case the title is acquired in vacant property instantly and by the mere fact of occupancy. Adverse possession requires a peaceable and notorious possession for a *length of time*, is urged against an existing owner, and is founded upon rules of public policy to promote security in titles. In this country the king was supposed before the Revolution to be the owner of the land, and titles of individuals were obtained by grants from him. Since the Revolution the title is derived either from a State or the U. S. government. The courts will take no notice of any title to land not originating in the act of one of these governments, or at least not sanctioned by one of them. Even though the land be in one sense owned by Indians, their ownership is not inconsistent with a title on the part of the government within whose jurisdiction the land is situated. The right of discovery, as recognized by the various civilized nations, is understood to give to the U. S. the exclusive right to acquire from the Indian tribes all the lands belonging to them, and not embraced within grants already made by the U. S. or sanctioned by treaty or otherwise, and not within the territory belonging to the original thirteen States. This proposition does not deny that the Indian tribes are owners, but affirms that they can only sell to the U. S. Any rule which would permit them to convey to any other nation would be fraught with danger to our government, and would be plainly subversive of the recognized rights depending upon discovery and settlement.

Owing to these considerations, titles to land by occupancy can only arise in special cases. One of these is that of accretion or gaining land from the ocean or a lake or a navigable stream, where the soil left bare by the water may be regarded as an incident to the principal ownership of the upland. When an island arises in the ocean or in a navigable stream it belongs to the state. The same result follows in cases of addition to the mainland, where the increase is sudden and perceptible. The rule of accretion, as applying to the adjoining owner, refers to increments gradually made, so that the rate of increase is imperceptible to the eye.

Another instance in which the title to land may still be gained by occupancy, if there be no statute to the contrary, is one depending upon an imperfect rule of common law as to the devolution of legal estates in case of an owner's death. The case is an estate granted to A for the life of B. Should A die before B, intestate, the law provides no one upon whom the unexpired portion of the estate shall devolve. It cannot pass to the heir of A, since it is not an estate of inheritance or fee (see FEE); it cannot belong to the executor (see EXECUTOR), since it is real estate; it cannot revert to the grantor until B dies, since he cannot derogate from his own grant. The law having thus provided no owner, the estate may be seized by any person who may be able to take possession of it. Such a person is called a "general occupant." In some instances the grant, instead of being made to A for the life of B, is made to A and his *heirs* during the life of B. In that case the heirs take the unexpired residue, not as *heirs* (for the estate is not inheritable), but because they are specially named, and are thence called "special occupants." These rules are in a number of the States changed by statute. It is sometimes provided that the unexpired portion of A's estate shall be regarded as a chattel, and shall pass to his personal representatives.

Passing to the subject of personal property, it is to be noticed that there are still several instances in which title by occupancy takes place. One is that of property taken from an enemy in time of war. According to the law of nations, this property belongs to the sovereign of the state of which the individual captor may be a member. It is, however, quite usual for the state to provide rules whereby the captors may be rewarded for their exertions by giving them a portion or the whole of the captured property. A distinction is taken between booty (property taken on land) and prizes taken at sea. In the case of property taken at sea the practice of the law of nations now demands that there should be an adjudication by a competent prize court organized under the authority of the belligerent claiming the property. In the case of booty no such adjudication is necessary. Undisturbed possession for a brief period is sufficient to confer a title. There may be cases, however, where prize and booty are so intimately blended that a prize court will have jurisdiction over both. (See remarks of Lord Mansfield in *Lindo* v. *Rodney*, Douglas Reports, 592.) There is some reason for believing that at an early day questions concerning booty were brought before the now obsolete court of the "constable and marshal" of England. (2 Knapp, Privy Council Rep., pp. 149, 151.) The present mode in which booty is distributed in England among the actual captors is to refer their petition to the lords of the treasury, who commonly recommend that a grant be made of it to trustees appointed by the Crown, who after receiving it distribute it according to principles submitted to them by the officials of the treasury. The scheme prepared

by the trustees must receive the royal assent. (2 Phillimore, *Int. Law*, 185.)

Another instance of title by occupancy is that of finding property upon land. (See FINDING.) Blackstone places under this general head also the case of accession, or the addition of value made by one person to the goods of another. (See ACCESSION.) Confusion may also be ranked under this head of title. The theory of title by confusion is that where a wrongdoer, with intent to commit a fraud, mingles his goods with those of another so that they cannot be distinguished, the innocent party becomes the owner of the entire subject-matter. The law will not compel him to separate the goods of the wrongdoer from his own, but will require that act of the defrauder; and as by the hypothesis the separation is impossible, the title to the goods is acquired by the fact of occupancy. The same writer refers the title to works of literature and art to the same source. Perhaps it would be more exact to say that they are cases of property acquired by one's own art or power of origination. (See LITERARY PROPERTY.) The property in trade-marks (see TRADE-MARK) is an instance of title acquired by occupancy. A person using a word or device to mark his ownership of goods or of a business becomes the owner of the so-called "trade-mark" itself. The title to wild animals (see FERÆ NATURÆ) is also gained by occupancy. The property or ownership in this case having once been gained remains imperfect so long as the animal has the capacity to resume its original wildness. Should it escape without any disposition to return (*animus revertendi*), the ownership is lost, and the law of title by occupancy may again be called into requisition in favor of one who may first take possession. On the other hand, if all capacity to escape had been lost, the ownership gained by occupancy would be absolute.

T. W. DWIGHT.

Occupa'tion. In Roman law this word was used of the act of taking possession. The possession thus acquired, if the law allowed, could end in full ownership. Thus, *occupaticius ager*, in one of the old Latin grammarians, denotes land deserted by its own cultivator and occupied or taken possession of by another. The principal objects which could by Roman law be thus taken possession of were, (1) wild animals, which in their free state were held to be without an owner, and wherever taken belonged to the *captor*. If, after being taken, they recovered their freedom, they again became without an owner and could belong to a new *captor*. (2) Things abandoned by an owner with the intention of giving up his ownership and without intending to transfer his right to another. (3) Treasure-trove belonged by Roman law to the finder in certain cases only, as where it had been hid in an unusual way and so long that the owner was not to be discovered. Where it was found by a man on his own ground or on ground without an owner, it belonged wholly to him. Where it was found on the ground of another, it went half to the finder, half to the proprietor of the soil; to the state if the land was public. (4) In war the foe was looked on as without rights, and thus his property was without an owner and capable of acquisition. Things taken from a public enemy during war, however, went first to the state, which could give rights over them to others, as to the captors.

There is a kind of military occupation, which international law has to do with, and which presents to us some peculiar difficulties. For those which arise out of the public actions of the occupant during his occupation, in case he afterwards relinquishes his hold on the place or district occupied, we refer to vol. ii., page 1254, col. 1, and to Phillimore, there cited. A question, however, may be asked to which we will attempt to give a succinct answer —namely, What is occupation of a country or a district by an invading belligerent? Such occupation, then, implies the termination of all political or municipal authority on the part of the former holders of power, except so far as such authority is consented to by the occupant invader. This is a result of military power and a fact. But it is not necessary that every part of the district should be held in control by a force on the spot; all that is necessary seems to be that the army should be so distributed as to have direct communication between its parts and detachments, and to have sufficient force to put down any insurrection within the district. Occupation must be effective, like blockade; but as a blockade may be raised by a superior force from without or run through by stealth, so, in the same way, the objects of an occupation may be defeated by an attack from without, or the lines be broken through by even a weak force where they are weakest. An occupied district is under military law exercised by the commander of the invading army (comp. sec. 1 of the instructions for the government of armies of the U. S. in the field), who may, if he sees fit, allow the ordinary laws of the land to take their course under control and supervision of military officers of his appointment. What proceedings within the occupied district on the part of discontented inhabitants should be punished with severity it is not easy to define by general rules. Thus much, however, may be said—that guerilla warfare by parties who have no uniform, or who put on and take off a uniform at pleasure, and are without any connection with the national army, is, and on account of the atrocity and insidiousness with which such warfare is apt to be carried on ought to be, punished with severity.

T. D. WOOLSEY.

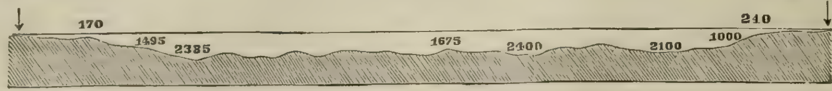
O'cean [Lat. *Oceanus*; Gr. Ὠκεανός]. The waters of the sea are divided by the solid lands into a few large basins or oceans, which are the counterpart of the continents. The Pacific, the Atlantic, and the Indian oceans correspond to the three worlds, and separate them from one another. Each of them is again subdivided into a northern and southern basin, except the Indian Ocean, which, on this account, is only a half ocean. The Arctic Ocean is properly a continuation of the Atlantic, but, surrounded as it is by the coasts of the three northern continents, it has a physiognomy of its own. As to the Antarctic Ocean, being bounded by no lands, it may be considered less as an ocean by itself than as the common root from which they all radiate. The three great oceans have a wide opening toward the south, and become gradually narrower toward the north, just the reverse of the continents. But they differ in general form. The Pacific Ocean is an oval, nearly shut up in the north, where the opposite coasts approach each other, so as to leave between Asia and America only the narrow passage of Behring Straits, by which it communicates with the Arctic Ocean. The Atlantic Ocean has been likened by Humboldt to a long valley with parallel sides, the projecting body of Africa fitting into the vast recess of the Gulf of Mexico and the Caribbean Sea, as South America and Cape St. Roque into the Gulf of Guinea. It is the only ocean widely open at the north, stretching from pole to pole, the only ready channel for the exchange of the polar and equatorial waters. The Indian Ocean has the form of a triangle, the vertex of which is turned to the north, but without communication with the northern waters. The Pacific Ocean contains more than one-half of all the waters of the sea. It is pre-eminently the great ocean. Its extent, its compact form, the direction of its longer axis from east to west, make it the counterpart of the Old World. The Atlantic has only half the size of the Pacific, and one quarter of all the water surface; by its narrow and slender form, its direction from north to south, it corresponds to the New World, as the Indian Ocean to Africa.

The Bed of the Ocean.—The basins of the oceans are depressed below the face of their waters as the continents are elevated above the same surface level. As they form nearly three-quarters of the relief of the earth's crust, a knowledge of their configuration would be of great interest, but very little is known on this subject. Numerous soundings, however, made in the shallow seas along the coasts of the continents for the wants of navigation, deep-sea soundings taken in the heart of the ocean from purely scientific motives, and recently similar observations for the laying of telegraphic cables across the Atlantic and the Mediterranean, have given us an approximate idea of the nature of the beds of these two seas which are the best known. The main feature of the Atlantic basin seems to be a deep valley which runs, with an average depth of 20,000 feet or more, along and parallel to the coasts of the New World. A large swell over 10,000 feet higher, bearing, perhaps, the islands of Tristan da Cunha, St. Helena, Ascension, and in the North Atlantic the Azores, separates it (as seen in Fig. 1, *b*) from another valley only 15,000 feet deep, which stretches along and close to the coast of Africa. Both valleys rise northward, and are confounded in one basin on the so-called telegraphic plateau between Newfoundland and Ireland, whose average depth is about 12,000 feet, and the greatest 2400 fathoms, or 14,000 feet, as seen in Fig. 1, *a*. Toward the northward the depth is gradually reduced to 8000 and 9000 feet, between Greenland and Iceland, while on the European side the depth averages hardly 1500 feet. In the Arctic Ocean the depth is still less considerable, but very irregular. In the neighborhood of the continents the seas are often shallow for a long distance, and their bottom seems only the continuation, by gentle slopes, of the continents which border them. Thus, from Newfoundland, along the line of the cables (Fig. 1, *a*), the submarine plain extends for 140 miles before reaching the depth of 1000 feet, but beyond it falls rapidly within a few miles to a lower terrace of 9000 feet. By another rapid step a still lower plain is attained, having a depth varying from 12,000 to 14,000 feet, and stretching with inconsiderable variations through 1700 miles, across the whole basin of the Atlantic. This is the so-

Fig. 1.—Sections across the Basin of the Atlantic Ocean.
Depth in Fathoms.

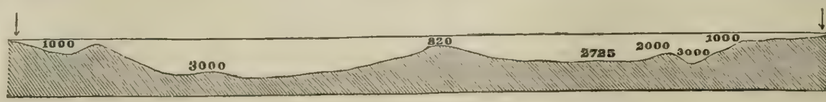
a. From Newfoundland to Valentia Island on the line of the Telegraph Cables.
Length 1850 Miles.

Newfoundland. Valentia Island.



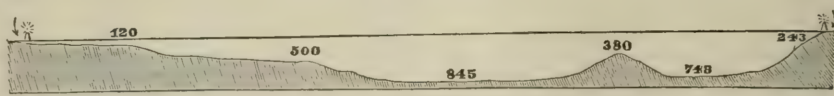
b. From Cape St. Roque, Brazil, to Cape Palmas, Western Africa.
Length 1860 Miles.

Cape St. Roque. Cape Palmas.



c. From Sand Key to Havana.
Length 83 Miles.

Sand Key. Havana.



called telegraph plateau. At about 230 miles from the coast of Ireland it ascends again, by similar steps, to the border of the submarine plateau on which rest the British Isles. A similar structure is found in other parts of the basin. From Cape Race, Newfoundland, southward for 200 miles across the Great Bank, the depth of the sea never exceeds 100 fathoms, when it plunges suddenly by two terraces into the deepest part of the North Atlantic, where the soundings give from 25,000 to 30,000 feet. From the New Jersey shore, according to the observations of the Coast Survey, the slope of the bottom of the sea is only 5 feet in a mile, but beyond 100 miles it descends suddenly 400 feet in a mile. About 114 miles from the coast a submarine plain begins at the depth of 6000 feet, and another, 12,000 feet deep, at a distance of about 300 miles. These facts, and the absence of any oceanic island other than volcanic or coralline, disprove the idea, often advanced, that the bed of the oceans is, like the surface of submerged continents, full of valleys and mountain-chains. It seems far more uniform. Extensive plains and huge table-lands predominate. True mountain-chains are only found near the continents, as parts of their structures, and when reaching above the surface form chains of continental islands. But these submarine plains and plateaus are gigantic compared with those above water. Nowhere on dry land do we see plateaus of 15,000 to 20,000 feet above the surrounding plains.

The Bed of the Pacific Ocean is much less known than that of the Atlantic. In the absence of soundings, which are few, its average depth has been inferred from the velocity of the tide and earthquake waves which often cross it from E. to W., this velocity depending upon the depth of the basin in which the waves move. From this kind of evidence Prof. Bache, superintendent of the Coast Survey, makes the depth of the Pacific between Japan and the coast of California from 12,000 to 14,000 feet. Prof. Hochstetter, using the waves raised by the great earthquake of South America in 1868, calculated the depth between the coast of South America and the Chatham Isles in the South Pacific at 11,500 feet. Both results agree with the soundings. The central axis of the ocean, free from islands, is probably deeper; some uncertain soundings exceed 40,000 feet. Similar depths are given for the Indian Ocean.

The inland and border seas properly belong to the continents. Around the British Isles and in the German Sea the depth rarely exceeds 600 feet, and is often much less. The continent of Europe is here prolonged in the form of a submarine plateau. The Baltic Sea, being a simple depression in the continent, is only a few hundred feet deep. The border-seas of Asia, inside of the chains of continental islands, hardly exceed a few hundred feet, while outside, the rapid slopes and deep ocean begin. The Mediterranean and Gulf of Mexico, being in the zone of broken lands, are much deeper. The first is divided into two basins by a high neck stretching between Sicily and the African shore, at the slight depth of 50 to 500 feet. The western basin has a depth of over 9000 feet, and the eastern, S. of the Ionian Sea, even 13,000 feet. The Gulf of Mexico, as shown in Fig. 1, *c*, has a depth of over 5000 feet. The Caribbean Sea averages 6000 feet, and reaches near Darien at least 10,000 feet. Still, outside of the Lesser Antilles the basin of the ocean proper sinks to 18,000 feet and more. The greatest depths of the ocean have been observed in the South Atlantic. West of St. Helena James Ross found no bottom with a line of 27,600 feet. West of the island of Tristan da Cunha, Capt. Denham touched the bottom at 46,000 feet. Captain Parker found even 50,000 feet in the same region. But from the difficulty of such measurements those figures can hardly be accepted as correct. On the whole, the ocean basins become less deep toward the north pole, just as the lands become lower toward the same region. A. Guyot.

Ocean, county of New Jersey, bounded E. by the Atlantic Ocean. Area, 683 square miles. It is generally low, level, and covered with pitch-pine forests and cedar swamps. Bog-iron ore and valuable greensand (known as marl, an excellent fertilizer) are obtained. Indian corn and lumber are leading products. Cap. Tom's River. Pop. 13,628.

Ocean, tp. of Monmouth co., N. J. Pop. 6189.

Ocea'na, county of Michigan, bounded W. by Lake Michigan. Area, 550 square miles. It is level, well-wooded, and adapted to grain and fruit raising. The lumber manufacture is the leading industry. The county is traversed by the Chicago and Michigan Lake Shore R. R. Cap. Hart. Pop. 7222.

Oceana, tp. of Muskegon co., Mich. Pop. 919.

Oceana, post-v. and tp., cap. of Wyoming co., West Va. Pop. 791.

Ocean Grove, post-v. of Ocean tp., Monmouth co., N. J., on the sea-coast, 6 miles S. of Long Branch.

Ocea'nica, the name given by modern geographers to all the islands or groups of islands situated between the south-eastern shore of Asia and the western shore of America, and consisting of the Malay Archipelago, Australasia, and Polynesia.

Ocean Navigation. See Navigation, by Lt.-Com. Alexander H. McCormick, U. S. N.

Ocean Springs, post-v. of Jackson co., Miss., on the New Orleans and Mobile R. R. Pop. 560.

Ocean Steam Navigation. See Navigation, Ocean Steam, by W. S. W. Vaux.

Ocel'lus Luca'nus, a Greek philosopher, b. in Lucania, Italy, probably in the fifth century B. C. Of his life nothing is known, and it has been much disputed whether the treatise Περὶ τῆς τοῦ Παντὸς Φύσιος ("On the Nature of the Whole"), written in the Ionic dialect, is a genuine work by him or not. There is a good edition of it by Mullach (Berlin, 1846), and an English translation by Thomas Taylor (1831). The treatise is remarkable, because it argues that the *whole* has had no beginning and will have no end.

O'celot [Aztec, *ocelotl*, from *oça*, "to paint"], a name applied to the *Felis pardalis*, one of the handsomest of the cat family, found in America from Louisiana and Texas S. to Patagonia. It is some three feet long, extremely agile and graceful, nocturnal in its habits, and a good climber of trees. It is easily tamed, and greatly resembles the common cat in its habits. Its skin is prized in commerce. It is gray, marked with black and fawn-colored lines. The painted ocelot (*Felis pictus*) and the gray ocelot (*F. armil-*

lata) are South American animals of similar size, habits, and appearance. Still other species or well-marked varieties are known.

O'chre. Clays colored by hydrated peroxide of iron in variable proportions, and thus yielding shades of yellow from pale yellow to deep orange, are largely used as pigments in the arts under the name of ochre, but the term is also more broadly applied to any clay richly colored by peroxide of iron. "Reddle," or "red chalk," is a variety of ochre consisting of decomposed *hematite.* In mineralogy, earth varieties of *hematite* or iron-peroxide, if bright tinted, are known as "red ochre," whilst argillaceous and decomposing *limonites*, or hydrated peroxides, give rise to "brown ochre." The term is moreover used in that science, in combination, to express the earthy, pulverulent, decomposing oxides of other elements.

Ocklawaha River, a navigable branch of the St. John's River, rises in the lakes of Orange and Sumter cos., Fla., and traverses Marion and Putnam cos., in a northward course. It has regular steam navigation.

Ock'ley (Simon), b. at Exeter, England, in 1678; studied at Queen's College, Cambridge, distinguishing himself by his attainments in the Oriental languages; took orders in the Church of England; became vicar of Swavesey, near Cambridge, 1705; published a Latin *Introduction to the Oriental Languages* (1706), a *History of the Jews* (1707), translated from the Italian of Rabbi Leon of Modena, with an original *Supplement concerning the Caraites and Samaritans*, and several translations from Oriental manuscripts; became professor of Arabic at Cambridge 1711; issued the first volume of his great work, the *History of the Saracens*, in 1708, and the second in 1718. D. at Swavesey Aug. 9, 1720.

O'Cle'ry (Michael), b. at Kilbarron, near Ballyshannon, Ireland, about 1575; entered the Franciscan order as a lay brother; resided during much of his life in the Irish convent at Louvain; was sent to Ireland to collect materials for Hugh Ward's *Lives of the Irish Saints*, and spent fifteen years in accumulating antiquarian documents. With the aid of Conary O'Clery, Cucogry O'Clery, and Forfeasa O'Mulconry, he compiled the *Annala Rioghachta Eireann*, or *Annals of the Kingdom of Ireland*, a valuable work usually known as *The Annals of the Four Masters.* (See O'Donovan, John.) O'Clery published an Irish dictionary and other works, and d. at Louvain in 1643.

Ocmul'gee River rises in the central part of Georgia by several head-streams, flows in a generally S. S. E. course, and above Colquitt joins the Oconee to form the Altamaha River. Small steamboats ascend to Macon. Its lower course is through sandy pine woods; its upper, through a granite region, where its many rapids might be utilized for water-power. It is 300 miles long.

Oco'nee, a new county in Georgia, near the headwaters of the Oconee River, formed from the southern part of Clarke co. Cap. Watkinsville.

Oconee, the westernmost county of South Carolina. Area, 550 square miles. It is hilly, and in part mountainous, with much mineral wealth. It is fertile, especially in the valleys. Corn and cotton are leading products. The county is traversed by the Blue Ridge R. R. Cap. Walhalla. Pop. 10,536.

Oconee, post-v. and tp., Shelby co., Ill., on the Northern division of the Illinois Central R. R. Pop. 1558.

Oconee River rises in Morgan co., Ga., and flows S. by E. Below Colquitt it unites with the Ocmulgee to form the Altamaha. Steamboats have ascended in high water to Milledgeville.

O'Con'nell (Daniel), the great Irish agitator, was b. at Carhen, county Kerry, Aug. 6, 1775, the son of a gentleman of small estate, but of ancient family; was educated at St. Omer and Douay, and in 1794 began to study law at Lincoln's Inn; in 1798 was called to the bar; rose at once to distinction as a barrister, and very soon became prominent in Irish politics, addressing himself to the work of the emancipation of the Roman Catholics and of Ireland. In 1815 he was challenged by Alderman d'Esterre of Dublin, whom he mortally wounded; and a duel with Mr. Peel was soon after prevented by the police. In 1828 he was chosen to Parliament from county Clare, but was excluded by the Test oath, but in 1829 the Roman Catholic emancipation took place, and O'Connell entered the House of Commons. His life-work was one of agitation, both among the people and in the House of Commons, for the repeal of the Union. In 1842 he began to hold "monster meetings" in Ireland, and in 1843 he was arrested on a charge of conspiracy and sedition, convicted, and fined heavily; but the Lords reversed the judgment Sept. 7, 1844. In 1845, when it was shown that O'Connell, who had long received a large yearly income from a popular subscription, was also acting as a middleman and collecting money from the tenants of another, his influence began to decline, and in 1846 his support of the Whig ministry tended to the same end. In 1847, enfeebled by overwork and by anxiety for Ireland, where the famine had broken out, he started to make a pilgrimage to Rome, but d. at Genoa May 15, 1847.

O'Con'nor (Gen. Arthur), b. at Bandon, near Cork, Ireland, July 4, 1767; was admitted to the bar 1788; sat in the Irish Parliament 1789–96; entered into the conspiracy of the United Irishmen; became one of the five members of their Directory; was imprisoned six months for publishing a so-called seditious pamphlet; went to France with Lord Edward Fitzgerald to negotiate an alliance for Ireland against England; concerted with Hoche the French invasion of Ireland; was arrested in England Feb. 27, 1798, tried for high treason at Maidstone, Kent, but acquitted May 22; rearrested in the court-room on another charge; kept five years a prisoner in Fort George, Scotland; was released June, 1803, on condition of perpetual exile from Ireland; went to Paris; was appointed by Napoleon general of division Feb. 29, 1804; sent to the coast of Scotland in command of the Irish brigade; married, in 1807, Elisa de Condorcet, only daughter of the philosopher; withdrew from the French army 1815; was naturalized as a French citizen 1818; edited with Arago the works of Condorcet (Paris, 12 vols., 1847–49), and wrote a number of controversial pamphlets. D. at Bignon Apr. 25, 1852.

O'Connor (Feargus Edward), b. at Dangan Castle, county Meath, Ireland, in 1796; entered Parliament for Cork 1832; took part in the socialistic agitations, making addresses at many places in England; edited a newspaper of violent tone, the *Northern Star;* was for a time regarded as the leader of the "Chartist" party, which elected him to Parliament from Nottingham 1847; visited the U. S. soon afterwards; became insane in 1852, and d. at Nottinghill, near London, Aug. 30, 1855.

O'Connor (Michael), D. D., b. at Cork, Ireland, Sept. 27, 1810; studied at Queenstown, and in 1824 entered the Propaganda, and in 1833 received the doctorate; became in 1838 president of the Roman Catholic seminary of St. Charles Borromeo, Philadelphia, Pa.; was consecrated bishop of Pittsburg in 1843; translated to the see of Erie, Pa., in 1853, but was referred to his former diocese in 1854. In 1860 he resigned the bishop's office and entered the Society of Jesus. D. at Woodstock College, Md., Oct. 18, 1872.

O'Connor (Roderick), popularly called Rory, the last independent king of Ireland, b. in Connaught in 1116; succeeded to the throne of Connaught on the death of his father, Turlogh O'Connor, 1156; disputed the supremacy for several years with the O'Neals and the O'Briens; assumed the title of king of Ireland 1166; assembled a parliament of lords and clergy at Athboy 1167; aided in the expulsion of Dermot, king of Leinster, 1168; defeated the English invaders under Strongbow in several engagements, but subsequently came to terms with them and reinstated Dermot in his kingdom; afterward carried on war with the English with varying success, until in 1175, after an interview with Henry II. of England, he acknowledged that monarch as lord paramount of Ireland, retaining for himself his ancestral kingdom of Connaught. His sons having revolted against him, Roderick retired in 1186 to a monastery, where he d. in 1198.

O'Connor (William Douglas), b. at Boston, Mass., in 1833; was educated for an artistic career; became associate editor of the Boston *Commonwealth* 1853, and of the Philadelphia *Saturday Evening Post* 1854–60; became clerk of the lighthouse board at Washington 1861, chief clerk 1873, librarian of the treasury department 1874; has written poems and tales for magazines, and published romance, *Harrington* (1860), *The Good Gray Poet* (1866), being a vindication of Walt Whitman, and *The Ghost* (1867).

Oconom'owoc, post-v. and tp. of Waukesha co., Wis., on the La Crosse division of the Chicago Milwaukee and St. Paul R. R., 30 miles W. of Milwaukee, is noted for its numerous lakes, fine drives, and the excellence of its hotels. It is called the "Saratoga of the West." Pop. of v. 1408; of tp. 2931. A. D. Harger, Ed. "Times."

O'Con'or (Charles), LL.D., b. in New York City in 1804, son of an Irish gentleman of education; received a common-school education; was admitted to the bar 1824, and by his untiring industry made his way to the leadership of the legal profession in that city, which he long held, having been retained in many of the most important cases since 1840. Always a Democrat, he never held office except that of district attorney for a few months during the

administration of Pres. Pierce, and that of member of the constitutional convention of 1864. In 1868 he was nominated for the Presidency by the extreme Democrats, and received complimentary votes in several States.

Ocosin'go, a considerable town in the state of Chiapas, Mexico, 70 miles S. E. of Ciudad Real, chiefly noted for extensive ruins, resembling those of Palenque, described by Dupaix and by John L. Stephens in his *Central America, Chiapas, and Yucatan.* Pop. about 5000.

Ocon'to, county of Wisconsin, bounded N. by Michigan and E. by Michigan and Green Bay. Area, 2268 square miles. It abounds in streams, lakes, and forests. Pine lumber is the principal product, and its preparation is the leading industry. The county is traversed by Chicago and North-western R. R. Cap. Oconto. Pop. 8321.

Oconto, post-v. and tp., cap. of Oconto co., Wis., on the Chicago and North-western R. R., 30 miles N. of Fort Howard. It has a public library, 11 public schools, 7 churches, 1 bank, 3 newspapers, a paid fire department, a public park, several hotels, and a number of stores. It owes its prosperity to the lumber trade. Pop. of v. 2655; of tp. 3278. J. W. Hall, Ed. "Lumberman."

O'cracoke, post-v. and tp., Hyde co., N. C. Pop. 368.

Ocracoke Inlet, a passage from the Atlantic to Pamlico Sound, between two of the long low coast-islands of North Carolina. It lies 23½ nautical miles S. W. of Cape Hatteras. On its N. side stands a brick lighthouse 65 feet high; lat. 35° 6′ 28″ N., lon. 75° 58′ 51″ W. It admits only light-draught vessels.

Octahe'dron [Gr. ὀκτώ, "eight," and ἕδρα, "base"], a solid bounded by eight triangular planes. If regular, its faces are equilateral. It has twelve edges and six solid angles, each formed by four equal plane angles. Its solid contents are equal to the cube of one of its edges multiplied by .4714045.

Octane, C_8H_{18}, the eighth of the marsh-gas series, a liquid, sp. gr. 0.7032, at 17° C.; boiling-point, 119° to 125°. It occurs naturally in American petroleum. It may be produced by the dry distillation of the lime-soap of menhaden oil, by passing the vapor of the thirteenth of the same series, tridecane, $C_{13}H_{28}$, through a red-hot tube, and also from octyl iodide, phthalic acid, indigo blue, acenaphthene, etc. By long-continued fractional distillation it may be separated into two hydrocarbons, having different boiling-points, but the same composition. E. Waller.

Oc'tave [Lat. *octavus;* Fr. and Ger. *octave*], in music, an interval eight degrees above or below some other on the scale, as from C to the next C, or F♯ to F♯, etc. Also, the series of notes included in such an interval, as when we speak of a voice or instrument having a range of so many octaves and fractions of octaves.

Octa'via, sister to Augustus, was first married to C. Marcellus, and after his death to Mark Antony. She was a woman of perfect beauty and great accomplishments, and her life shows an almost heroic nobleness of character. She bore to Marcellus two daughters and a son, and to Antony two daughters. Of the latter, the elder was married to L. Domitius Ahenobarbus, and became the grandmother of Nero; the younger was married to Drusus, and became the mother of Claudius and the grandmother of Caligula. Her son, M. Marcellus, was adopted by Augustus, but died young. She also educated the children of Antony by Fulvia and Cleopatra. She d. in 11 B. C.

Octene, C_8H_{16}, **Octylene,** or **Caprylene,** the eighth of the series of olefines. The name was proposed by Hofmann in 1863. Boils at about 118° to 120°; is prepared by the distillation of pelargonic and other fatty acids with lime. Octene is a mobile liquid, insoluble in water, very soluble in alcohol and ether; burns with a bright smoky flame, and is violently attacked by nitric acid, yielding nitro compounds. E. Waller.

Octo'ber [Lat., from *octo*, "eight"], the eighth month of the old style, or Julian year, and the tenth in the Gregorian year.

Octop'oda [from ὀκτώ, "eight," πούς, ποδός, "foot"], a sub-order of cuttle-fishes (class *Cephalopoda*) of the order Dibranchiata, in which the body is sacciform, the head united with the body by a broad cervical band and surrounded by eight fleshy arms; the arms are furnished with sessile cup-like suckers destitute of horny rings; the eyes fixed in the skin and incapable of rotation; the gill chamber longitudinally divided by a muscular partition; the siphuncle entire; oviduct double; no rudimental gland developed, and there is no true shell. The sub-order is exhibited in four living families: (1) *Octopidæ;* (2) *Cyrtopidæ;* (3) *Philonexidæ*, and (4) *Argonautidæ*. The first two are chiefly represented by species inhabiting the shallow waters or near the coast, and the last two by those living in the open sea. The males of all the species are distinguished by a peculiar generative economy; the males and females differ little from each other in general appearance, but in the former one of the eight arms becomes developed in a peculiar manner, supplied with semen, and, in fact, modified as a copulatory organ, and capable of performing the generative function. It then becomes detached from the animal, and may lead for a time an independent life, but at length, in some cases, it is received by a female, and serves to impregnate her. This function was for a long time unknown, and the arm so modified and detached was supposed to be a peculiar parasitic worm, and named *Hectocotylus*. The arm in question is not always the same, in some species one arm being so developed and in others another. The arm so modified is known as a hectocotylized arm. It is periodically renewed and detached. Theo. Gill.

Octopod'idæ [from the generic name *Octopus*], a family of Cephalopods of the order Dibranchiata and sub-order Octopoda (which see). The body is oval and generally destitute of fins; the mantle separated by fleshy bands; the arms with two rows (rarely one) of cups and united at the base by a slight or moderate web, with or without distinct equiferous cells between the bases of the arms. The family includes the common cuttlefish of the European coasts, and one representative is found in deep water off the eastern N. American coast. Some of the species attain a very large size, and exaggerated accounts may be found of their ferocity and size in many popular works. Theodore Gill.

Octroi' [Fr., remotely from the Lat. *auctoritas*, "authority"], a toll in money or in kind levied upon farm and garden produce at the gates of some European towns.

O'Cur'ry (Eugene), b. at Dunahu, near Carrigaholt, county Clare, Ireland, in 1796; received a liberal education; was employed in the archæological department of the ordnance survey of Ireland 1834–41; was then engaged by the Royal Irish Academy and the corporation of Trinity College, Dublin, in cataloguing and transcribing their ancient Gaelic MSS.; discovered and deciphered valuable remnants of the ancient Brehon laws, which he with Dr. O'Donovan was commissioned to edit and translate by the Brehon law commissioners 1853; became professor of Irish history and archæology in the newly-established Roman Catholic university at Dublin 1854; contributed to the *Transactions* of learned societies; edited works for the Celtic Society and the Irish Archæological Society, and published *Lectures on the Manuscript Materials of Ancient Irish History* (1861). Prof. O'Curry's labors constituted the foundation of Sir H. S. Maine's *Lectures on the Early History of Institutions* (1875). D. at Dublin July 30, 1862.

Odd Fel'lows, Independent Order of, a secret benevolent and beneficial association which had its origin in London, England, about 1745. The character attributed to the earliest societies or lodges of Odd Fellows is that of assemblages mainly for social purposes, having an initiation ceremony, and a collection being made to aid needy members.

About the year 1800 the lodges in London and Liverpool were known as "The London Order." In 1809 a member of a London lodge removed to Manchester and introduced the order into that city, where it was so favorably received that several lodges were speedily organized, and in 1814 the lodges in Manchester and vicinity were consolidated under the title of "The Independent Order of Odd Fellows of the Manchester Unity." A grand lodge, composed of those who had filled the chair of noble grand (the presiding officer) a regular term in a subordinate lodge, was organized and assumed supervision of the subordinates. The London associations and other lodges throughout the country refused to acknowledge the authority of the Manchester organization, and several other "Unities" sprang into existence. The Manchester adherents attained greater prosperity than any of their rivals, and the increase of lodges in Great Britain determined the Manchester authorities to organize an "annual movable committee" to take the place of the local grand lodge, the first meeting of which was held at Hanley in the Potteries, Staffordshire, May 19 and 20, 1823, and was attended by 98 deputies, representing the several subordinate lodges. The early laws were crude and imperfect, the receipts being inadequate to meet the authorized disbursements. The annual movable committee eventually established a system of rates based on the experience acquired, which enabled the subordinates to meet the relief requirements and accumulate a reserve fund ample for all probable demands.

The condition of the Manchester Unity, the largest and most important body of Odd Fellows in Europe, is exhibited in the following statement, made Jan. 1, 1875: Lodges, 4029; members, 496,559; lodge funds, $16,809,670; receipts, including interest on investments, in the ten years

1865–75, $24,554,085; paid for sick and funeral benefits 1865–75, $15,392,582. Accurate statistics of the other Unities cannot be obtained, but it may be safely assumed that the various branches in Great Britain aggregate 5000 lodges and 700,000 members. The Manchester Unity has organized lodges in England, Scotland, Wales, Ireland, France, Turkey, Africa, North and South America, East and West Indies, and Australasia.

Societies or lodges of Odd Fellows were organized in New York and other cities in the U. S. as early as 1806, but had a brief existence. On Apr. 26, 1819, Thomas Wildey and four others, who had been members of Odd Fellows lodges in England, organized a lodge in Baltimore, Md., calling it Washington Lodge No. 1. A member of a lodge at Preston, England, visited this self-instituted body in the latter part of the year 1819, and on his return to his home procured from the Duke of York's Lodge of the Manchester Unity, located at Preston, a document dated Feb. 1, 1820, clothing the American organization with the powers of a grand as well as a subordinate lodge, under the title of "No. 1, Washington Lodge, the Grand Lodge of Maryland and of the U. S. of America." This action of a subordinate was subsequently confirmed by the grand committee of the Manchester Unity. On Feb. 22, 1821, Washington Lodge surrendered the English charter to a "body of past grands," and "the Grand Lodge of Maryland and the U. S." was regularly organized, the members of Washington Lodge receiving a subordinate charter from the new grand lodge. In 1823 the self-instituted lodges in Philadelphia, New York, and Boston were induced to recognize the Maryland organization, and that body immediately forwarded charters to the subordinates, as well as grand lodge charters for Pennsylvania, New York, and Massachusetts. On Apr. 15, 1824, it was deemed advisable to separate the powers of the national from the State organization, and the project was consummated Feb. 22, 1825, when the first meeting of the Grand Lodge of the U. S. was held. In 1826, Thomas Wildey, the presiding officer of the Grand Lodge of the U. S., known as the "grand sire," visited England and obtained from the grand committee of the Manchester Unity an independent charter, granting to the Grand Lodge of the U. S. authority "to conduct the business of Odd Fellowship *without the interference of any other country,* so long as the same is administered according to the principles and purity of Odd Fellowship." Intimate relations between the two grand bodies continued for several years, but in 1842, after fruitless efforts on the part of the heads of the order in England and the U. S. to reconcile, by correspondence, vital differences in the work which had arisen, James L. Ridgely, grand corresponding and recording secretary, and Isaac D. Williamson, grand chaplain of the Grand Lodge of the U. S., were commissioned as special deputies to the Manchester Unity to adjust the matters in dispute. The commissioners attended the meeting of the annual movable committee at Wigan May 16, 1842, and after a conference continued through several days found that their efforts for harmonious co-operation were futile. The commissioners presented an elaborate report of their proceedings to the Grand Lodge of the U. S. in Sept., 1842, and that body adopted a series of resolutions on the subject. The hostilities of the Manchester Unity, threatened in 1842, and consummated in 1843 by their attempt to institute lodges in the U. S., resulted in an entire severance of the existing relations.

The objects of American Odd Fellowship are "to visit the sick, relieve the distressed, bury the dead, and educate the orphan." It seeks "to improve and elevate the character of man, imbue him with proper conceptions of his capabilities for good, enlighten his mind, enlarge the sphere of his affections, and lead him to a cultivation of the true fraternal relation designed by the great Author of his being." The motto "Friendship, Love, and Truth" was known and used in connection with the order in 1775. The organization for attaining these objects has two branches, closely connected, yet entirely distinct—lodges and encampments.

To become a member of a lodge under the jurisdiction of the Grand Lodge of the U. S. the applicant must be a free white male of good moral character, who has arrived at the age of twenty-one years, and who believes in a Supreme Being, the Creator and Preserver of the universe. Five or more members holding withdrawal cards granted by legal lodges may apply to the grand lodge of the State or Territory in which it is proposed to locate, for a charter for a lodge; and when instituted, such subordinate is invested with the power to initiate and confer the five degrees on persons regularly proposed and elected residing within the district assigned to it. No one but a member who has attained the fifth or scarlet degree in a lodge is eligible to membership in an encampment, and can remain a member of the encampment only so long as he continues in good standing in his lodge. An encampment confers three degrees; and seven or more members, having the third or Royal Purple degree and holding legal withdrawal cards, may petition the grand encampment of the State or Territory in which it is proposed to locate, for a subordinate encampment. Application for a lodge in a State or Territory in which no grand lodge has been organized must be made to the Grand Lodge of the U. S., and the same rule applies to a petition for an encampment. On the petition of ten or more lodges the Grand Lodge of the U. S. will issue a warrant for a grand lodge of the State, Territory, or province in which the petitioning lodges are located, or for a grand encampment on a similar application by five or more subordinate encampments. A grand lodge or encampment is composed of the past presiding officers of its subordinates, and the representatives of the several grand bodies constitute the U. S. Grand Lodge. Lodges and encampments have the power to regulate the fees for initiation, degrees, and weekly dues, and may determine the amounts to be paid for weekly benefits to sick or disabled members, funeral benefits, etc.; but such amounts must not be less than the minimum prescribed by the grand body having jurisdiction.

The statistics from 1830 (previous to which they are incomplete) to 1875 are as follows: Initiations, 979,428; members relieved, 724,285; widowed families relieved, 97,065; members buried, 64,654; receipts, $59,850,774.31; paid for sick and funeral benefits and the care of widows and orphans, $22,081,772.12. According to the returns of 1874 and the reports so far as received, the following is the present condition of the order in the U. S.: grand lodges, 54; subordinate lodges, 6558; lodge members, 463,087; grand encampments, 40; subordinate encampments, 1761; encampment members, 87,253; receipts, $4,590,000; members relieved, 38,400; widowed families relieved, 6000; members buried, 4000; paid for relief of members and widowed families, burial of dead, education of orphans, $1,590,000.

The Grand Lodge of the U. S. has organized grand lodges in every State and in most of the Territories of the U. S., the provinces of Canada, Switzerland, Australia, Chili, S. A., and a grand lodge of the German empire, which has five grand lodges under its jurisdiction. Subordinate lodges have been organized in the Sandwich Islands, Peru, S. A., and London, England. Grand and subordinate encampments have been instituted in nearly every locality where lodges are established. Nine monthly and twelve weekly periodicals in the interest of the order are published—twenty in the U. S. and one in Germany.

THEODORE A. ROSS.

REVISED AND APPROVED BY JAMES L. RIDGELY, *Grand Corresponding and Recording Secretary R. W. G. L. U. S.*

Ode [Gr. ᾠδή, fr. ἀοιδή, a "song"], in the modern use, signifies a lyric piece of more dignified character than the song, and usually one in which profound feelings are expressed. The ancients originally included under this name all kinds of lyric verse. Pindar, Alcæus, Anacreon, Sappho, and Simonides among the Greeks, and Horace among the Romans, were the chief writers of odes.

Odell′, post-v. and tp. of Livingston co., Ill., on the Chicago Alton and St. Louis R. R., 82 miles from Chicago, has 3 churches, 1 newspaper, and 1 hotel. Large quantities of corn are shipped from this point. Pop. of v. 739; of tp. 1455. W. D. WILSON, ED. "WEEKLY."

O′den, tp. of Chicot co., Ark. Pop. 1523.

O′denheimer (WILLIAM HENRY), D. D., b. at Philadelphia, Pa., Aug. 11, 1817; graduated at the University of Pennsylvania 1835; took orders in the Protestant Episcopal Church 1838; became rector of St. Peter's, Philadelphia, 1840, and bishop of New Jersey Oct. 13, 1859. Author of *Jerusalem and Vicinity* (1855), and several liturgical and theological works.

O′denkirchen, town of Rhenish Prussia, has cotton-spinning and silk, linen, and cotton-weaving factories, and large dyeworks. Pop. 7211.

O′dense, town of Denmark, on the island of Fünen, is an old but prosperous city, with good educational institutions and an active trade. Hans Christian Andersen was born here. Several large sugar-refineries and iron-foundries are in operation. Pop. 18,500.

O′denwald, a mountain-region of Germany, occupying the southern part of Hesse-Darmstadt, and extending for a distance of about 45 miles from the Neckar, which to the S. separates it from the Black Forest, to the Main, which to the N. separates it from the Spessart Mountains. Its western declivities towards the plain of the Rhine are abrupt, but to the N. it slopes down through several terraces, and to the S. E. it gradually disappears in the

level plains. Its highest peaks rise to about 2000 feet, but its general character is very friendly and inviting. It is covered with pine, oak, and beech, and its valleys with orchards and vineyards. Besides its natural beauty, it has great historical interest on account of its many remains from the Roman period and from the Middle Ages.

O′der, a river of Germany, rises in Moravia at an elevation of 1000 feet above the sea, enters Prussian Silesia, where it becomes navigable at Ratibor, traverses the provinces of Brandenburg and Pomerania, and, after a course of 550 miles, empties through the Stettiner Haff into the Baltic. Its navigation is difficult, and along its lower course expensive embankments are required to protect the surrounding country against inundation; as a route of commerce it is of great importance.

Oder′zo [anc. *Opitergium*], town of Northern Italy, province of Treviso, about 14 miles N. E. of the town of Treviso. It is a place of very active traffic, and contains some fine palaces with elegant gardens. Some of these palaces are rich in pictures by Bassano, Paris Bordone, Palma il Giovine, etc. The Villa Colfrancui contains many interesting antiquities, inscriptions, architectural fragments, bas-reliefs, cippi, etc., which have been disinterred in the neighborhood. *Opitergium* is mentioned by all the early Latin historians, and they state that 1000 young soldiers from this town belonging to the army of Cæsar, having fallen into the hands of Pompey, slew themselves rather than remain prisoners. The population at its most flourishing period is said to have reached 50,000, and the beautiful objects in gold, ivory, bronze, etc. which have been found here confirm the story of its former importance. Its later Roman and mediæval history is full of vicissitudes, and its modern fortunes have been those of Venice. The first bishop of Oderzo was Epodius of the fifth century. Pop. 6434.

Odes′sa, town of Russia, government of Kherson, is situated in lat. 46° 29′ N., lon. 30° 44′ E., on a bay of the Black Sea, midway between the mouths of the Dnieper and Dniester. The Turks had here only a small fortress, but after the cession of the territory to the Russians by the Peace of Jassy, Catharine II. founded the present town in 1794. Alexander I. made it a free port for thirty years in 1817, and under the wise administration of its governor, the duke of Richelieu, it increased rapidly, and ranks now as the third commercial town of the Russian empire, and as the first port of the Black Sea, communicating by regular steamship lines with Constantinople, Trieste, Marseilles, Barcelona, Lisbon, Bordeaux, Havre, Antwerp, and London. It stands on a plateau about 200 feet high, which sinks abruptly towards the sea, leaving only a very small belt of shore, occupied by barracks, bathing establishments, and shipping facilities. Along the edge of the plateau runs a very elegant boulevard, planted with trees, lined with palatial houses, and communicating with the beach by a magnificent flight of granite steps. The city is generally well built, with broad and straight streets, and the immediate neighborhood contains many orchards and vineyards, while the plateau farther behind is a sterile steppe. Its benevolent and educational institutions, among which is a university founded in 1865, are numerous and good. It has also important breweries, woollen-mills, and manufactories of sailcloth, cordage, soap, candles, etc. But it is especially as a commercial place that the town has acquired importance. Its harbor is spacious, convenient, safe, and frozen only for a very short time during midwinter; 1253 vessels, of 722,979 tons burden, entered it in 1872, and 1286, of 752,816 tons burden, cleared it. The value of exports amounted during the same year to $34,380,000; that of imports to $40,720,000. The principal articles of exportation are grain, timber, tallow, and wool. The value of wheat exported in 1872 amounted to $25,580,000. Pop. 121,335, containing many Greeks, Armenians, Tartars, Italians, Germans, and Jews. Odessa was subjected to a bombardment by the allied fleets in 1854. (See BOMBARDMENT.)

Odessa, post-v. of St. George hundred, New Castle co., Del. Pop. 695.

Odessa, tp. of Ionia co., Mich. Pop. 959.

Od′ic Force, a term originally applied by Reichenbach to a peculiar iridescence which some people could see about the arms of a magnet. It has been the favorite catchword of humbugs, and applied to everything mysterious. It has received the synonym *psychic force* from Crookes, who performed several startling experiments with Home, the spiritualist, Sergeant Coxe, and others. A lever 36 inches long was fastened at one end to the wall, and upon this a heavy man sat. Home held the tips of his fingers against the distal end of the board, and the board retained its horizontal position, meanwhile supporting the person who sat upon it. Several equally wonderful performances were shown to a number of intelligent and honest people, who authenticated the report of Crookes and others. It is difficult to believe that any such force exists—at any rate, no general attention has been paid to the subject; and it may safely be considered a humbug till some reasons can be given for its physical production.

ALLAN MCLANE HAMILTON.

O′din, the Old Ger. *Wuotan*, the Saxon *Wotan*, occupies in the Scandinavian mythology the same position as Zeus in the Greek. He is the creator of the world, the father of the gods, and, being possessed of the deepest wisdom, he holds the highest power. In battle he gives the victory and sends forth the Valkyries; in council he gives the decision and the expedient; in every-day life he makes the field fertile, the wind and the waves favorable, etc. Behind and above the special gods he is the supreme ruler. The peculiar features under which he was imagined by his worshippers are often vague, sometimes even childish, but generally not without a certain suggestiveness. He had only one eye; the other he had pledged to Mimer, of whose fountain he drank wisdom. Two ravens sat perched on his shoulders—Huginn, the mind as perceiving, and Muninn, the mind as retaining; they flew every day through the world, and whispered in his ear what they saw. But the general idea of him as the god of the heaven, the sky, the wind, riding through space on his eight-footed horse, wrapped in his cloud mantle, and holding the lightning in his hand, is as magnificent as that of the serene Zeus enthroned in brightness, and as characteristic of the climate and the race. He never reached that perfect individualization which distinguishes Zeus, perhaps because the Scandinavian mythology was broken off in the middle of its course without ever ripening into maturity, perhaps because its ideas by their very nature were unfit for a thorough artistic development. But the attempts of mythologists to analyze the myth-forming process, and extract the materials which entered from reality into the mythical creation, may prove more successful with Odin than with Zeus.

Odin, post-v. and tp., Marion co., Ill., on the Illinois Central and the Ohio and Mississippi R. Rs. Pop. 1268.

Odin′ (JEAN MARIE), D. D., b. at Ambierle, France, Feb. 25, 1801; joined the Lazarists in his youth; came to the Lazarist community of the Barrens, Mo., in 1822, and soon afterwards became a priest. In 1842 was made bishop of Claudiopolis *in partibus infidelium* and vicar-apostolic of Texas. In 1847 was translated to the see of Galveston, and in 1861 became archbishop of New Orleans. In 1869 repaired to the Vatican Council, but by reason of infirm health was excused from attendance. D. at Ambierle, France, May 25, 1870.

Od′ling (WILLIAM), M. D., F. R. S., b. at Southwark, England, Sept. 5, 1829; studied medicine at Guy's Hospital and at the University of London; became lecturer on chemistry at St. Bartholomew's Hospital 1863, professor of the same science at the Royal Institution 1868, and at the University of Oxford 1872; author of a *Manual of Chemistry* (1861), *Lectures on Animal Chemistry* (1866), and of various scientific memoirs on chemical theory, of which he is regarded as one of the ablest living exponents.

Odoa′cer, king of Italy from 476 to 493 A. D., was educated in the camp of Attila, but entered afterwards the service of the West Roman empire, and held a high position in the imperial guard when (in 475) Orestes, commander-in-chief of the army, deposed the emperor, Julius Nepos, and placed his own son, Romulus Augustulus, on the throne. The army, consisting of barbarian mercenaries, now demanded of Orestes that one-third of the soil of Italy should be given up to them for permanent settlement; and when Orestes refused, the soldiers chose Odoacer for their leader, and a war broke out which ended with the defeat and death of Orestes and the abdication of Romulus. Aug. 25, 476, the Roman senate declared the West Roman empire dissolved, constituted the kingdom of Italy, and gave the crown to Odoacer, the first barbarian who wore it. He was acknowledged by Zeno, the Byzantine emperor, took up his residence at Ravenna, and governed with energy and moderation. For several years Italy enjoyed peace. The laws and institutions were maintained, the Church was respected, and several campaigns in Dalmatia and Noricum were successfully carried through. Meanwhile, Theodoric, the king of the Ostrogoths, crossed the Alps, instigated and perhaps supported by Zeno, and in three great battles Odoacer was defeated, and finally shut up in Ravenna. Here he held out for more than two years, but capitulated on the condition that he and Theodoric should rule as joint kings. The agreement was confirmed by a solemn oath, but a few days afterwards Theodoric had Odoacer put to death, Mar. 5, 493.

Odom'eter, or, more correctly, **Hodom'eter** [Gr. ὁδός, a "way," and μέτρον, "measure"], an instrument by means of which the distance travelled by a carriage or other vehicle, or even a person walking, is registered.

O'Don'nell (Leopold), Marshal, duke of Tetuan, count of Lucena, and captain-general in the army of Spain, b. Jan. 12, 1809, at Santa Cruz in Teneriffe, was the son of Lieut.-Gen. Carlos O'Donnell, a descendant of an Irish gentleman exiled with James II.; entered the army; became a colonel, and for his services against the Carlists at Lucena (1839) was made a grandee and lieutenant-general. In 1840 he abandoned the cause of Espartero, his patron, by whom he was twice driven into exile; but in 1843, after Espartero's fall, he was made captain-general of Cuba, where he became moderately wealthy. In the insurrections of 1854 he took a prominent part; was for the time reconciled with Espartero, and thenceforth often war-minister and a leading conservative politician at Madrid. In 1859–60 he commanded in Morocco; captured Tetuan Feb. 6, 1860; retired from public life in July, 1866. D. at Biarritz Nov. 5, 1867.

O'Don'ovan (John), LL.D., b. at Atateemore, county Kilkenny, Ireland, July 9, 1809, son of a small farmer; was employed about 1830 in the historical department of the ordnance survey of Ireland, with the object of settling the orthography of places on the ordnance maps by the testimony of Gaelic MSS. and local traditions; repeatedly visited every county in Ireland in executing this commission; was called to the bar 1847, but never practised law; published a *Grammar of the Irish Language* (1845); edited *The Book of Rights* (1847), the superbly printed work *The Annals of Ireland by the Four Masters, from the Earliest Historic Period to A. D. 1616, consisting of the Irish Text from the Original MS., and an English translation*, etc. (Dublin, 3 vols. 4to, 1848–51; 2d ed. 7 vols., 1856; see O'Clery, Michael); became professor of the Irish language, history, and archæology at Queen's College, Belfast (1849), with a salary of only £100; aided Prof. Eugene O'Curry in editing the Brehon laws (1853); was editor of several curious works for the Irish Archæological and Celtic societies. D. at Dublin Dec. 9, 1861. A work prepared by him for the press, O'Clery's *Martyrology of Donegal, a Calendar of the Saints of Ireland* (Dublin, 1864), has been issued since his death.

Odontaspid'idæ [from *Odontaspis*—ὀδούς, ὀδόντος, a "tooth," and ἀσπίς, a "buckler"—the typical genus], a family of sharks most nearly related to the mackerel sharks; the body is, however, in shape more like that of the ordinary sharks, the tail being much prolonged backwards; the head is depressed, oval, and with the snout pointed; the eyes have no nictitant membrane; the nostrils are simple and remote from the mouth; the mouth inferior and with a wide gap; the teeth are nail-like and with basal cusps in both jaws, and in the upper jaw on each side, near the symphysis, are small ones; the opercular apertures are of moderate width, five in number, and all in advance of the pectorals; minute spiracles are persistent and far behind the eyes; the dorsal fins are two, the first in advance of the ventrals, the second at least partly anterior to the anal; the caudal has a small inferior lobe; the tail has no pits at the root, and no lateral keels. The family has but few, and perhaps not more than two, living species, *Odontaspis ferox*, an inhabitant of the Mediterranean Sea, and *Eugomphodus litoralis*, a denizen of the east coast waters of the U. S., and, according to Günther, also represented at the Cape of Good Hope and in the Tasmanian seas. The American species is popularly known as sand-shark. Theodore Gill.

Odontoglos'sa [from ὀδούς, ὀδόντος, "tooth," and γλῶσσα, "tongue"], a group of pectinibranchiate gasteropods, of the sub-order Rhachiglossa, distinguished by the dentition. The radula or lingual ribbon has three longitudinal rows of teeth, the central of which is narrowest and fixed, and the lateral, also fixed, are broad and armed with numerous denticles. It includes the families *Fasciolariidæ* and *Mitridæ*. Theodore Gill.

Odontol'ogy [from ὀδούς, ὀδόντος, "tooth," and λόγος, "discourse"], that branch of zoology which treats of the structure and development of the teeth arming the mouth of vertebrate animals. (See Teeth.) Theo. Gill.

Odontop'teris [Gr. ὀδούς, "tooth," and πτέρις, "fern"], a genus of fossil ferns occurring in the Carboniferous rocks, so called from the tooth-like form of their pinules. Their fronds are usually bipinnate, the pinules adherent by their entire base, without midrib, and supplied with nerves which spring from the rachis along the entire base. J. S. Newberry.

Odontor'nithes [ὀδούς, "tooth," and ὄρνις, "bird"], an extinct group of birds with teeth, as yet known only from the Cretaceous of Kansas, where their remains have been found in excellent preservation. These birds are divided into two well-marked orders—Odontotormæ and Odontolcæ, from the Greek word for tooth combined with τόρμος, "socket," and ὁλκός, "furrow" or "groove." The Odontotormæ have the teeth small, compressed, and pointed, directed more or less backward, and set in distinct sockets. The order contains, as far as known, only two genera. The first and best-known genus is *Ichthyornis*, so named from the vertebræ, which, even in the cervical region, have their articular faces biconcave, as in fishes. The wings are well developed, and the scapular arch and bones of the legs conform closely to the true bird-type. The sternum is keeled, and has elongated grooves for the expanded coracoids. The sacrum, as in living birds, is composed of a large number of co-ossified vertebræ. The length of the tail is unknown. These birds were carnivorous and probably aquatic. *Ichthyornis dispar*, Marsh, was about the size of a pigeon, and *Apatornis celer*, Marsh, was about as large, but of somewhat more slender proportions. The Odontolcæ have the teeth in grooves. This group is represented by the *Hesperornis regalis*, Marsh, a large bird measuring between five and six feet from the bill to the toes, and in many points of structure closely resembling the loons of the present day. It was not, however, a flying bird, as the wings were small or rudimentary, and the sternum was destitute of a keel. The pelvis resembles in a side view that of the cassowary, but is much more slender. The ilium, ischium, and pubis are separate at their posterior extremities, and the acetabulum is closed internally by bone, except a foramen that perforates the inner wall. The vertebræ are of the ordinary bird-type, but those of the tail are provided with elongated and flattened transverse processes, and the flattening even includes the terminal co-ossified vertebræ, so that there is no true ploughshare-bone. The tail was not long, but may have been of use in swimming, as in the beaver. No other birds are known to possess teeth, as the supposed teeth of *Archæopteryx*, upon the slab containing that fossil, belonged, as stated by Owen, to a fish; and the *Odontopteryx*, described by that author from the Eocene clay of London, has only serrations on the bony jaw, similar to those found, in a less degree of development, in the jaws of the merganser and other living birds. O. C. Marsh.

Œcolampa'dius (Johannes), whose true name was Hans Hussgen, b. at Weinsberg, Suabia, in 1482; studied first jurisprudence at Bologna, then theology at Heidelberg, subsequently Greek under Reuchlin at Stuttgart, where he also learned Hebrew from a Spanish Jew, and received an appointment as teacher in 1516 at Bâle, where he assisted Erasmus in his *Annotations* on the New Testament. Luther's writings immediately made a very deep impression on him, and for some time he lived in the castle of Ebernburg as chaplain to Franz von Sickingen. In 1522 he returned to Bâle as preacher and professor in theology, and after the disputations at Baden (1526) and Berne (1528) he succeeded in introducing the Reformation in Bâle and Ulm. In the controversy between Luther and Zwingli concerning the Lord's Supper he gradually adopted the views of Zwingli, which he maintained in his *De Genuina Verborum Domini, "Hoc est Corpus meum," Expositione* (1525), and in his disputation with Luther at Marburg in 1529. He was an accomplished scholar, and a character of great gentleness, which procured for him the name of the "Swiss Melanchthon." He was married, and d. at Bâle Nov. 24, 1531. Besides the above-mentioned dissertation he wrote *De ritu paschali; Epistola canonicorum indoctorum ad Eccium*, and several commentaries and introductions to the books of the Old Testament. There are biographies of him by Hess (Zurich, 1791), Herzog (Bâle, 1843), and Hagenbach (Elberfeld, 1859).

Œcumenical Council. See Council, Œcumenical.

Œde'ma [Gr. οἴδημα, "swelling"], in pathology, a term denoting a puffed and swollen state of any tissue or organ, most commonly caused by the exudation of fluids into the œdematous tissue. If œdema is caused by obstruction to the circulation, by a watery state of the blood, resulting in disturbed relations between the tissues and the blood in respect to osmotic action, or by any other than a strictly local cause, it is called passive œdema; if associated with local inflammation, it is active œdema.

Oe'denburg, town of Western Hungary, near the Lake of Neusiedl, 37 miles S. E. of Vienna, with which it communicates by railway. Its old fortifications have been demolished with the exception of a huge watch-tower, the highest in Hungary; remains of the Roman time are also found, and the town is generally well built. P. 21,208.

Œd'ipus, in Grecian mythology, a son of Laius, king of Thebes, and Jocasta, was exposed by his father on ac-

count of an ill-boding oracle, but was saved by a shepherd and brought to Corinth. Misunderstanding another oracle, he left Corinth and went to Thebes: on the way he unawares slew his father, and at Thebes married his mother. She bore him two sons, Eteocles and Polynices, and two daughters, Antigone and Ismene; but the hidden horrors of his life were subsequently revealed to him. Jocasta hanged herself; between Eteocles and Polynices there was a deathly hatred, and they slew each other; Œdipus put out his own eyes and wandered blind, guided by Antigone, from Thebes to Colonus in Attica, where he died in the grove of the Eumenides. The legends of Œdipus, of which the two baneful oracles and his meeting with the Sphinx, whose enigma he unriddled, form the mystical but singularly suggestive centre, were often treated by the Attic tragedians, and there still exist two tragedies on this subject by Sophocles, *King Œdipus* and *Œdipus at Colonus*.

Œ'gir, in Scandinavian mythology, the god of the ocean, did not belong to the Asa family, nor did he live in Asgaard. He descended from the dark ages before Odin slew Ymer, and was a jotun himself, but he stood in friendly relation to Odin.

Œh'lensläger (Adam Gottlob), b. Nov. 14, 1779, at Frederiksberg, a suburb of Copenhagen, where his father was steward of the royal summer palace; received a rather desultory education; tried various occupations; studied jurisprudence for some time under the direction of his friend, A. S. Oersted, and adopted finally poetry as his calling. In this he was not mistaken. His first publications, *Digte* (1803), a collection of poems, containing the dramatic sketch *St. Hans Aften Spil*, and *Poetiske Skrifter* (1805, 2 vols.), containing *Vaulundurs Saga* and *Aladdin*, made a deep impression on his countrymen. The young generation received an awakening and inspiring influence from these books, and it soon became evident that with them a new period was inaugurated in Danish literature, in Danish civilization. With a stipend from the government he travelled from 1805 to 1809 in Germany, France, Switzerland, and Italy; lived for some time at Halle with Steffens, at Weimar with Goethe, at Coppet with Madame de Staël; and wrote some of his finest tragedies, *Hakon Jarl*, translated into English by F. C. Lascelles (1874), *Palnatoke*, *Correggio*, translated into English by Theodore Martin (1854). On his return to Copenhagen he was appointed professor in æsthetics at the university in 1810. Meanwhile, a controversy between the old rationalism of the eighteenth century and the new romantic school broke out on almost every field of spiritual life in Denmark, and by degrees it formed itself into a contest between Baggesen and Œhlensläger, which grew very hot and lasted for several years, till Baggesen left Denmark in 1820. Œhlensläger did not take part personally in the controversy. He wrote during this period *Helge*, *Hroars Saga*, and *Nordens Guder* (1819), one of his principal works, a cycle of ballads representing the Scandinavian mythology, translated into English by W. E. Frye (1845). But he suffered much, and of his numerous and varied productions (twenty-four tragedies) written after 1820, none can compare with the works of his youth. But his disciples carried farther, with great success, what he had begun. (See Danish Literature and Language.) He d. at Copenhagen Jan. 20, 1850. A complete edition of his works was published at Copenhagen in 32 vols. (1857–65). Selections from his works are very numerous.

Oels, town of Prussia, in the province of Silesia, on the Oelse. It has manufactures of linen and cotton fabrics, leather, and tiles, and flax of a superior quality is extensively cultivated in its vicinity. Pop. 8124.

Œnan'thic E'ther and **Acid.** Œnanthic ether was a name given by Liebig and Pelouze to an ether existing in all wines, giving them their characteristic odor. It remains behind as an oily liquid when large quantities of wine are distilled; obtained in larger quantities by distilling wine-lees after mixing with half their bulk of water. Thus prepared, it is an oily liquid with a strong vinous odor, of a gravity of 0.862, very soluble in alcohol and ether, boiling between 225° and 300° C. According to Liebig and Pelouze, the constitution is $C_{18}H_{36}O_3$; Delffs considers it identical with ethyl pelargonate, $C_9H_{17}(C_2H_5)O_2$. The vapor density rather favors the former views. By treating œnanthic ether with an alkali and decomposing by sulphuric acid, an acid is obtained, which solidifies at 13° C. to a buttery mass above that temperature, being of an oily consistency and soluble in alkalies, ether, and alcohol. Pelouze and Liebig assigned the formula $C_{14}H_{28}O_3$, and called it œnanthic acid; and while Delffs claims that it is pelargonic acid, Fischer claims that it is a mixture of capric and caprylic acids. (Pelouze and Liebig, *Ann. Ch. Pharm.* xix. 241; Delffs, ibid., lxxx. 290; Fischer, ibid., cxv. 247.) A solid substance called œnanthic ether, which is manufactured in Bavaria and used for flavoring inferior wines, was exhibited in the International Exhibition of 1862. (Hofmann's *Report*, p. 113.) E. Waller.

Œnop'ides (Οἰνοπίδης), a Grecian astronomer and philosopher of Chios, who is commonly supposed to have been a contemporary of Anaxagoras; is named among the Greeks who visited Egypt and became acquainted with the learning of the Egyptians; is said to have claimed the discovery of the obliquity of the ecliptic; invented a cycle for bringing into agreement the solar and lunar year, which invention he inscribed on a brazen tablet and set up at Olympia. He proposed also a theory of the rise and fall of the waters of the Nile, and an explanation of the Milky Way as the original pathway of the sun. H. Drisler.

Œnothera. See Primrose.

Oe'rebro, town of Sweden, at the influx of the Swartelf into the Hjelmar Lake, manufactures carpets, waxcloth, woollen goods, and guns. Pop. 8990.

Oer'sted (Hans Christian), b. at Rudkjöbing, in the Danish island of Langeland, Aug. 14, 1777. His father was an apothecary, and in the shop he made his first studies and experiments. In 1794 he repaired to the University of Copenhagen, together with his elder brother, Anders Sandöe (b. Dec. 21, 1778; d. May 1, 1860), who became a celebrated jurist and a statesman of great influence in Danish politics. In 1799 he took the degree of doctor of philosophy, on which occasion he wrote the *Architectonics of Natural Metaphysics*. After travelling from 1801 to 1803 in Holland, Germany, and France, he was appointed extraordinary professor in natural philosophy at the University of Copenhagen in 1806, and his lectures soon attracted attention on account of their lively and popular form, and their latent though omnipresent enthusiasm. To awaken the interest of his countrymen for the study of nature, and to spread among them some knowledge of this science, were the aim of his life, and he succeeded in establishing a polytechnic school in Copenhagen, of which he was director from 1829, and in introducing natural science as an element of instruction in the Latin schools. During a scientific journey in Germany in 1812 and 1813 he wrote an essay on the identity of chemical and electrical forces, in which he for the first time shadowed forth his ideas of the unity of electricity and magnetism which he had entertained since 1800. But his great discovery on this point was not made until 1819, and was communicated to the world in a little pamphlet in 1820: *Experimenta circa efficaciam Conflictus electrici in Acum magneticam.* The discovery was immediately accepted, and honors were showered on the discoverer. His other writings comprise a large number of minor essays, most of which were translated into German, and two larger works, *Naturlärens mechaniske Deel* ("Manual of Mechanical Physics") and *Aanden i Naturen*, which latter has been translated into English by Miss Horner under the title *The Soul in Nature.* It contains many details of great logical sharpness and delicate poetical sense, and as a whole it makes a refreshing impression of clearness and repose. D. in Copenhagen Mar. 9, 1851.

Oe'sel, an island of Russia, in the Baltic and belonging to the government of Livonia. Area, 1200 square miles. Pop. 46,000. Wheat, rye, oats, and barley are raised, cattle, sheep, and horses are reared, and considerable fishing is carried on.

Œsoph'agus [Gr. οἰσοφάγος], the gullet, that part of the alimentary canal that leads from the pharynx to the stomach. In the adult man it is nine inches long, extending in a nearly vertical line from the fifth cervical vertebra through the posterior mediastinum and through the œsophageal foramen of the diaphragm, ending in the cardiac orifice of the stomach. It has an outer or muscular coat, containing an outer layer of longitudinal muscle-fibres, and another of similar annular fibres, the upper fibres being chiefly striped and partly voluntary in the upper part, but entirely involuntary and non-striated in the lower portion. The middle or cellular coat abounds in glands which open by a long duct. The innermost or mucous coat is lined by scaly epithelium. In calibre the œsophagus is the smallest part of the alimentary tube. In the lower animals the œsophagus has several modifications, the most remarkable of which is that singular dilatation which is called the *crop*, and which is observable in gallinaceous and vulturine birds, etc. Most articulate and many molluscous organisms have also a so-called œsophagus.

O'Fal'lon, a v. (O'Fallon Dépôt P. O.) of St. Clair co., Ill., on the Ohio and Mississippi R. R., has 1 weekly newspaper. Pop. 1117.

O'Fallon (Col. John), b. at Louisville, Ky., Nov. 23, 1791: served under Gen. Harrison in the war of 1812; was severely wounded at Tippecanoe; became a merchant at St. Louis, Mo.; acquired great wealth; endowed the

O'Fallon Polytechnic Institute with property worth $100,000, and was a liberal benefactor of Washington University and other educational and charitable institutions, having spent more than $1,000,000 in this manner.

Ofan'to, the ancient *Aufidus*, a river of Southern Italy, rises 6 miles E. of Monte Marano, enters the Adriatic 4 miles N. W. of Barletta, after a course of 75 miles. The battle of Cannæ was fought on its right bank near its mouth.

Of'fa, king of Mercia, succeeded Ethelbald 755, after defeating his rival Beornred; defeated Cynewulf, king of Wessex, thereby annexing the districts of Oxford and Gloucester; conquered the "Welsh march-land," between the Severn and the Wye, 779, which he peopled with Saxon colonies, and constructed for its protection the celebrated dike, 100 miles long, known by his name, which for several centuries was the boundary between England and Wales; established an undisputed suzerainty over the Heptarchy; murdered Ethelbert, king of East Anglia, and took possession of his kingdom 792; founded the abbey of St. Alban's; drew up a code of laws. D. 794.

Of'fenbach, town of Germany, grand duchy of Hesse-Darmstadt, on the Main. It has extensive manufactures of carriages, musical instruments, jewelry, carpets, hosiery, paper, tobacco, and pipes. Pop. 22,691.

Offenbach (Jacques), b. at Cologne June 21, 1819, of Jewish parentage; studied from 1835 to 1837 at the Conservatory of Paris; played afterwards the violoncello in the orchestra of the Théâtre Comique; became in 1847 leader of the orchestra of the Théâtre Français; established in 1855 the Bouffes Parisiens, and composed a great number of burlesque operas and scenes, of which *Barbe bleue*, *Orphée aux Enfers*, *La Belle Hélène*, and *La Grande Duchesse*, were the most applauded.

Of'fenburg, town of Baden, Germany, on the Kinzig, carries on a considerable trade in grain and wine, and has 5756 inhabitants. In 1853 a statue of Sir Francis Drake was erected here in commemoration of his introduction of the potato into Europe.

Office, in law. This consists in the right and obligation of one or more persons to exercise the duties of a place of public or private trust, and to receive the compensation attached to it. An office is either judicial or ministerial. The one requires the exercise of judgment and discretion; the other involves obedience to the direction and judgment of others. The two classes of duties are sometimes combined, so that the office may be partly judicial and partly ministerial. A ministerial office of a public nature may be in England the subject of ownership: the office of high sheriff may thus be hereditary. In this country no such view prevails. An office is deemed to be held for the benefit of the public, and it has in it no element of property. Unless protected by the Constitution, it may be abolished by the legislature, so as to displace an existing incumbent, and he will have no legal remedy. There is an important distinction between judicial and ministerial offices in the matter of acting by deputy. In the former class of cases official acts must be performed personally. A judge, even though for the time being incapable of acting, cannot summon a member of the bar, however learned and experienced, to take his place. The public have stipulated for his personal skill and judgment. In the case of ministerial offices a different rule prevails. The duties of a sheriff or of a clerk of a court are largely discharged by deputy, the principal officer remaining responsible for a proper discharge by the deputy of his duties. This doctrine cannot be extended so far as to permit the sheriff or other ministerial officer to make a sale of the office. This is not only contrary to the policy of the common law, but was at an early day prohibited in England by statute, followed in some of the States of this country. It is important to distinguish accurately between such a sale and the act of creating a deputy. In a strict sale the officer would place the purchaser in possession of the office, who would act in his place and in his own name. On the other hand, as it would usually be impracticable for such an officer as a sheriff to perform personally all the duties pertaining to his office, he is allowed to select subordinate officers, called under-sheriffs, deputies, or jailers, who will act in his stead, and perform duties in his name. They are merely instruments for the performance of his duties. If the high sheriff dies or is removed, his deputies cease to have an official existence except so far as statutes may otherwise provide. (See Sheriff.) The law does not even allow the office of a deputy to be made the subject of sale by the principal officer. Thus, to continue the illustration from the same office of sheriff, that official would not be allowed, in general, to farm out the office of deputy sheriff for a fixed sum, though he might take a percentage of the profits or returns, except that if the compensation of the deputy was itself fixed by law, the sheriff could not lawfully, in making an appointment, stipulate to receive a portion of it. The test is whether the fees belong to the sheriff before any selection of a deputy is made. If they do, he may lawfully agree for a percentage of them. As an appointment to public office involves considerations of importance to the State, the law will tolerate no contract looking to the employment of irregular influences for obtaining it. Any secret agreement whereby the emoluments are to be divided between the officer and a person who may procure or solicit the appointment is deemed to be a fraud upon the appointing power, and accordingly void as between the contracting parties. In some instances an office is held by a number of persons, and this may be true whether it be public or private. It is the common rule, in a public office, in this case, that all must meet for deliberation, while a majority may act; while in the case of a private office, all must both meet and concur in a conclusion. The rule is sometimes modified by statute. Thus, in the case of a court consisting of a number of persons, it is frequently provided that a majority shall form a quorum, and of the number present a majority may decide a cause. The common law rule is found in many instances to be too rigid for the purposes of practical convenience. There was a special rule in the common law designed to secure an impartial and intelligent administration of justice in the courts. It provided that no judicial office should be held in reversion (or to commence at a future day), nor should it be created for a term of years, but at most for life or during good behavior. The reason of these rules is sufficiently obvious. If a judicial office were to commence hereafter, there would be no certainty that competency to perform its duties would then exist. If an office of this kind were granted for a fixed time, the incumbent might die before the fixed period had elapsed, and the residue of the term would pass to executors, etc. who might not have the requisite qualifications. However, this last difficulty may be readily obviated by a provision that the term of years shall not exceed the life of the appointee. The judges of the highest courts in some of our States are chosen in this way by the people. The present tenure in New York is fourteen years, limited by the life of the incumbent, as well as by his attaining the age of seventy. The question of the incompatibility of offices is sometimes important. The same person may seek to hold an office both under the State and Federal government, or two or more offices under the same government. There are some cases in which it is plain that both offices cannot be held at the same time by one person. One cannot be both judge and sheriff; an acceptance of one office would be an implied resignation of the other. In other cases the legislature have power to declare that the holding of one office is inconsistent with the enjoyment of another. It may accordingly declare, where constitutional provisions do not conflict, that a person holding an office under the U. S. government shall not hold a State office, or that the acceptance of one office under a State government shall preclude an appointment to another. There are instances in which State constitutions provide that all votes cast for the higher judges of the courts by the legislature or at a State election for any office of trust and profit other than judicial shall be inoperative and void. Though this provision in form operates upon the electors, in substance it disqualifies the judge from accepting while in office any other office of trust, etc. (For other topics affecting this subject see Officer, Information, Quo Warranto.)

T. W. Dwight.

Office Found. See Inquest of Office.

Officer, in law, one who holds an office. (See Office.) The subject will be considered under the following divisions: I. The different kinds of officers, including officers *de facto* and *de jure*; II. The mode of appointment, including official oaths and bonds and removal; III. Tenure of office; IV. The effect of their acts, including liability for misconduct; V. Compensation.

I. While the various powers of government are either legislative, executive, or judicial, it is common only to consider those as officers who attend to judicial and executive duties. Members of the legislature are not in general called officers. Thus, sec. 4 of art. ii. of the U. S. Constitution, which provides that all "civil officers" of the U. S. shall be removed from office on conviction upon an impeachment, does not apply to members of the legislature. However, if the intent be sufficiently plain, it is not to be doubted that members of the legislature may be designated by this term. The word "officers," as used in this article, will only include persons having executive and judicial duties to perform. A distinction is frequently taken between officers *de facto* and *de jure*. By the latter expression is meant one who is rightfully in office; by the former, one

who actually fills the place, although he may be a usurper. A person is with a certain looseness of expression sometimes called an officer *de facto* who is rightfully an officer and has all the evidences of lawful appointment, but who has committed an act whereby his office may be forfeited. It is, however, conceived that the correct term then is an officer *de jure* having a defeasible title. No one can raise a question as to the act of forfeiture except the State by an appropriate legal proceeding. It may waive the forfeiture, whereupon the officer's tenure is indefeasible and absolutely perfect. On the other hand, when an office is usurped it originates in a wrong and can have no element of right in it, even though some statute of limitation may prevent its rectification. The acts of an officer *de facto* are upheld as far as the public or third persons are concerned, although, as between him and the true officer, they may be nugatory; so, when an officer *de facto* is plaintiff and suing for property in his official character, he might be precluded from all recovery on account of the vice or infirmity in his appointment. But it would be plainly contrary to public policy and subversive of the ends of justice to maintain that the acts of an officer *de facto* should be wholly nugatory. It would, then, happen that the acts of a judge who happened to have received a certificate of an election to office, when in fact he was not elected, would be so completely nugatory that all judgments which he had rendered would be absolutely void, and all criminals who had been imprisoned or executed under his order would have been unlawfully bereft of liberty or murdered under forms of law. No such doctrine could, of course, be tolerated. If, however, a legal controversy takes place between an officer *de facto* and *de jure* as to the lawfulness of the former's title, the whole question of the right to the office must be considered as though he had never exercised official functions. This may take place by an appropriate legal proceeding, such as a writ of *quo warranto* or an information in the nature of a *quo warranto*.

II. The general mode of selection of officers in use in this country is either appointment by the U. S. or State executive, or election by the people or some part thereof. Under the U. S. Constitution, it is provided that the President shall nominate, and with the advice and consent of the Senate appoint, ambassadors, other public ministers and consuls, judges of the supreme court, and all other officers of the U. S. whose appointments are not in the Constitution otherwise provided for and which shall be established by law. To this direction there is a qualification to the effect that Congress may by law vest the appointment of such inferior officers as they think proper in the President alone, in the courts of law, or in the heads of departments. There is thus a distinction taken between "inferior" officers and those of another and superior class. The Constitution, however, points out no mode of distinguishing between the two. It is certainly reasonable to consider that all those specially named in the clause referred to—viz. ambassadors, public ministers, etc.—are not inferior officers, and, accordingly, Congress has no power to affect the mode of appointment by the nomination of the President and the advice of the Senate. It will be observed that in the case of the so-called "inferior" officers Congress can only vest the appointment in one of three agencies pointed out in the Constitution—either in the President alone or in the courts of law or in the heads of departments. It follows that it would not be lawful to provide for an election of these officers by the people directly. The theory of the Constitution is to adopt for the selection of judicial and administrative officers the mode of appointment rather than of election. On the other hand, under the State constitutions, a different theory is in general adopted. The plan of election of officers either by the entire people of the State or by a certain portion of them, as represented in city, village, and town organizations, usually prevails. In many of the States this is true even of judicial officers of the highest grade. It is commonly required that officers should take an oath of office before entering upon their duties. (See OATH.) In many instances, particularly where the receipt and disbursement of money are involved, or where the acts of the officer may be such as to affect the persons or property of individuals so as to give them a right of action, an official bond is required. There has been much discussion upon the point whether those acts are of such a nature as to precede the vesting of the powers and duties of the office, or whether the office vests before they are performed, and a failure to fulfil these requirements of the law is to be regarded as a ground of forfeiture. On this latter view the appointee would have the office, but would hold it by a defeasible title, subject to legal proceedings for a forfeiture. The decision of this question will depend much upon the language of the statute creating the office. If an officer was prohibited from *holding* the office before taking the oath or filing the bond, those acts would be vital to his existence as an officer; but if the language is that before he enters upon the duties of his office he must give a bond, etc., he will be an officer, though liable to have his office withdrawn by appropriate proceedings.

The power of removal from office is closely connected with that of appointment. The exact nature of its connection is a matter of great magnitude under the provisions of the U. S. Constitution, as there is no specific mention of the power of removal. It is clear that, as to all officers whose term of office is not explicitly mentioned in the Constitution, there is a power somewhere vested to remove them at pleasure. The only point of difficulty is as to the branch of government invested with its exercise. Is the power of removal vested in the President alone, or is it in him in conjunction with the Senate? As to the "inferior" officers already referred to, so far as Congress has power to regulate the mode of appointment, it may prescribe the term of office as well as the manner of removal. But in the absence of authorized legislation the stress of the inquiry is whether the sole power of removal is vested in the President alone, or in the President in conjunction with the Senate. It can scarcely be said that this question is as yet definitely determined. It has been claimed, on the one hand, that the power of the President to nominate, and with the advice of the Senate to appoint, involves the power to remove, and that this power of removal is vested solely in him. It is argued that removal is in its nature an executive act, and that it is indispensable to the right administration of public affairs that the President, who is responsible to the country for the proper management of the various departments of government, should be able to displace at once men who have proved incapable or unfaithful. Without this power of removal he cannot be held responsible for the misconduct of his subordinate; with it, the people may directly fasten upon him the consequences of mismanagement or corruption. If it be said that too vast a power is thus conferred upon him, the answer is that he is under the check of impeachment and removal from office, and that of public opinion acting promptly and efficiently by reason of our system of frequent elections. On the other hand, it is urged that the power of the President to *nominate* does not include the power to remove, and that this latter power can only be implied from that of *appointment*. Any implication of removal derived from that power would include the Senate, since the appointment is not complete by the action of the President alone. If this view be correct, wherein the power to appoint is vested in the President, by and with the advice and consent of the Senate, removal can only take place by the action of the President with the same advice and consent. The former view prevailed in the time of Washington in both houses of Congress by a narrow majority; in the House of Representatives by a vote of thirty-four members against twenty, and in the Senate by the casting vote of the Vice-President. It is a matter of recent history that this question led to a great struggle between the houses of Congress and President Andrew Johnson. It is not necessary to enter into the details of the contest. Prior to the accession of President Grant (Mar. 2, 1867) an act was passed by Congress regulating the tenure of certain civil officers. (See also the act of Apr. 5, 1869.) These statutes are in substance re-enacted in the *Revised Statutes of the U. S.*, §§ 1767–1775. These sections provide that every person holding any civil office to which he may be appointed with the advice and consent of the Senate shall be entitled to hold the office for the term for which he was appointed, unless sooner removed with the same advice and consent. This general rule is qualified by the further provision that (with the exception of the judges of the U. S. courts) there may be, during the recess of the Senate, a suspension by the President of any civil officer appointed as before stated until the end of its next session, and in the mean time some other person may be designated by the President to perform the duties of the suspended officer. Within thirty days after the commencement of the session the President is to nominate persons to fill the place of all officers suspended; and if the Senate, during the session, shall refuse to advise and consent to an appointment in the place of any suspended officer, then, and not otherwise, the President shall nominate another person as soon as practicable to the same session of the Senate for the office. The President has power by the Constitution and laws to fill all vacancies which may happen during the recess of the Senate by reason of death or resignation or expiration of term of office, by granting commissions which shall expire at the end of the next session. Nominations to permanently fill these offices should regularly be made to the Senate for confirmation within thirty days after the commencement of the next session after the vacancy is filled. If no appointment is

made during that session, the office remains in abeyance, without any salary, fees, or emoluments. The same rule is applied to all the offices in question vacant at the commencement of the session and not filled by temporary appointment. (*Revised Statutes,* § 1769.) The power of removal by the executive of a State is to some extent regulated in the State constitutions. It is impossible to refer to these provisions in detail. As to the large number of State offices which are filled by election for a definite term, the governor would not in general have any power of removal unless for good cause, and the officer would have a right to be heard by way of defence. As to those which are directly filled by appointment of the executive, with the advice and consent of the State senate, the same general questions as to the power of removal might be presented as have been referred to in connection with the office of the President of the U. S. Removal from a private office, such as that of a president of a university, is governed by different considerations. Such an appointment may assume the form of a contract, and may be governed by the rules upholding the obligation of contracts. (*Allen* v. *McKeon*, 1 Sumner's Reports, 276.)

III. When the term of office is fixed by the constitution, it cannot, of course, be reduced by the action of legislative bodies. It has also been decided that if the constitution declares an office to be elective, but leaves the length of the term to the discretion of the legislature, and this is subsequently fixed and an officer elected, his term of office cannot be extended by legislative act, since for the extended period he would not hold by election. (*People* v. *Bull*, 46 New York Reports, 57.) In other cases the term is in the discretion of the legislature. There are but few offices under the U. S. Constitution in respect to which the term is prescribed. The judges of the supreme and inferior courts hold during good behavior. This is not true of the territorial judges. Territorial courts, not being provided for in the Constitution, but being established by Congress, are not protected by the constitutional provision. The practice has been to appoint them for a term of years. All offices specifically created by the U. S. Constitution not being judicial in their nature are established for a term of years. The same term is usual in the State constitutions, and is largely made applicable even to judicial offices. Where no term is fixed by a constitution, the whole subject is under the control of the legislature, which may at any time abolish the office without making compensation to the officer. So it may enlarge official functions without making an increase of compensation.

IV. The duties of a public officer of course depend upon the law under which he is created. It is not within the scope of this article to state the various requirements of the statutes. It is only of importance to refer to general principles of law governing official conduct. The presumption of law is that official duties have been rightly performed. There is in general a presumption of authority, and not of usurpation. If a statute gives an officer discretionary power to be exercised by him upon his own opinion of certain facts, the prevailing rule of construction is that the statute makes him the exclusive judge of the existence of the facts. This rule is not to be applied to subordinate officers, who possess no authority except such as is conferred upon them by statutes, and their right to act is made to depend upon the existence of some fact. If they erroneously determine that such fact exists, and they act accordingly, their acts are void, and they may become personally liable for the consequences. The acts of a public officer when unlawful may either cause an injury to an individual or to society at large. In the former case the law gives a remedy to the individual by action; in the latter case the State may proceed against the wrong-doer by indictment or by impeachment. It is no defence to an officer, when called upon to answer in a court of justice for an illegal act, that he acted under the orders of the head of an executive department, nor is it important that he acted upon the high seas under color of naval discipline. This rule was applied in a case where a naval officer illegally assaulted and imprisoned one of his subordinates. In the great mass of cases coming before the courts the act complained of is one of negligence. (See NEGLIGENCE.) For personal neglect involving a breach of duty the officer is in general responsible, as where a superintendent of a canal negligently permits a sunken boat to remain in the canal, whereby damage is caused to the complainant. Still, public officers are not in general liable for the neglect or wilful acts of their subordinates, causing damage to individuals, where they have used reasonable care in their selection of servants. Thus, the postmaster of a city is not liable for the misconduct of a clerk in purloining money from letters, unless personal misconduct or neglect can be brought home to the postmaster himself. Some suggestions should be made as to the power of public officers to bind the government by contracts. It is well settled that they cannot bind the government by any acts beyond or contrary to the authority given them by law. The government is to be regarded as the principal and the officer as an agent; and if the government has limited its liabilities by statute, the restrictions are binding upon all who deal with the officer, as they are bound to take notice of the statute. Thus, the head of an executive department can bind the government by contract only when expressly authorized by law, or where an appropriation is made to be expended by him for a specific purpose. In this last case the officer acts without authority if he exceeds the appropriation. It is a further rule that the officer is not personally liable if he acts in the line of his duty and in the course of his authority. His engagements are binding upon the government, and not upon himself. This is true though he affix his own private seal to the contract. A public officer may, if he see fit, by the use of appropriate language, make himself exclusively liable or jointly with the government. Whenever he acts without authority he fails to bind the government, and will in general make himself personally liable.

There are some acts of the official heads of executive departments acting as instruments of the President of the U. S., which are not the subject of judicial cognizance. Whether this be the case or not must depend upon the nature of the act to be done. If one of the heads of departments is acting as the political or confidential agent of the executive merely to execute his will or to perform some matter in which there is a discretionary authority, his act cannot be examined judicially, though a different rule prevails where a specific duty is assigned by law and individual rights depend upon the performance of the duty. In this last case an individual who deems himself to be injured may have recourse to the law for redress. Questions frequently arise as to the liability of a ministerial officer, such as sheriff or constable, acting at the time under the order of a court. The real inquiry is whether the order will protect the officer. The general rule is that if the magistrate or court has jurisdiction (see JURISDICTION) over the subject, and an execution (see EXECUTION) regular in its form is issued, the officer cannot be held liable as a wrong-doer for rendering obedience to the order. A different rule will prevail if there is a want of jurisdiction. The order of the court to seize a debtor's property and to sell it to satisfy the debt does not point out the debtor's property, but leaves it to the sheriff's judgment to ascertain what can be properly regarded as belonging to the debtor. The officer in that respect acts at his peril, and can be sued by any party injured by a wrongful seizure. On the other hand, if the court itself points out specifically what property is to be taken by an officer, he has no discretion. He must obey, and can shield himself under the judicial mandate. Public officers are also criminally liable in certain cases for neglect of duty or oppression or extortion. These offences are in general misdemeanors. They may also be urged as grounds for a forfeiture of the office in the course of an appropriate legal proceeding. (See INFORMATION and QUO WARRANTO.) The great frauds and embezzlements recently practised by municipal and other officers have led in some of the States to stringent legislation. Thus, in New York the act of wrongfully obtaining and converting to one's use public money with intent to defraud, or wilfully paying or auditing a false claim whereby such money shall be obtained and converted, is made a felony, and punishable by imprisonment in a State prison (chap. 19, laws of 1875). The delinquent officer may also be liable to impeachment (see IMPEACHMENT), and also, in some instances, to removal from office by the action of the executive on due notice and hearing. (For these points, the constitutions and statutes of the respective States must be consulted.)

V. There are some important points to be noted concerning the compensation of officers. In some instances they are paid by fees; in other cases there is a compensation fixed by law and paid out of the public treasury. On an appointment to office compensation does not in general commence until the officer is liable to duty. Thus, if an officer in the navy should receive an antedated commission, he is not entitled to pay from the time of the date, but only from the time of his acceptance of the office. So, if an officer be suspended under the authority of the U. S. from service, and be subsequently restored, he is not entitled to compensation during the period of the suspension unless the order is revoked as made without cause and by mistake. If an officer be removed by the appointment of another, he practically continues in office until he receives notice of the appointment of his successor, and is entitled to compensation up to that time. There is quite a number of provisions in the statutes of Congress affecting the compensation of officers. (*Revised Statutes,* §§ 1760–1766,

§ 1782, § 1784, § 1790.) The principal of these are that no person who holds an office under the U. S. government, the annual compensation attached to which amounts to the sum of $2500, shall receive compensation for discharging the duties of any other office unless expressly authorized by law, and that no allowance or compensation shall be made to any officer or clerk by reason of the discharge of duties which belong to any other officer or clerk in the same or any other department, and that no allowance or compensation shall be made for any extra services whatever which any officer or clerk may be required to perform, unless expressly authorized by law, and finally that no officer in any branch of the public service or any other person whose salary or pay is fixed shall receive any additional pay or compensation in any form for the disbursement of public money or other service unless the same is authorized by law, and the appropriation therefor explicitly states that it is for such additional pay or compensation (§§ 1763–1765). Under provisions of law similar to these, it has been decided by the supreme court of the U. S. that the government is not liable upon an agreement by the head of a department to pay a clerk who continues to hold his place and draw pay as a clerk in the department for services rendered outside of the scope of his employment; *e. g.* making inquiries and collecting information in a foreign country. As a general rule of law, and without reference to prohibitory legislation, a salaried officer cannot claim compensation for additional duties imposed upon him by the legislature (*Smith* v. *New York*, 37 New York Reports, 518), nor can he claim extra compensation on the ground that he has performed the duties of his office with extraordinary diligence.

(Further information as to the subject of this article may be sought in the statutes of the respective States, and in Cole *On the Law and Practice of Quo Warranto* and in Tancred on the same.) T. W. DWIGHT.

Off′set, in surveying, is a short course measured at right angles to a longer one. The method of surveying by offsets is used when the lines to be determined are irregular. It is also used in locating the positions of prominent objects lying near the principal lines of a survey.

Og′den, post-v. of Boone co., Ia., on the Chicago and North-western R. R., has good schools, 2 churches, 3 grain-elevators, a steam flouring-mill, 3 hotels, 1 bank, 1 newspaper, and stores. It is situated in a rich farming section. Pop. about 600. CARL BILLINGS, ED. "REPORTER."

Ogden, post-v. and tp., Riley co., Kan., on the Kansas Pacific R. R. Pop. 530.

Ogden, post-v. and tp., Lenawee co., Mich., on the Canada Southern R. R. Pop. 1515.

Ogden, post-v. and tp., Monroe co., N. Y. Pop. 2874. The township is intersected by the Erie Canal and the New York Central and Hudson River R. R. (ADAMS BASIN STATION).

Ogden, a v. (OGDEN CITY P. O.) and cap. of Weber co., Ut., at the junction of the Weber and Ogden rivers, at the mouth of Ogden Cañon, at the junction of the Central Pacific, the Union Pacific, the Utah Central, and the Utah Northern R. Rs., has large agricultural and mining interests, and 1 weekly newspaper. Pop. 3127.

Ogden (AARON), LL.D., b. at Elizabethtown, N. J., Dec. 3, 1756; graduated at Princeton 1773; served gallantly through the Revolution, in which he was successively aide-de-camp to Lord Stirling and to Gen. Maxwell, and was distinguished at Yorktown; became a lawyer after the peace; was boundary commissioner for New Jersey; was U. S. Senator 1801–03, governor 1812–13; commanded the New Jersey militia during the war of 1812, and became president-general of the Society of Cincinnati. D. at Jersey City Apr. 19, 1839.

Ogden (DAVID), b. at Newark, N. J., in 1707; graduated at Yale College 1728; studied law in New York; became the head of his profession in New Jersey; became judge of the Supreme Court 1772; was regarded as a Tory, though anxious for an equitable settlement of the questions between Great Britain and the colonies; took refuge in New York 1776; retired to England 1783, his property having been confiscated; returned to the U. S. in 1790, and d. in Queens co., L. I., in 1800.

Ogden (JOHN), A. M., b. at Mount Vernon, O., in 1824; removed in childhood to what is now Crestline, O; was educated by his own efforts; studied at Wesleyan University, Delaware, O., and for three years was principal of its normal department, and then for three years principal of the McNeely (O.) State Normal School; was principal of the State Normal School, Winona, Minn., 1859–62; served in the U. S. volunteers 1862–65; was the founder of Fisk University, Nashville, Tenn., and for a time its principal; afterward became connected with the normal school at Worthington, O.; author of *The Science of Education*.

Ogden (WILLIAM B.), b. in Delaware co., N. Y., 1805; studied law for some time, but entered in 1826 into business; was elected to the legislature of New York in 1834; moved in 1836 to Chicago, of which city he was the first mayor, and for whose prosperity he did very much by his immense transactions in real estate, railroads, canals, and the lumber business. D. at Fordham Heights, N. Y., Aug. 4, 1877.

Og′densburg, city of St. Lawrence co., N. Y., on the St. Lawrence River, at the mouth of the Oswegatchie River, and on the Central Vermont R. R., and the terminus of the Rome Watertown and Ogdensburg R. R., 72 miles below Lake Ontario. It was incorporated in 1868. It is the head-quarters of the Northern Transportation Company's line of 20 screw-steamers plying between Chicago and intermediate lake ports. It contains 9 public schools, 6 churches, a paid fire department, good water-power, finely-shaded streets laid out at right angles, a post-office and U. S. court-rooms costing $275,000, 1 daily and 2 weekly newspapers, a good supply of water, 3 fine parks, a marine railway, and 3 banks. It has considerable commerce, and is a port of entry. Pop. 10,076.

N. H. LYTLE, ED. "DAILY JOURNAL."

Ogee′chee Lime, the *Nyssa capitata*, a small tree of the order Cornaceæ, growing in wet places in the Southern States. It has a soft wood and a remarkably sour edible red fruit about an inch long.

Ogeechee River rises in Green co., Ga., flows in a course generally parallel to that of the Savannah River, and falls into Ossabaw Sound. Its lower waters are navigable for steamers, and a large part of its course for keel-boats.

O′gemaw, county of Michigan. Area, 576 square miles. It is densely timbered and has a good soil, but its resources are but little developed. Pop. 12.

Ogham is the name of a secret alphabet once in use by the Irish and other Celtic nations, but neither the origin nor the meaning of the name is known. The alphabet is often used on tombstones, but the inscriptions seldom contain more than a name. Such stones are frequent in Ireland, and a few are found in Scotland and Wales.

O′gilby (FREDERICK), b. in Ireland Dec. 27, 1814; came early to America; was educated in Rutgers College and the General Theological Seminary; became deacon in Grace church, New York, then rector of the Church of the Ascension, Philadelphia, and in 1855 assistant minister of Trinity church, New York. D. in New York Mar. 25, 1878.

Ogilby (JOHN), b. in Edinburgh, Scotland, Nov., 1600; translated Homer, Virgil, and several other classic authors; published a number of atlases of various regions of the world, and was author of *America, being the most accurate Description of the New World* (London, folio, 1671); conducted the poetical part of the coronation pageantry 1661; erected a printing-house in London 1667, and was appointed royal cosmographer. D. at London Sept. 4, 1676.

Ogilby (JOHN D.), D. D., b. about 1808; graduated at Columbia College, N. Y., 1829; was rector of the grammar school of that institution 1829–30; professor of languages at Rutgers College 1832–40; became a clergyman of the Protestant Episcopal Church, and was professor of ecclesiastical history in the general theological seminary, New York, from 1841 until his death at Paris in 1851. Author of *An Argument against the Validity of Lay Baptism* (1842), and of *The Catholic Church of England and America* (1844).

O′gilvie (JAMES), b. in Scotland about 1760; came to America about 1785; established a classical academy at Richmond, where Winfield Scott, the future general, and other celebrated men were his pupils; retired to the backwoods of Kentucky, where in a log cabin he composed a series of lectures afterwards delivered with success in the Atlantic States; went to Scotland to lay claim to a peerage about 1819, and d., probably by his own hand, at Aberdeen Sept. 18, 1820. He published *Philosophical Essays* (1816).

O′gle, county of N. Illinois. Area, 576 square miles. It is rolling and very productive. Live-stock, grain, and wool are leading products. There are manufactures of carriages, wagons, etc. The county is traversed by Rock River and by various railroads. Cap. Oregon. Pop. 27,492.

O′gle (BENJAMIN), b. in Maryland in 1749; was in the provincial council before the Revolution; was governor of Maryland 1798–1801; d. at Annapolis July 6, 1809.—SAMUEL OGLE, proprietary governor of Maryland 1735–42, and 1747–52, had previously held office in Ireland. D. 1751.

O′glesby, post-v. of La Salle co., Ill., on the Illinois Central R. R.

Oglesby (RICHARD JAMES), b. in Oldham co., Ky., July 25, 1824; left an orphan at the age of eight years, he re-

moved to Decatur, Ill., in 1836; learned the carpenter's trade, which, with farming, occupied his time until 1844, meanwhile studying law, and in 1845 was licensed and commenced practice at Sullivan. In 1846 he returned to Decatur, and was commissioned first lieutenant in the 4th Illinois regiment (Col. E. D. Baker's), and with which he participated at Vera Cruz and Cerro Gordo. Resuming his practice at Decatur in 1847, he pursued a course of study at the Louisville Law School, graduating in 1848; in 1849 he journeyed overland to California and engaged in mining until 1851, when he again resumed his residence and practice at Decatur. In 1858 he was defeated for Congress, but was elected to the State senate in 1860, which seat he resigned, and accepted the colonelcy of the 8th Illinois Volunteers; commanded a brigade at capture of Forts Henry and Donelson, and made brigadier-general Mar. 21, 1862, remaining in command of brigade until the battle of Corinth, where he was severely wounded, and disabled until April, 1863, when he returned to duty, having meanwhile (Nov., 1862) been promoted to be major-general, and was assigned to the 16th corps. Resigned May, 1864, and in November of that year was elected governor of Illinois (1865–69); re-elected in 1872, but chosen U. S. Senator Jan., 1873.

O'glethorpe, county of N. E. Georgia. Area, 480 square miles. It is uneven and generally very fertile. Cotton and corn are staple products. It is traversed by a branch of the Georgia R. R. Cap. Lexington. Pop. 11,782.

Oglethorpe, post-v., cap. of Macon co., Ga., on the Flint River and on the Georgia Central R. R. Pop. 400.

Oglethorpe (James Edward), b. in London Dec. 22, 1696; entered the army 1710; went to Oxford 1714; served under Prince Eugene and Marlborough 1715–17; entered Parliament in 1722 for Haslemere; obtained a charter in 1732 and a grant for the founding of Georgia and the colonization of poor debtors in that province; founded Savannah 1733; received the Protestant emigrants of Salzburg 1734, and soon after revisited England, but returned to Savannah with John and Charles Wesley in 1735; in 1736 he took a regiment of troops thither; became in 1737 a colonel and commander-in-chief in Carolina and Georgia; made an unsuccessful attack on St. Augustine 1739–40, and in 1742 repelled by stratagem the attack of the Spaniards upon Georgia; returned finally to England 1743; served as major-general against the Pretender 1745; was court-martialled for misconduct 1746, but acquitted; became lieutenant-general 1747, and general 1765, when he retired upon half pay. D. at Cranham Hall, Essex, July 1, 1785. (See his *Life*, by Robert Wright, 1867.)

O'glio [anc. *Ollius*], a river of Northern Italy, rises in the Rhætian Alps, flows through Lombardy, and joins the Po, after a course of 150 miles, near Borgoforte, 10 miles S. W. of Mantua.

O'Gor'man (James), D. D., b. in Ireland in 1814; came to the U. S., and 1859 was consecrated Roman Catholic bishop of Rhaphanea *in partibus infidelium*, and appointed vicar-apostolic of Nebraska. D. July 4, 1874.

Ogowai, a river of Western Africa, is formed in lat. 40′ S., 100 miles from the coast, by the junction of the Okanda and the N'gooyai, and has been explored up to this point. In the dry season it is navigable for light-draught steamers up to Goombi, 95 miles from the coast, but in the wet season it rises 15 feet and carries an immense quantity of water to the Atlantic through its several mouths.

Og'yges, in Greek mythology, the first king of Thebes, whose oldest gate was called after him the Ogygian. During his time the waters of Lake Copais rose above its banks and inundated the whole valley of Bœotia. An Ogygian deluge is also spoken of in Attica, and Ogyges himself is sometimes represented as a Bœotian autochthon, sometimes as an Egyptian king, and was brought into manifold connections with the earliest legendary history of Greece.

Ohatch'ie, tp. of Calhoun co., Ala. Pop. 857.

Ohi'o, one of the central States of the American Union, lying between the great lakes and Ohio River. It is between the parallels of 38° 23′ and 41° 58′ N. lat., and between the meridians of 80° 31′ and 84° 48′ W. lon. from Greenwich. It is bounded on the N. by Michigan and Lake Erie, on the E. by Pennsylvania and West Virginia, on the S. by West Virginia and Kentucky, from which it is separated by Ohio River, and W. by Indiana. Its greatest length from N. to S. is about 210 miles, and from E. to W. it has a breadth of 195 miles. Its area is 39,964 sq. m., or 25,576,960 acres.

Face of the Country, etc.—The State has no mountains, but the greater part of its surface is a table-land elevated about 1000 feet above the sea-level, rising to a height of 1300 or 1400 feet on the divide or watershed which separates the waters flowing into Lake Erie from the tributaries of Ohio River, and attaining nearly the same height in the line of hills which crosses the State just below the parallel of 40°. From this table-land there is a gentle de-

Seal of Ohio.

scent to Lake Erie on the N. (the lake-shore being about 650 feet above the sea), and a somewhat more rapid descent to Ohio River on the S., that river being 414 feet above the sea at Cincinnati and 680 at Pittsburg. Between the two nearly-parallel ridges named, which have a general direction from E. to W., there is a level and at times marshy tract. In the N. and N. W. parts of the State there are prairies of considerable extent. The streams flowing into the Ohio have cut deep channels of erosion in the southern part of the State through the soft and disintegrating limestones and sandstones, and have thus created apparent high bluffs along their banks. The lake-shore of the State is 230 miles in extent, and Ohio River has a course of 436 miles of navigable waters along the S. and S. E. The *rivers* of the State are the Ohio, and its tributaries on the N. bank—viz. the Mahoning, the Muskingum (formed by the junction of Walhonding and Tuscarawas rivers), the Scioto, and its principal affluent, the Olentangy or Whetstone River, the Little Miami, and the Great Miami. The Hockhocking and Brush are smaller streams. These rivers drain about three-fourths of the State, and have about 285 miles of navigable waters aside from those of the Ohio. The principal rivers flowing into Lake Erie are the Maumee, Sandusky, Huron, Vermilion, Black, Rocky, Cuyahoga, Chagrin, Grand, Ashtabula, and Conneaut. The Maumee is the only one of these streams which is navigable, and this usually only to Perrysburg (18 miles), though in high stages of water steamboats go to Defiance, 42 miles farther. The lake-shore has not many bays or indentations, but there are good harbors at Cleveland, Sandusky, and Maumee Bay. Sandusky Bay, the largest of these, extends nearly 20 miles inland, and in the bay and in the lake near it are a number of islands of considerable size. Some of these have extensive vineyards. There are no large lakes in the State, but several small ones in Mercer, Shelby, and some of the other western counties.

Geology.—The whole State, except in the mere surface-soil, belongs to the Palæozoic system. No formations above the coal-measures are found within its limits until we come to the Quaternary; the Permian, Triassic, Cretaceous, and Tertiary systems having no representatives in the State. Nor does the Eozoic system come to the surface at any point, the different groups and strata of the Carboniferous, Devonian, and Silurian systems being all that are found in the State, except the surface-soil, which is Quaternary, and a large proportion of it Drift. These Quaternary deposits Prof. Newberry regards as having covered a very long period, during which there were several alternations of elevation and subsidence and of an arctic and a very mild climate. The lowest of the Drift or Quaternary deposits were the result of general glaciated action, which furrowed and striated the rocks and excavated valleys, channels, and lake-basins to a great depth, most of which were subsequently filled up, wholly or in part, by later deposits; while this same glaciated action threw down a tough blue unstratified clay known as *boulder clay*, or hard pan; upon this was deposited a finely-laminated clay known as the *Erie clay*; next above came a layer of carbonaceous matter, called the *Forest bed*, which was a deposit from a growth of vegetation covering a large part of the area previously covered by the ice-sheet. This is the source of many of the peat deposits of Southern Ohio. Above this come in successive layers the stratified deposits of the *Lacustrine drift*, the scattered boulders, blocks, cobble-stones, and sometimes masses of iron and copper, which constitute the *Iceberg drift*, with occasional deposits of hills, ridges, and banks corresponding to the "Kames"

and "Eskers" of the Old World Drift; and finally, above all these, and more recent than any of them, the *Lake ridges*, embankments of sand, gravel, and clay which run imperfectly parallel with the present margin of Lake Erie. These are six or eight in number, the lowest being 100 feet, and the highest about 250 feet, above the present level of the lake. The Carboniferous system as developed in Ohio is a portion of the great Appalachian coal-field, which extends through Western Pennsylvania, West Virginia, Eastern Kentucky and Tennessee, Northern Alabama, and Central Mississippi. It occupies in Ohio about 12,000 sq. m., or nearly one-third of the area of the State. But though all the groups found in this area belong to the Carboniferous system, they are by no means all of them coal-bearing. Beginning with the western border of the coal-field, a short distance E. of Portsmouth, and following a nearly N. N. E. line almost to Lake Erie—along which line the Carboniferous rocks first show themselves as overlying the Devonian system, which occupies the central N. E. and N. W. portions of the State—the strata are developed in the following order: the Waverley group, succeeding immediately to the Erie shale (the highest member of the Devonian), and consisting of the Cuyahoga shale, the Berea grit, the Bedford, Cleveland, and other shales; next above this comes the Lower Carboniferous limestone, succeeded by a thick conglomerate; and next in order the lower coal-measures, in which, interstratified with fire-clays, sandstones, limestones, and shales, the Ohio geological survey have found seven distinct veins of coal of different qualities, but all or nearly all valuable either for combustion, smelting, or gas-producing purposes. The lower coal-measures have an average thickness of about 400 feet. Next to these succeed the lower barren measures, also about 400 feet thick, in which there are local seams of coal occurring among the beds of limestones, sandstones, and shale. The upper coal-measures come next, about 350 feet in thickness, and, like the lower coal-measures, containing, interstratified with sandstones, limestones, clays, and shale, six more coal-veins, some of them of great value. Still above this are found irregular deposits, in some places attaining a thickness of 300 feet, of what are known as the upper barren measures, containing thin local seams of coal. The aggregate thickness of all the workable beds of coal is estimated by Prof. Newberry at about 50 feet, of which perhaps not more than 30 feet can be conveniently wrought. The amount of coal in this district is roughly calculated at 3,000,000,000 tons. The annual product for several years past has been from 2,500,000 to 3,000,000 tons. The Devonian system comes to the surface in immediate connection with the Waverley group, which forms the rim of the coal-basin on its western side. Here we have in descending order the Erie shales, the shales, flagstones, limestones, and water-lime of the Portage and Chemung groups; the slates, shales, and limestones of the Hamilton group, a narrow belt of the Utica shales; and the Silurian system comes to the surface with its limestone and sandstone strata of the Niagara group, underlaid immediately by the Helderberg limestones, the Onondaga salt group not appearing in Ohio. In the S. W. corner of the State still older rocks make their appearance, members of the Trenton group of limestones and of the Black River and Birdseye limestone groups. In the N. W., as in the N. E. of the State, the Devonian system overlaps the Silurian, and the Oriskany, Corniferous, and Hamilton groups extend into the State from Indiana and Southern Michigan.

Minerals.—We have already spoken of the abundance of coal in the State. Several of the large veins are excellent for smelting purposes, containing very little sulphur and hardly a trace of phosphorus. Iron ore of excellent quality is equally abundant, extending over an area of nearly 12,000 miles in the southern part of the State, where the coal is readily accessible. The amount of iron ore mined annually must exceed 600,000 tons, as the production of pig iron in 1872 and 1873 exceeded 400,000 tons per annum. Salt is also largely produced from salt springs, the yield in 1873 being 1,400,000 barrels, and that of 1874 a larger amount. Petroleum is produced to the extent of about 1,500,000 gallons in the State; lime is burned to the amount of 500,000 barrels, and water-cement to a moderate extent. There are numerous quarries of excellent sandstone and limestone for building, and grindstones and burr or mill stones. There are numerous mineral springs in the State, and large deposits of marl in the Maumee Valley and elsewhere.

Soil and Vegetation.—In 1873 the amount of woodland or forest in the State was reported at 5,650,000 acres, a reduction of more than 1,000,000 acres in twenty years. In 1820 nearly four-fifths of the surface of the State was covered with forests; now there is but little more than one-fifth. The principal forest trees are, among the evergreens, a few pines, hemlocks, tamaracks, cypresses, and spruce, mainly found in the northern portions of the State, and some of them only in the swamps; and of deciduous trees, white, red, Spanish, black, burr, swamp, jack, and swamp white oak; blue, white, and black ash; beech; black, sugar, and red or swamp maple; bitternut, shagbark, thick shellbark, mockernut, and pignut hickory; white, red or slippery, and water elm; sycamore, hackberry, dogwood, ironwood, hop hornbeam, black walnut, butternut, yellow poplar or tulip tree, buckeye (which gives its popular name to the State), pawpaw; 5 species of poplar, including the white poplar, quaking ash, cottonwood, balsam poplar or tacamahac, and balm of Gilead; the red and wild or black cherry; the linden; 5 species of thorn; the honey locust, the box elder, redbud, Kentucky coffee tree; several species of mulberry; the gum tree, sassafras, etc. The flora of the State is extensive and varied; it includes most of the flowering plants common to the Eastern States, and a large proportion of those peculiar to the Mississippi Valley. Among the medicinal plants, ginseng, valerian, colombo, gentian, cohosh, mandrake, blood and snake roots are indigenous.

Climate.—We give below our usual statistics of temperature and rainfall for nine places of observation, covering as many different sections of the State:

METEOROLOGICAL DATA.	Cleveland, lat. 41° 30′, lon. 81° 47′; elevation, 685 feet.	Hudson, lat. 41° 15′, lon. 81° 30′; elevation, 1137 feet.	Little Mountain, lat. 41° 38′, lon. 81° 17′; elevation, 1180 ft.	Toledo, lat. 41° 40′, lon. 83° 32′; elevation, 602 feet.	Urbana, lat. 40° 06′, lon. 83° 44′; elevation, 1044 feet.	Massillon, lat. 40° 47′, lon. 81° 37′; elevation, 982 feet.	Marietta, lat. 39° 25′, lon. 81° 30′; elevation, 640 feet.	Portsmouth, lat. 38° 45′, lon. 82° 54′; elevation, 523 feet.	Cincinnati, lat. 39° 06′, lon. 84° 26′; elevation, 523 feet.
	°	°	°	°	°	°	°	°	°
Mean temperature of the year.	45.87	49.51	48.98	49.55	48.30	52.06	50.56	55.83	51.37
Highest " " "	96	98	95	100	96	99	101	104	103
Lowest " " "	8	2	—5	—16	—12	—8	4	8	6
Range of annual temperature..	88	96	100	116	108	107	97	96	97
Mean temperature of spring...	44.39	44.17	43.40	47.45	49.49	47.12	50.80	55.71	51.59
Highest " "	86	88	83	88	88	86	90	96	94
Lowest " "	15	14	9	15	10	15	17	23	19
Range of spring temperature.	71	74	74	73	78	71	73	73	75
Mean temperature of summer	70.52	71.63	69.50	71.99	75.11	72.92	74	78	77.50
Highest " "	96	98	95	100	96	99	101	104	103
Lowest " "	44	41	37	44	47	50.51	52.50	59	56
Range of summer temperature	52	57	58	56	49	48.49	48.50	45	47
Mean temperature of autumn.	53.06	52.73	53.03	51.27	54.07	55.23	53.79	57.95	56.53
Highest " "	87	89	81	90	82	83	89	93	92
Lowest " "	17	13	11	11	22	25	13	17	14
Range of autumn temperature	70	76	70	79	60	58	76	76	78
Mean temperature of winter..	31.08	29.51	29.97	26.99	32.66	32.99	37.08	40.81	35.33
Highest " "	66	63	60	63	61	62.50	65.50	70	69
Lowest " "	8	2	—5	—16	—12	—8	4	8	6
Range of winter temperature..	58	61	65	79	73	70.50	61.50	62	63
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Mean annual rainfall............	38.43	34.74	44.45	38.64	39.78	32.44	39.57	38.32	36.49
Rainfall of spring..................	6.65	8.35	10.35	11.78	7.42	7.22	7.39	9.18	9.41
" summer..............	10.24	7.10	10.15	10.87	10.62	9.15	10.56	11.62	8.77
" autumn...............	10.24	7.77	9.56	9.72	6.91	6.30	6.85	6.38	7.99
" winter................	11.30	11.52	14.39	6.27	14.73	9.77	14.77	11.14	10.32

There is a very marked difference between the climate of the northern and southern portions of the State: the former is characterized by rigorous winters and generally a heavy fall of snow, which lies long on the ground (longer a few miles S. of the lake-shore than in the immediate vicinity of the lake). The summers and autumns are temperate and agreeable. In the southern part the summers are long, and characterized often by intense heat. The

winters are usually mild, with but little snow. The State is very healthy, and malarious diseases, which in its early history were quite prevalent, have almost entirely disappeared.

Zoology.—Very few of the larger wild animals are left in the State. The bear is nearly extinct; the large or gray wolf and the coyote or prairie wolf are rare; deer are occasionally seen, and the raccoon, opossum, skunk, weasel, ground-hog, as well as rabbits, hares, squirrels, and the smaller rodents, are abundant in some parts of the State. Game-birds are plentiful in their season, and most of the birds of prey and song-birds found in New York and Pennsylvania are found in Ohio. Of the reptiles, the number and species are those common to Pennsylvania and the States of the Mississippi Valley. Most of the streams are stocked with trout, black bass, perch, roach, and other fresh-water fish, considerable attention having been paid to fish-culture. Lake Erie has a bountiful supply of the lake white-fish and the salmon or lake trout, as well as many other fish.

Agricultural Productions.—Ohio has a very large proportion of arable land, as well as excellent grazing lands. It has been for many years one of the leading States of the Union in the production of cereals, and also largely engaged in stock-raising. The census of 1870 gives the value of the farms of the State at $1,054,465,226; of farming implements and machinery, $25,692,787; the value of all farm products, $198,256,907, ranking below New York and Illinois in this particular; of animals slaughtered and sold for slaughter, $40,498,375, Illinois alone having a larger amount; the forest products were $2,719,140; the market-garden products, $1,289,272; the orchard products, $5,843,679; and wages paid to farm laborers, $16,480,778. The following table gives the comparative quantities of the principal crops and live-stock statistics for 1870, 1872, and 1874:

Crops, etc.	Amount in 1870.	Amount in 1872.	Amount in 1874.
Wheat....................bushels...	27,882,159	18,087,664	26,896,818
Rye.................... " ...	846,890	295,843	235,435
Indian corn.......... " ...	67,501,144	103,053,234	101,815,494
Oats.................... " ...	25,347,549	25.825,742	19,557,014
Barley.................. " ...	1,715,221	1,528,266	1,233,934
Buckwheat .... " ...	180,341	266,807	240,015
Flax ....pounds...	17,880,624	9,060,588	6,233,341
Hemp .... " ...	50,000		
Wool.................... " ...	20,539,643	17,536,209	16,684,276
Hay.......................tons........	2,289,565	1,763,350	1,508,385
Hops.....................pounds...	101,236		
Tobacco .... " ...	18,741,973	34,900,996	9,245,520
Maple-sugar......... " ...	3,469,128	2,834,714	1,248,955
Sorghum and maple molasses ....gallons...	2,376,039	1,324,450	1,244,364
Irish potatoes.......bushels...	11,192,814	7,832,297	7,348,907
Sweet potatoes...... " ...	230,295	215,023	170,502
Peas and beans..... " ...	45,443	46,250	43,580
Apples .... " ...	11,012,582	21,632,475	15,918,974
Peaches................ " ...	309.639	405,619	2,235,574

Crops, Live-Stock, etc.	Amount in 1870.	Amount in 1872.	Amount in 1874.
Pears.....................bushels...	67,047	153,968	136,587
Grapes ....pounds...	15,853,719	9,616,427	17,965,604
Beeswax............... " ...	22,488		
Honey .... " ...	763,124		
Domestic wine, includes vineyards..........gallons...	2,577,907	425,923	1,078,056
Clover-seed...........bushels...	102,355	308,903	194,066
Flax-seed.............. " ...	631,894	457,379	368,800
Grass-seed............ " ...	48,811	51,110	62,817
Butter ....pounds...	50,266,372	45,413,066	44,335,657
Cheese.................. " ...	8,169,486	34,403,857	33,123,880
Milk sold..............gallons...	22,275,344	23,785,115	25,112,000
Value of all live-stock.........	$120,300,528	$117,700,746	$120,148,655
Horses..................number...	704.664	724,602	738,839
Mules and asses... " ...	16,065	22,958	26,312
Milch cows........... " ...	654,390	....	778,500
Working oxen...... " ...	23,606	1,765,331	894,700
Other cattle.......... " ...	758,221		
Sheep .... " ...	4,928,635	4,464,898	4,333,868
Swine.................. " ..	1,728,968	2,315,554	1,778,399

Among the special agricultural productions which have attained prominence in Ohio is the culture of flax, in which it leads all the other States, and the culture of the grape for the production of wine. There are two distinct wine-districts in the State—one on the Ohio River, in the vicinity of Cincinnati, noted for many years past for its Catawba wines; the other on the shores and islands of Lake Erie, in and near Sandusky Bay. The island climate has proved very favorable to the production of wine-grapes, and from the two districts from 1,000,000 to 2,000,000 gallons of wine are annually produced.

Manufacturing Industry.—No complete statistics of the manufactures of Ohio have been published since the census of 1870. A few industries have reported, but even these very imperfectly. We are therefore under the necessity of giving the figures of 1870 for the industrial products of the State. There were in that year 22,773 manufacturing establishments in Ohio, employing 137,202 hands (119,686 men, 11,575 women, and 5941 children); the amount of capital reported was $141,923,964; wages paid, $49,066,488; raw materials used, $157,131,697; and annual product, $269,713,610: the State ranks fourth in the amount of her manufactures. No portion of the census statistics is so unreliable as those of manufactures, and this is especially true of the larger States. Could a really accurate census of these productions have been taken in 1875, the amount of annual production would doubtless have been more than double that stated above. The leading branches of manufacture were the following: iron, and all manufactures of iron, $37,239,685; of these there were 65 furnaces for making pig iron, and their product was $10,956,938; in 1874 the number of furnaces was 81 and of stacks 94, and the production a little more than 400,000 tons or about $13,500,000. Flouring-mill products in 1870 employed 699 mills and produced of flour and meal $24,965,629; 953 establishments produced clothing to the value of $13,194,998; 219 factories produced agricultural implements to the amount of $11,907,366; 227 machine-shops turned out machinery valued at $11,248,402; 1280 saw and planing mills produced lumber valued at $10,820,562; 58 packing-houses put up meats and pork to the value of $10,655,950. In 1875, 93 packing-houses put up of pork products alone $16,597,490, besides other meats. 915 furniture warehouses produced furniture to the amount of $6,801,085; 300 establishments produced distilled, malt, and vinous liquors to the amount of $13,085,697; 882 tanning and currying establishments produced leather to the value of $7,263,332; 452 tobacco and cigar factories produced tobacco, cigars, and snuff to the value of $5,307,591; carriages and cars were produced in 1232 establishments to the amount of $7,605,435; sash, doors, and blinds, in 142 establishments, to the value of $3,416,998; coal oil was rectified in 25 establishments to the amount of $5,388,473; casks, barrels, tubs, and kegs were produced in 658 shops to the amount of $3,554,171; tin, copper, and sheet-iron ware, in 652 shops, produced $3,214,285; woollen goods, in 191 mills, to the amount of $3,187,815; printing, newspaper, job, and publishing, in 187 offices, to the amount of $4,228,948; soap and candles, in 42 establishments, $2,976,544; boots and shoes, 164 shops, $2,866,803; cheese, 195 factories, $2,287,804; bread and other bakery products, 279 bakeries, $2,202,818; saddlery and harness, 787 shops, $2,074,268; oils, animal and vegetable, in 38 refineries, $3,803,283; marble and stone work, including monuments and tombstones, 197 establishments, $2,221,023; brick, 331 kilns, $1,252,857; hardware, 36 establishments, $1,048,960; hubs and other wagon material, 58 factories, $1,712,208; malt, 34 establishments, $1,129,695; paints, lead, and zinc, 14 mills, $1,061,280; patent medicines and compounds, 17 establishments, $1,004,200; stone and earthen ware, 170 potteries, $970,749 (this was reported in 1873 as exceeding $2,000,000).

Mining and Fishery Products.—The census of 1870 reports 535 mines, quarries, oil-wells, and peat-cutting establishments in Ohio, employing 11,241 hands, having a capital of $9,017,197, paying wages to the amount of $4,682,571, using raw material of the value of $437,714, and producing annually $7,751,544. The State inspector of mines gives, as the result of careful inquiry and returns from the greater part of the coal-mines in the State, the production of coal in the State in 1872 and 1873 at a little more than 5,000,000 tons each year—in 1874 not quite so much; at the average price of $3 per ton, which for the entire State is a very fair average, this would make the coal production alone over $15,000,000. From 280,000 to 340,000 tons of iron ore are raised annually, and perhaps half as much more smelted in favorable seasons; the production of pig iron in 1874–75 was said to be 419,052 tons. The amount of petroleum, salt, building-stone, etc. produced is very large, and all the items included under the head of mining products in 1875 must have exceeded $50,000,000. The products of the fisheries are understated in the census of 1870. Its report gives 106 fishing establishments, employing 565 hands, $262,000 capital, $14,512 of material, and putting up fish to the amount of $383,121. The actual export of white-fish, lake trout, etc. from the lake ports considerably exceeds $1,500,000, aside from the amounts consumed at home.

Railroads and Canals.—There were in the State Jan. 1, 1876, 56 lines of railroads operated by steam, having an aggregate length of main tracks and branches of 5650 miles, equivalent to 7218 miles of single track, and the entire length of the main track and branches of the roads

which pass through the State, or those which have the whole of their course in the State, is 7809 miles. The proportion of capital, debts, and cost of roads and equipment for which Ohio was responsible was—of capital stock paid in, $151,386,011.98; of funded and floating debt, $164,290,040.62; total stock and debt, $315,676,052.60. The actual cost of roads, equipment, etc. for the Ohio portion was $282,937,812.29; the proportion of gross earnings for Ohio was $35,254,117.60; of operating expenses, $25,573,058.14; of net earnings, $9,681,059.46. All the great trunk-lines across the continent have a portion of their route through Ohio, and the four great lines, New York Central, Erie, Pennsylvania Central, and Baltimore and Ohio, lease directly or indirectly the Ohio lines which form parts of their through routes. Most of the lines running from N. to S. through the State also have connections with the S. or S. E., and nearly all of them will eventually, if they do not now, form parts of railway lines extending to the Gulf of Mexico, or to Savannah, Charleston, Wilmington, or Richmond and Norfolk; while the E. and W. lines all connect directly or by a moderate circuit with Chicago, St. Louis, and Omaha.—The *canals* of the State have an aggregate length of 736 miles. They are—Ohio and Erie, extending from Cleveland to the valley of the Muskingum, to Columbus, and thence down the Scioto Valley to Portsmouth; Wabash and Erie, which follows the Maumee Valley to Fort Wayne, and thence extends to Terre Haute, Ind.; Miami Canal, which branches from the Wabash and Erie a few miles N. of Defiance, follows the valley of the Auglaize up to the watershed, and, crossing that, passes down the Miami Valley to Hamilton and Cincinnati.

Finances.—The State debt amounted on Nov. 15, 1875, to $7,949,920.12, of which $4165 bears no interest. Except $1665, which bears no interest, it is held out of the State. There are also school and trust funds on which the State pays interest, the principal of which amounts to $4,121,393.52, and which together constitute what is known as the irreducible State debt. The entire indebtedness of the State therefore amounts to $12,071,373.64. The sinking fund meets the interest on this entire debt, and had Nov. 15, 1875, a balance of $1,131,078.64 toward the principal of the funded debt. The actual receipts into the treasury in the year ending Nov. 15, 1875, were $5,325,192.03, and the actual disbursements were $4,707,810.70. The capital of the school fund proper Nov. 15, 1875, was $2,917,567.37, and of other educational funds $1,203,826.15.

Commerce.—There are four customs districts in the State. We give below the imports and domestic and foreign exports of each for the year ending June 30, 1875, the entrances and clearances for the year ending June 30, 1874, and the shipping registered, enrolled, and licensed as belonging to each port, for the same year:

Customs Districts.	Imports for year ending June 30, 1875.	Domestic exports for year ending June 30, 1875.	Exports of foreign goods for year ending June 30, 1875.	Entrances of vessels for year ending June 30, 1874.			Clearances of vessels for year ending June 30, 1874.			Total entrances and clearances of vessels, year ending June 30, 1875.	Total tonnage of vessels entered and cleared, year ending June 30, 1875.	Vessels registered, enrolled, and licensed, year ending June 30, 1874.	Tonnage of such vessels.
				Vessels.	Tonnage.	Crews.	Vessels.	Tonnage.	Crews.				
Cincinnati	$656,354*	....	......	......	....	....	......	....	....	......	....	220	67,750.71
Cuyahoga	348,025	$747,360	$6,032	924	198,676	8,069	947	189,587	7,780	1,871	388,266	466	86,519.67
Miami	164,525	1,729,187	......	302	69,517	2,610	286	71,339	2,645	588	140,856	170	13,945.99
Sandusky	17,867	86,406	.....	136	12,089	631	155	14,332	737	291	26,421	100	16,618.03
Totals	$1,186,771	$2,562,953	$6,032	1,362	280,282	11,310	1,388	275,258	11,162	2,750	555,543	956	184,834.40

Banks, Savings Banks, etc.—There were on Jan. 1, 1876, 171 national banks doing business in Ohio, besides 13 closed or closing. Of these, 5 were in Cincinnati and 6 in Cleveland. The resources of the whole were $106,132,031.98; their aggregate capital was $29,546,000; their undivided profits, $9,503,094; and their other liabilities, $67,083,837.98. There were, besides these, 20 incorporated banks, with a capital of $525,503; 22 savings banks, with a capital of $1,879,324 (these had in Nov., 1875, assets amounting to $3,894,049.52, and liabilities, including capital, dividends of profit, etc., $4,293,671.96). Their capital was $1,274,280. There were 198 private banks; capital, $6,561,743.

Insurance.—There were on Jan. 1, 1875, 37 joint-stock fire and fire marine insurance companies in Ohio, having an aggregate capital of $5,157,500, all paid up except $153,047.55 in stock notes; their gross assets were $8,472,839.61; their liabilities, including capital, were $7,255,371.35; income for the year, $3,469,602.46; their expenditures, $2,898,760.99; their surplus over liabilities and capital, $1,217,468.26; the aggregate risks in force at that date, $220,910,039.01; and the amount of dividends paid, $412,836.65. There were at the same time 17 mutual fire companies in the State, holding $4,571,840.06 in premium notes, and reporting assets, including premium notes, at $5,782,973.34; their liabilities were stated at $899,432.44, their income for the year at $554,102.09, their expenditures at $394,130.05, and the risks in force Jan. 1, 1875, at $186,564,372.65. At the same time, 105 companies from other States and countries were doing business in Ohio, and during the year took risks in the State amounting to $203,166,398.47. *Life Insurance.*—There were in Ohio Jan. 1, 1875, 6 life insurance companies, but only 3 of them were doing business; these had an aggregate capital of $320,000; admitted assets were $1,252,122.49; unadmitted assets, $118,238.77; liabilities, $892,232.48; income, $564,537.81; expenditures, $384,437.44; number of policies in force, 7023; amount of same, $12,600,796; number of policies lapsed during the year, 1120; amount of same, $1,938,515. At the same date 47 companies from other States and countries were insuring lives in Ohio. These companies had admitted assets amounting to $393,636,236.08, and had 847,901 policies in force, calling for the sum of $2,114,978,134.96, while the lapsed policies of the year amounted to 70,536, covering an amount of $177,524,207.96.

Population.

Year of census.	Total pop.	Males.	Females.	White.	Colored.	Natives.	Foreigners.	Density.	Ratio of increase.	Illiteracy.	Of school age, 5 to 20.	Of military age, males, 18 to 45.	Of voting age, males, 21 years and upward.	Citizens.
1800	45,365	24,613	20,752	45,028	337	....	....	1.13						
1810	230,760	120,626	110,134	228,861	1,899	....	....	5.77	408.67					
1820	581,434	303,130	278,304	576,572	4,723	....	....	14.55	151.96					
1830	937,903	484,502	453,395	928,329	9,574†	....	....	23.46	61.31	58,411	371,771§			
1840	1,519,467	784,100	735,367	1,502,122	17,345‡	....	....	38.02	62.01	67,851	618,932§			
1850	1,980,329	1,016,808	963,521	1,955,050	25,279	1,757,746	218,193	49.55	30.33	66.020	767,267	379,519	411,170	381,790
1860	2,339,511	1,190,162	1,149,349	2,302,808	36,673	2,011,262	328,249	58.54	18.14	64,828	864,582	444,095	519,524	480,122
1870	2,665,260	1,337,550	1,327,710	2,601,946	63,213	2,292,767	372,493	66.59	13.90	173,172	959,640	501,750	640,820‖	592,350

Education.—The following items are from advanced sheets of the superintendent of schools' report for the year ending Nov. 15, 1875: Number of persons of school age (6 to 21 years), 1,017,726; number of school-houses, 11,834; number of new school-houses built in 1875, 146; number of pupils enrolled in the schools, 712,129; average number of pupils in daily attendance, 433,814; number of different teachers actually employed, 22,492; number necessary to supply the schools, 14,763; cost of school-houses erected within the year, $1,046,918; value of school-houses and grounds in the State, $19,876,504; total amount of receipts for school purposes, including balance on hand Nov. 15, 1874, $11,803,077.64; total expenditures for school purposes, $8,170,959.98. Average number of weeks the schools were in session, 29.3; average cost for each child enrolled, $17.29; average monthly wages of male teachers, $59.50; of female teachers, $45. Number of private schools reported in 1874, 220; number of teachers of such schools reported, 265; number of pupils, 13,066.

* Dutiable goods in the year ending June 30, 1874.
† Including 6 slaves. ‡ Including 3 slaves. § Whites only.
‖ The enumeration of these in 1875 was 647,226.

Normal Schools.—There are 10 normal schools and normal institutes in the State. Two only receive aid from public funds—viz. the Cincinnati normal school and the North-western normal school at Fostoria. The following table gives the statistics of the 10 schools, so far as they can be ascertained:

Title of School, etc.	Location.	When founded.	How supported—by State, private funds, or tuition.	Instructors.	Students. Male.	Students. Female.	Model-school pupils.	No. of graduates past year.	Value of property.	Income from all sources.	Annual expenditures.	Volumes in library.
									$	$	$	
Cincinnati Normal School.	Cincinnati	1868	City aid..........	9	...	85	.....	45	....	8,411	8,400	200
N. W. Ohio Normal School	{ Ada, Hardin co. }	1871	Tuition and endowment...	8	43	29	244	11	26,000	4,375	4,617	700
North-western Nor. School	Fostoria.........	1870	Part State..........	9	250	150	.....	6	....	....	....	200
Hopedale Normal School..	Hopedale.......	1855	Tuition and private funds	9	98	71	.....	2	47,000	3,300	3,300	1,600
National Normal School*..	Lebanon........	1855	Tuition and private funds	17	51	42	250	60	90,000	25,709	24,850	3,500
Western Reserve Normal School..........	Milan............	1832	Tuition and private funds	3	75	68	.....	.....	5,000	....	....	
Mount Union Nor. School	Mount Union.	1846	Tuition..........	12	63	48	234	.....	....	....	....	1,446
Orwell Normal Institute..	Orwell	1865	Tuition and private funds	3	100	92	.....	12	6,000	....	....	325
Ohio Central Nor. School..	Worthington.	1871	Tuition and private funds	12	95	100	20	17	15,000	3,600	3,600	1,600
Nor. and Training School of Wilberforce Univ.....	Near Xenia...	1872	Connected with university	6	10	12	.....	4				
Totals..........	....	......	....	88	785	697	748	157	189,000	45,395	44,767	9,571

In 1874, 75 teachers' institutes were held, at an expense of \$15,318.81, of which \$3526.65 was paid by the teachers themselves or their friends, and \$11,792.16 from the teachers' institute fund, derived from examination fees of teachers.

Higher Education.—The following table gives the particulars for 1874–75 in regard to the colleges and scientific and professional schools of the State, so far as they are ascertainable:

Colleges, Universities, Scientific and Professional Schools.	Location.	Date of organization.	Under what control.	Professors and instructors.	Students. Preparatory.	Students. Collegiate, scientific, or professional.	Value of buildings, grounds, apparatus, etc.	Amount of productive endowment.	Income from endowment.	Income from all sources.	Amount of scholarship funds.	Number of volumes in library.
I. *Colleges and Universities:*							$	$	$	$	$	
Antioch College..........	Yellow Springs.........	1853	Unitarian	9	60	39	80,000	123,000	9,888	14,612	......	5,700
Baldwin University	Berea..........	1846	Meth. Episcopal..	10	140	39	94,500	54,300	3,300	......	3,000	1,200
Buchtel College..........	Akron..........	1871	Universalist......	15	100	112	250,000	40,000	2,400	6,000	20,000	1,100
Capital University..........	Columbus	1850	Evang. Lutheran.	6	....	80	100,000	....	......	......	......	3,000
Cincinnati University..........	Cincinnati	1873	Non-sectarian	5	....	55	......	....	29,424	68,598		
Cincinnati Wesleyan University (female).....	Cincinnati..........	1842	Meth. Episcopal..	18	106	114	225,000	....	......	32,000		
Dennison University..........	Granville	1831	Baptist..........	11	106	62	90,000	190,000	11,400	15,160	10,500	11,000
Farmers' College of Hamilton co..........	College Hill..........	1848	Non-sectarian	9	45	14	20,000	67,000	4,000	......	......	2,000
Franklin College..........	New Athens..........	1825	United Presb.....	8	121	27	10,000	....	......	......	......	3,000
Geneva College..........	West Geneva..........	1849	Reformed Presb..	5	170	....	10,000	....	......	3,000	......	350
German Wallace College..........	Berea	1864	Meth. Episcopal..	6	60	42	43,703	37,000	3,566	3,648	24,930	900
Heidelberg College..........	Tiffin	1850	Reformed German	9	104	71	40,000	70,000	5,000	6,172	60,000	2,000
Hiram College..........	Hiram	1867	Disciples.........	9	199	26	45,000	50,000	3,000	6,000	......	2,500
Kenyon College..........	Gambier..........	1825	Protestant Epis...	8	13	53	260,000	240,000	7,000	7,700	......	19,000
McCorkle College..........	Bloomfield..........	1873	Presbyterian.....	3	40	12	8,000	8,760	640	905	......	76
Marietta College..........	Marietta..........	1835	Presbyterian.....	11	117	85	130,000	115,000	8,500	......	58,000	26,000
Mount St. Mary's of the West..........	Cincinnati	1851	Roman Catholic..	18	39	42	170,000	.....	......	12,000	......	14,500
Mount Union College..........	Mount Union..........	1846	Meth. Episcopal..	23	492	317	100,000	351,225	......	27,540	......	4,168
Muskingum College..........	New Concord..........	1837	Non-sectarian	5	42	44	22,000	....	......	1,650	......	900
Oberlin College..........	Oberlin	1834	Congregational...	20	258	215	170,000	115,000	8,000	20,603	......	12,000
Ohio Central College..........	Iberia..........	1854	United Presb.....	5	112	33	15,000	....	......	......	......	900
Ohio University..........	Athens..........	1804	Non-sectarian	6	69	36	50,000	75,000	4,262	6,866	......	7,600
Ohio Wesleyan University..........	Delaware..........	1844	Meth. Episcopal..	12	193	180	177,000	244,000	15,000	16,500	40,000	14,100
One-Study University..........	{ Scio, New Market Station, Harrison co. }	1866	Meth. Episcopal..	4	....	175	25,000	....	......	3,000	......	800
Otterbein University..........	Westerville..........	1847	United Brethren..	9	150	75	75,000	50,000	4,500	8,000	......	1,500
Richmond College..........	Richmond..........	1845	Non-sectarian....	4	121	....	25,000	....	......	1,270	......	200
St. Xavier College..........	Cincinnati..........	1842	Roman Catholic..	20	114	155	150,000	....	......	11,000	......	19,000
University of Wooster..........	Wooster..........	1866	Presbyterian	12	72	149	140,000	....	......	......	......	3,000
Urbana University	Urbana..........	1850	{ New Church (Swedenborg). }	4	14	9	15,000	25,000	5,000	6,000	......	5,000
Western Reserve College..........	Hudson	1826	Presbyterian	10	58	65	90,000	207,000	13,193	16,513	......	10,000
Wilberforce University..........	Near Xenia..........	1863	African M. E.....	12	153	12	72,950	20,000	......	2,141	6,300	4,000
Willoughby College..........	Willoughby	1865	Methodist	5	120	24	75,000	....	......	......	......	3,000
Wilmington College..........	Wilmington..........	1871	Friends	4	....	12	50,000	....	......	......	......	502
Wittenberg College..........	Springfield..........	1844	Evang. Lutheran.	13	49	78	75,000	125,000	12,000	15,500	......	7,000
Xenia College..........	Xenia..........	1850	Meth. Episcopal..	5	45	122	25,000	....	......	2,500	......	300
II. *Scientific Schools:*												
Ohio Agricultural and Mechanical College....	Columbus..........	1870	State..........	9	....	59	300,000	700,000	30,000	30,500	......	1,000
Scientific department Dennison University...	Granville	1831	Dennison Univ...	Re	por	ted wi	th colle	ge.				
" " Oberlin College........	Oberlin	1834	Oberlin College...	"	"	"	"					
Toledo University of Arts and Trades.........	Toledo	1872	Trustees..........	1	....	89	15,000					
III. *Schools of Theology:*												
German M. E. Seminary (Ger. Wallace College)	Berea	1864	Meth. Episcopal..	5	....	12	......	12,070	960			
Heidelberg Theological Seminary..........	Tiffin	1850	Reformed German	2	....	15	......	23,000	1,600	......	......	2,700
Lane Theological Seminary..........	Cincinnati..........	1832	Presbyterian	5	....	49	150,000	250,000	17,000	......	......	12,000
Theological dept. Mount St. Mary's of the West	Cincinnati..........	1851	Roman Catholic..	7	....	34						
St. Mary's Theological Seminary..........	Cleveland..........	1849	Roman Catholic..	3	....	28	75,000					
Theological Seminary of St. Charles Borromeo	Carthagena	1860	Roman Catholic..	8	....	52	25,000	....	......	......	......	4,800
Theol. Sem. of Evan. Joint Synod of Ohio....	Columbus	1830	Evang. Lutheran.	6	....	30	80,000	....	......	......	......	3,500
Theological department of Oberlin College....	Oberlin	1834	Congregational...	10	....	40	70,000	40,000	3,200			
Theological department of Wittenberg College.	Springfield..........	1845	Evang. Lutheran.	2	....	16	......	....	......	......	......	2,000
Theological School of Wilberforce University.	Xenia..........	1863	African M. E. Ch.	5	....	8						
Union Biblical Seminary..........	Dayton..........	1871	United Brethren..	3	....	19	10,000	25,000	5,000	......	......	200
United Presbyterian Theological Seminary...	Xenia..........	1794	United Presb.....	5	....	29	......	45,000	2,900	......	......	3,500
IV. *Schools of Law:*												
Law School of Cincinnati College..........	Cincinnati..........	1833	Cincinnati College	4	....	66	......	....	......	2,500	....	1,500
" " Wilberforce University........	Xenia..........	1872	Wilberforce Univ.	2	....	1						
Ohio State and Union Law College..........	Cleveland..........	1856	Trustees..........	8	....	....	......	....	......	......	......	3,000
V. *Schools of Medicine:*												
Cincinnati College of Medicine and Surgery..	Cincinnati..........	1851	Trustees..........	12	....	108	30,000	....	......	......	......	500
Cleveland Medical College..........	Cleveland..........	1843	Trustees..........	15	....	70	100,000	....	......	3,500	......	2,000
Medical College of Ohio..........	Cincinnati..........	1819	Trustees..........	10	....	252	......	....	......	......	......	5,000
Miami Medical College..........	Cincinnati..........	1852	Trustees..........	11	....	130	35,000					
Medical department of University of Wooster.	Cleveland..........	1869	Trustees..........	12	....	90	40,000					
Starling Medical College and Hospital........	Columbus..........	1847	Trustees..........	9	....	138	200,000	....	......	......	......	300
Eclectic Medical Institute..........	Cincinnati..........	1843	Trustees..........	7	....	143	80,000					
Homœopathic Hospital College..........	Cleveland..........	1849	Trustees..........	17	....	65	50,000	....	......	......	......	1,000
Ohio College of Dental Surgery..........	Cincinnati..........	1845	Trustees..........	7	....	24	15,000	....	......	......	3,000	75
College of Pharmacy of Baldwin University..	Berea	1867	Trustees..........	3	....	4	......	....	......	......	200	
Cincinnati College of Pharmacy..........	Cincinnati..........	1849	Trustees......	3	....	153	2,000	....	......	......	......	100

Special, Charitable, and Reformatory Education.—The Ohio Asylum for the deaf and dumb was founded in 1826 at Columbus. In 1829 the State purchased 10 acres of land and commenced the erection of buildings for it. In the forty-eight years which followed, the expenditure for additional land, buildings, repairs, and betterments was \$727,237.26. Buildings for printing and bookbinding are connected with the asylum. Its current expenses are about \$81,000 annually. The number of pupils in attendance in

*This school has also a collegiate department and business college, attended in 1874 by 1314 students.

1874 was 468—272 males and 196 females; the average daily number 400; average daily expense per head 56 cents. The asylum for the blind is also at Columbus. It was established in 1837, but its present buildings and site were not provided till after 1847. It has 17½ acres of land, and its buildings and repairs, with the land and permanent improvements, have cost about $421,100. The number of pupils in 1874 was 169—males 94, females 75; average attendance, 119; annual expenses, $32,275. The Ohio State Asylum for idiotic and imbecile youth is also at Columbus. It was founded in 1857, but occupied rented buildings till 1868, when it removed into the buildings erected for it. It has 187½ acres of land, and the expenditures for buildings, land, and permanent improvements have been about $437,100. Its current annual expenses are about $69,100. It had 386 children under its care in the year 1874, and an average daily number of 352. It had 19 teachers, instructors, and assistants. The Ohio Soldiers' and Sailors' Orphans' Home is on a farm of 100 acres near Xenia, donated for the purpose in 1870, and $245,463.15 were expended for buildings and permanent improvements on it up to 1875. The current expenses in 1874 were $61,051.75. There were 14 teachers and other officers, and 555 children were under instruction, 218 of them received during the year. The average daily number was 520. The Ohio State Reform Farm is near Lancaster. The farm contains 1170 acres of land, purchased in 1857. The expenditures for buildings, farm, and betterments to 1875 were about $220,000, and the current expenses about $49,000 in the year 1874. During the year 636 boys were in the institution, and the average daily number was 460. The farm is conducted on the *family* plan, each family numbering from 30 to 60 boys. The results have been very satisfactory. The Girls' Industrial School, established 1869, is at White Sulphur Springs; the farm consists of 180 acres. The land and buildings had cost to 1875 about $100,000. The annual expenses in 1874 were $20,202. The whole number of girls in the school in 1874 was 166; average daily number, 143.

Charitable and Penal Institutions not Educational.—There are 4 State hospitals for the insane in Ohio, and 2 others which receive State patients—viz. the Western Ohio Insane Hospital, at Dayton; the Northern, at Newburg, near Cleveland; the Central, at Glenwood, near Columbus (now in course of erection, the former hospital having been destroyed by fire); and the South-eastern, at Athens. The Longview Hospital near Cincinnati receives both white and colored patients from the State, and the Lucas Co. Hospital at Toledo also receives State patients. The insane population of these 6 hospitals, taking the number treated through the year, is over 3000, and the average number under treatment at any one time not far from 2000. The current expenses and ordinary repairs of these asylums cost the State about $420,000 annually, aside from the cost of buildings and grounds. The State penitentiary at Columbus is apparently well conducted. It had Nov. 1, 1874, 1005 prisoners; 509 had been received and 371 discharged during the year. Notwithstanding heavy losses from fire and the depression of business, the receipts from the convicts' labor, U. S. prisoners, visitors' fund, etc. exceeded the entire expenditure by $7412.02, the total receipts being $179,367.33, and the total expenditures $171,955.31. The prison manufactures gas for the other public institutions of Columbus, and a part of the convicts are employed in cooperage, in the manufacture of enamelled hollowware, and other labor for contractors.

Newspapers.—In 1870, Ohio had 395 newspapers and periodicals, having an aggregate circulation of 1,388,367, and issuing annually 98,548,814 copies. Of these, 26 were dailies, having 139,705 circulation; 8 tri-weeklies and 3 semi-weeklies, with 20,760 circulation; 299 weeklies, with 923,502 circulation; 8 semi-monthlies and 47 monthlies, with a circulation of 293,800; 2 bi-monthlies and 2 quarterlies, with 10,600 circulation. In 1875 the number had increased to 537, of which there were 35 dailies, 10 tri-weeklies, 5 semi-weeklies, 407 weeklies, 1 bi-weekly, 12 semi-monthlies, 63 monthlies, 1 bi-monthly, and 3 quarterlies.

Churches.

Denominations.*	Church organizations, 1870.	Church edifices, 1870.	Sittings, 1870.	Church property, 1870.	Church organizations, 1875.	Church edifices, 1875.	Ministers, 1875.	Members or communicants, 1875.	Adherent population, 1875.	Value of church property, 1875.
All denominations	6,488	6,284	2,085,586	$25,554,725	8,120	6,830	5,391	513,566	2,524,820	$33,328,000
Baptists (regular)	555	545	164,020	2,533,000	735	725	437	49,469	225,000	3,871,500
Baptists, Free-Will, Seventh-Day, Tunker, etc.	158	157	38,850	225,500	178	175	128	10,680	41,500	391,400
Christian Connection (including also Disciples)	681	610	167,625	1,366,990	753	678	476	48,793	290,870	1,987,500
Congregationalists	198	195	87,150	1,385,585	227	222	196	19,278	78,000	1,873,000
Protestant Episcopalians	114	112	51,150	1,343,280	114	114	112	10,122	42,000	1,820,000
Evangelical Association	157	140	33,500	338,500	180	160	133	14,450	57,500	577,500
Friends	91	91	26,050	218,770	95	95	......	7,200	28,000	260,000
Jews	7	7	4,000	360,584	8	8	8	1,600	6,400	400,000
Lutherans	477	476	131,050	1,392,975	563	559	409	33,780	135,000	1,864,000
Methodists	2,161	2,115	714,146	6,540,910	2,572	2,509	1,715	161,428	645,200	8,143,500
Moravians	4	4	1,200	14,000	4	4	7	600	2,500	18,000
New Jerusalem (Swedenborgians)	8	6	1,350	55,000	9	7	7	700	2,800	70,000
Presbyterians (regular)	628	625	233,945	3,580,756	741	716	598	75,409	312,000	4,328,000
Presbyterians (United, Associate, Cumberland, etc.)	164	165	60,000	564,970	180	178	123	17,425	70,000	729,500
Reformed Church (late Dutch)	2	2	700	9,500	2	2	2	300	1,200	10,200
Reformed Church (late German)	288	266	88,900	887,700	309	298	217	21,630	86,450	1,008,000
Roman Catholics	295	295	160,700	3,959,970	545	506	377	....	410,000	4,997,800
Shakers	4	4	2,100	16,000	4	4	......	900	2,000	20,000
Spiritualists	4	3	850	4,100	4	3	......	750	3,000	5,000
Unitarians	8	8	3,100	60,000	9	9	9	800	3,200	75,000
United Brethren in Christ	370	344	85,350	484,310	710	623	346	30,207	120,800	612,500
Universalists	78	78	20,750	175,950	98	96	60	4,445	18,000	224,600
Union churches	33	33	8,600	34,775	40	39	31	3,600	14,400	48,000

Constitution, Courts, Representatives in Congress, etc.—The executive authority of the State is vested in a governor, lieutenant-governor, and treasurer, each elected for two years; a secretary of state and attorney-general, elected for the same period, but on alternate years to the first-named officers; a comptroller of the treasury and State school commissioner, each elected for three years; a board of three commissioners of public works, elected for the same period, but one going out of office each year; and finally of an auditor of state, elected for four years. The legislature is composed of a senate of varying numbers (its present number of members being 37) and a house of representatives, which also differs with different years, according to a schedule in the act of apportionment; the present number is 111. The judicial power is vested in a supreme court, having both appellate and original jurisdiction, of 5 judges, chosen for five years, one judge retiring from office each year, and the judge having the shortest term to serve being chief-justice; of a superior court, with 6 or 7 judges; of 10 courts of common pleas, with 50 or more judges, elected for five years in their several districts and sub-districts (Hamilton co. constituting one district, and the other districts being divided into three sub-districts). These judges also hold county courts and district courts, in which one of the supreme court judges presides, in every county in the State. There are also probate judges for each county, and justices of the peace for each township. Suffrage is allowed to all male citizens of the U. S. 21 years of age and residents of the State for a year, soldiers, marines, idiots, insane persons, and those convicted of infamous crimes being excluded. The State is entitled to 20 Representatives in Congress.

Cities and Towns.—Columbus, the capital of the State, in 1870 had 31,274 inhabitants, and Cincinnati, the chief city of the State, 216,239; Cleveland had 92,829; Toledo and Dayton, from 30,000 to 32,000 each. Springfield, Hamilton, Portsmouth, Zanesville, and Akron, from 10,000 to 15,000 each; Canton, Chillicothe, Mansfield, Steubenville, and Youngstown, from 8000 to 10,000 each; Circleville, Delaware, Fremont, Ironton, Lancaster, Marietta, Massillon, Mount Vernon, Newark, Piqua, Pomeroy, Tiffin,

* There was also in 1870, 1 Second Advent church, with one church edifice, 300 sittings, and $1000 of church property.

Wooster, Xenia, and East Cleveland, between 5000 and 8000 each; Bellair, Gallipolis, Lima, Urbana, Warren, Alliance, Galion, Norwalk, Painesville, and Salem ranged between 3500 and 5000 inhabitants; Ashland, Bellefontaine, Bucyrus, Defiance, Elyria, Findlay, Greenville, Hillsboro', Kenton, Lebanon, Marion, Middletown, New Philadelphia, New Richmond, Oberlin, Sidney, Troy, Upper Sandusky, and Van Wert, from 2500 to 3500 inhabitants; and Barnesville, Bryan, Cambridge, Crestline, East Liverpool, Jackson, London, Middleport, Napoleon, Piqua (Franklin co.), Putnam, Ravenna, Ripley, Wapakoneta, Washington, Willsville, and Wilmington, each exceeded 2000 inhabitants.

***Counties.*—The number of counties is 88, as follows:**

Counties.	Pop., 1870.	Males, 1870.	Females, 1870.	Pop., 1860.	True valuation, U.S. census, 1870.	Assessed valuation, 1875.
					$	$
Adams	20,750	10,297	10,453	20,309	9,555,481	6,099,889
Allen	23,623	11,949	11,674	19,185	12,664,050	10,817,590
Ashland	21,933	10,830	11,103	22,951	16,067,439	13,239,444
Ashtabula	32,517	16,071	16,446	31,814	19,425,000	16,435,712
Athens	23,768	11,955	11,813	21,364	10,474,263	8,821,395
Auglaize	20,041	10,275	9,766	17,187	8,642,293	7,869,800
Belmont	39,714	19,730	19,984	36,398	29,547,000	21,389,140
Brown	30,802	15,221	15,581	29,958	15,961,419	11,275,178
Butler	39,912	20,017	19,895	35,840	42,000,000	33,750,805
Carroll	14,491	7,195	7,296	15,738	13,650,000	8,981,058
Champaign	24,188	12,151	12,037	22,698	19,648,235	21,317,153
Clarke	32,070	16,201	15,869	25,300	37,905,000	27,672,900
Clermont	34,268	16,887	17,381	33,034	22,611,631	15,018,690
Clinton	21,914	11,064	10,850	21,461	20,733,702	14,662,371
Columbiana	38,299	17,064	19,235	32,836	36,257,471	23,571,397
Coshocton	23,600	11,808	11,792	25,032	20,791,461	13,682,770
Crawford	25,556	12,866	12,690	23,881	24,786,902	15,483,060
Cuyahoga	132,010	66,725	65,285	78,033	106,575,000	92,359,728
Darke	32,278	16,612	15,666	26,009	30,436,350	19,368,985
Defiance	15,719	8,047	7,672	11,886	7,940,596	5,744,293
Delaware	25,175	12,748	12,427	23,902	25,035,973	16,499,982
Erie	28,188	14,252	13,936	24,474	15,276,166	12,222,642
Fairfield	31,138	15,762	15,376	30,538	27,305,235	18,404,630
Fayette	17,170	8,847	8,323	15,935	16,637,986	14,607,049
Franklin	63,019	31,967	31,052	50,361	66,546,900	50,649,291
Fulton	17,789	9,083	8,706	14,043	6,616,103	5,111,878
Gallia	25,545	12,839	12,706	22,043	9,415,259	7,863,277
Geauga	14,190	7,114	7,076	15,817	11,029,795	8,206,698
Greene	28,038	14,012	14,026	26,197	31,498,478	23,291,280
Guernsey	23,838	11,609	12,229	24,474	12,567,368	10,935,968
Hamilton	260,370	128,530	131,840	216,410	341,250,000	222,930,563
Hancock	23,847	11,943	11,904	22,886	18,064,233	12,328,921
Hardin	18,714	9,545	9,169	13,570	26,741,519	9,226,930
Harrison	18,682	9,191	9,491	19,110	13,619,073	13,292,130
Henry	14,028	7,295	6,733	8,901	6,417,713	4,511,710
Highland	29,133	14,468	14,665	27,773	24,243,858	15,743,493
Hocking	17,925	8,987	8,938	17,057	8,423,962	7,774,999
Holmes	18,177	9,103	9,074	20,589	11,630,473	8,408,792
Huron	28,532	14,503	14,029	29,616	26,831,575	18,332,400
Jackson	21,759	11,125	10,634	17,941	8,400,000	5,156,493
Jefferson	29,188	14,211	14,977	26,115	28,931,260	20,023,480
Knox	26,333	13,060	13,273	27,735	23,702,975	16,728,601
Lake	15,935	7,785	8,150	15,576	14,171,449	10,473,555
Lawrence	31,380	16,030	15,350	23,249	11,334,186	9,100,487
Licking	35,756	17,526	18,230	37,011	38,437,990	27,088,271
Logan	23,028	11,469	11,559	20,996	22,177,673	14,193,760
Lorain	30,308	15,158	15,150	29,744	24,879,670	18,434,021
Lucas	46,722	23,673	23,049	25,831	32,287,500	24,265,190
Madison	15,633	7,791	7,642	13,015	22,036,807	14,892,730
Mahoning	31,001	15,619	15,382	25,894	27,510,000	19,599,858
Marion	16,184	8,328	7,856	15,490	18,649,693	13,216,671
Medina	20,092	9,984	10,108	22,517	20,712,540	13,116,577
Meigs	31,465	15,873	15,592	26,534	15,437,670	9,720,988
Mercer	17,254	8,826	8,428	14,104	5,515,078	4,685,230
Miami	32,740	16,363	16,377	29,959	30,927,538	22,238,254
Monroe	25,779	12,941	12,838	25,741	8,047,939	5,925,672
Montgomery	64,006	32,800	31,206	52,230	68,775,000	46,605,410
Morgan	20,363	10,073	10,290	22,119	10,282,582	8,474,881
Morrow	18,583	9,228	9,355	20,445	18,254,095	12,663,326
Muskingum	44,886	21,899	22,987	44,416	25,031,981	26,430,390
Noble	19,949	10,039	9,910	20,751	8,810,543	6,559,488
Ottawa	13,364	7,011	6,353	7,016	4,601,810	5,205,465
Paulding	8,544	4,466	4,068	4,945	4,725,000	2,473,[illegible]66
Perry	18,453	9,060	9,393	19,678	13,247,489	8,884,322
Pickaway	24,875	12,728	12,147	23,469	36,562,734	19,989,515
Pike	15,447	7,711	7,736	13,643	9,660,000	5,203,637
Portage	24,584	12,311	12,273	24,208	19,919,420	16,633,145
Preble	21,809	10,847	10,962	21,820	29,665,461	18,117,650
Putnam	17,081	8,687	8,394	12,808	8,472,202	5,909,756
Richland	32,516	16,195	16,321	31,158	24,184,794	22,091,000
Ross	37,097	18,406	18,691	35,071	32,824,329	22,075,759
Sandusky	25,503	12,936	12,567	21,429	17,353,597	13,264,643
Scioto	29,302	14,785	14,517	24,297	19,624,631	12,023,183
Seneca	30,827	15,508	15,319	30,868	23,133,987	17,615,666
Shelby	20,748	10,525	10,223	17,493	15,487,565	10,178,581
Stark	52,508	26,444	26,064	42,978	47,884,648	33,749,100
Summit	34,674	17,441	17,233	27,344	39,661,650	22,699,865
Trumbull	38,659	19,635	19,024	30,656	34,941,818	20,679,795
Tuscarawas	33,840	17,013	16,827	32,463	20,200,145	17,387,091
Union	18,730	9,424	9,306	16,507	14,115,946	10,725,695
Van Wert	15,823	8,136	7,687	10,238	7,513,837	6,445,799
Vinton	15,027	7,486	7,541	13,631	5,583,937	4,216,681
Warren	26,689	13,342	13,347	26,902	35,496,536	22,156,399
Washington	40,609	20,460	20,149	36,268	17,161,659	13,685,681
Wayne	35,116	17,467	17,649	32,483	28,213,234	24,169,708
Williams	20,991	10,730	10,261	16,633	11,406,819	7,602,381
Wood	24,596	12,566	12,030	17,886	11,908,537	9,624,259
Wyandot	18,553	9,466	9,087	15,596	12,749,284	10,256,313
Totals	2,665,260	1,337,550	1,327,710	2,339,511	2,235,430,300	1,598,575,862

History.—The first explorations of the present territory of Ohio were made by the French under La Salle about 1680, and, though they made no actual settlement, yet they claimed the territory and planted their military posts on the Ohio, never relinquishing their claim till 1763. Prior to La Salle's discovery the greater part of what now constitutes the State of Ohio was inhabited by tribes of Indians superior in intelligence and civilization, and probably also in religious knowledge and in military skill, to the aborigines found here by the French, and later by English settlers. Their mounds and fortifications, whether intended for defence or for burial-places for their great chieftains, were constructed with an artistic skill as well as a high degree of culture to which the Indians of the last two or three centuries can lay no claim. Many of these mounds have been opened and their contents examined, but it has not been satisfactorily settled where among the prominent races of the human family the Mound-builders belonged. Some have believed them to be the lost tribes of Israel; others, with more probability, have regarded them as of the same race as the Moquis of Arizona, or perhaps as either Toltecs or Aztecs. But when the French soldiers passed through the country, or the American trappers and hunters visited it, they found there tribes of Indians differing in no respect from those of New York or Pennsylvania, though perhaps they were not so warlike or revengeful as their neighbors in the adjacent States. There do not seem to have been any white settlers within the limits of the State previous to Apr., 1788, when a colony from New England founded Marietta. In December of the same year a settlement was made on the present site of Cincinnati. Virginia, Massachusetts, Connecticut, and New York all laid claim to portions of the territory, their claims being based on their chartered grants, but all eventually ceded the right of eminent domain to the U. S., Virginia and Connecticut reserving, however, the ownership of about 3,700,000 acres each—the Connecticut lands forming what was called the Western Reserve, and the Virginia the region about the Falls of the Ohio, which eventually became a part of Indiana. The Western Reserve began to be settled about 1800, and by that time there were in the present bounds of the State, then a part of the North-west Territory, about 45,000 inhabitants. They suffered from Indian incursions from 1792 till about 1799. In 1802, Ohio was admitted into the Union as a State with nearly its present boundaries. During the war of 1812 it suffered from repeated raids of British and Indian bands, and Major Croghan, then a youth of twenty-one, gained a high reputation for his gallant defence of the fort at Sandusky with 100 men against Proctor with 500 British troops and a considerable force of Indians. The most noteworthy action of that war, however, so far as Ohio was concerned, was the battle of Lake Erie, fought Sept. 10, 1813, at Put-in Bay, in which the gallant commodore O. H. Perry defeated a superior British squadron in a desperate battle. The growth of the State since that time has been rapid but uneventful. During the late civil war it sent into the field its full quotas of brave and gallant troops; and through the energy and patriotism of its chief magistrates they were well equipped and provided for the great conflict, while the noble women of the State with untiring zeal and industry cared for the sick and wounded with an ample and almost lavish generosity. From no other State of the Union was there so long or so grand a list of the foremost actors in the great struggle. During the war one of her most honored citizens was secretary of the treasury, and subsequently chief-justice of the U. S.; another was secretary of war; another was the first general-in-chief. The State was twice subjected to raids from Confederate bands, the second time at the hands of the guerilla chief, Gen. John H. Morgan.

Governors.

I. _Territorial._

Arthur St. Clair..July, 1788–1802
Charles W. Byrd (acting)............1802–03

II. _State._

Edward Tiffin...............1803–07
Thomas Kirker (acting).1807–08
Samuel Huntington.......1808–10
Return Jonathan Meigs.1810–14
Othniel Looker (acting)..1814–14
Thomas Worthington....1814–18
Ethan Allen Brown........1818–22
Allen Trimble (acting)...1822–22
Jeremiah Morrow..........1822–26
Allen Trimble...............1826–30
Duncan McArthur.........1830–32
Robert Lucas.................1832–36
Joseph Vance..................1836–38
Wilson Shannon............1838–40
Thomas Corwin............1840–42
Wilson Shannon............1842–44
Thomas W. Bartley (acting).........................1844–44
Mordecai Bartley...........1844–46
William Bebb................1846–49
Seabury Ford........Jan., 1849–50
Reuben Wood......1850–July, '53
William Medill (acting), July, 1853–Jan., '54
William Medill.............1854–56
Salmon P. Chase...........1856–60
William Dennison.........1860–62
David Tod......................1862–64
John Brough *..............1864–65
Charles Anderson (acting)..............................1865–66
Jacob Dolson Cox..........1866–68
Rutherford B. Hayes......1868–72
Edward F. Noyes...........1872–74
William Allen...............1874–76
Rutherford B. Hayes......1876–

*** Died in office.**

Electoral and Popular Votes for President and Vice-President.

Year of election.	Candidates for whom the electoral vote of the State was cast.	Electoral vote.	Pop. vote.	Candidates of the opposition.	Pop. vote.	Third-party candidates.	Pop. vote.	Fourth-party candidates.	Pop. vote.
1804	Thomas Jefferson P..... George Clinton V.-P....	3	Unknown.	Charles C. Pinckney P... Rufus King V.-P.........					
1808	James Madison P....... George Clinton V.-P....	3	Unknown.	Charles C. Pinckney P... Rufus King V.-P.........					
1812	James Madison P....... Elbridge Gerry V.-P....	7	Unknown.	De Witt Clinton P....... Jared Ingersoll V.-P.....					
1816	James Monroe P........ D. D. Tompkins V.-P...	8	Unknown.	Rufus King P............ John E. Howard V.-P....					
1820	James Monroe P........ D. D. Tompkins V.-P...	8	Unknown.	John Quincy Adams P... Richard Rush V.-P......					
1824	Henry Clay P........... Nathan Sanford V.-P...	16	19,255	Andrew Jackson P....... John C. Calhoun V.-P...	18,457	John Quincy Adams P... John C. Calhoun V.-P...	12,280	William H. Crawford P.. Nathaniel Macon V.-P...	No report.
1828	Andrew Jackson P...... John C. Calhoun V.-P..	16	67,597	John Quincy Adams P... Richard Rush V.-P......	63,396				
1832	Andrew Jackson P...... Martin Van Buren V.-P.	21	81,246	Henry Clay P............ John Sergeant V.-P......	76,539	William Wirt P.......... Amos Ellmaker V.-P.....	No report.		
1836	William H. Harrison P. Francis Granger V.-P..	21	105,405	Martin Van Buren P..... Richard M. Johnson V.-P.	96,948	Hugh L. White P......... John Tyler V.-P..........	No report.	Daniel Webster P........ Francis Granger V.-P...	No report.
1840	William H. Harrison P. John Tyler V.-P........	21	148,157	Martin Van Buren P..... Richard M. Johnson V.-P.	124,782	James G. Birney P....... Thomas Earle V.-P......	903		
1844	Henry Clay P........... T. Frelinghuysen V.-P..	23	155,057	James K. Polk P......... George M. Dallas V.-P...	149,117	James G. Birney P........ Thomas Morris V.-P.....	8,050		
1848	Lewis Cass P............ Wm. O. Butler V.-P....	23	154,775	Zachary Taylor P........ Millard Fillmore V.-P....	138,360	Martin Van Buren P..... C. Francis Adams V.-P..	35,354		
1852	Franklin Pierce P....... William R. King V.-P...	23	169,220	Winfield Scott P.......... Wm. A. Graham V.-P...	152,526	John P. Hale P........... George W. Julian V.-P..	31,732		
1856	John C. Fremont P...... William L. Dayton V.-P.	23	187,497	James Buchanan P...... J. C. Breckenridge V.-P.	170,874	Millard Fillmore P........ A. J. Donelson V.-P.....	28,126		
1860	Abraham Lincoln P.... Hannibal Hamlin V.-P.	23	231,610	J. C. Breckenridge P..... Joseph Lane V.-P........	11,303	Stephen A. Douglas P.... H. V. Johnson V.-P......	187,232	John Bell P............. Edward Everett V.-P.... Gerrit Smith P...........	12,193 136
1864	Abraham Lincoln P..... Andrew Johnson V.-P...	21	265,154	George B. McClellan P... George H. Pendleton V.-P.	205.568				
1868	Ulysses S. Grant P..... Schuyler Colfax V.-P...	21	280,223	Horatio Seymour P....... Francis P. Blair, Jr., V.-P.	238,606				
1872	Ulysses S. Grant P..... Henry Wilson V.-P.....	22	281,852	Horace Greeley P......... Benj. Gratz Brown V.-P..	244,321	Charles O'Conor P..........	1,163	James Black P........... and scattering..........	2,162

(For valuable statistical and other documents used in the preparation of this article we are indebted to Hon. William Bell, Jr., secretary of state of Ohio.)

L. P. Brockett.

Ohio, S. E. county of Indiana, bounded E. by the Ohio River, which separates it from Kentucky. Area, 90 square miles. It is in great part very hilly, but is fertile, producing good crops of grain; and has some manufactures. Cap. Rising Sun. Pop. 5837.

Ohio, county of Central Kentucky. Area, 625 square miles. It is partly bounded S. by Green River. It is uneven, fertile, and abounds in bituminous coal and iron ore. Tobacco, live-stock, corn, and wool are leading products. The county is traversed by the Elizabethtown and Paducah R. R. Cap. Hartford. Pop. 15,561.

Ohio, county in the "Panhandle" of West Virginia, bounded E. by Pennsylvania and W. by the Ohio River. Area, 175 square miles. It is hilly and highly fertile. It is celebrated for its fine wool, but also produces grain, fruit, coal, iron ore, etc. It has important manufactures of iron, metallic wares, cigars, clothing, carriages, glass, lumber, leather, etc. It is traversed by the Baltimore and Ohio and the Hempfield R. Rs. Cap. Wheeling. Pop. 28,831.

Ohio, post-v. and tp., Bureau co., Ill., on the Mendota and Clinton branch of the Chicago Burlington and Quincy R. R. Pop. 1137.

Ohio, tp. of Bartholomew co., Ind. Pop. 747.

Ohio, tp. of Crawford co., Ind. Pop. 1078.

Ohio, tp. of Spencer co., Ind. Pop. 3843.

Ohio, tp. of Warrick co., Ind. Pop. 3290.

Ohio, post-v. and tp., Madison co., Ia. Pop. 705.

Ohio, tp. of Franklin co., Kan. Pop. 575.

Ohio, tp. of Mississippi co., Mo. Pop. 632.

Ohio, tp. of Richardson co., Neb. Pop. 622.

Ohio, post-v. and tp., Herkimer co., N. Y. Pop. 1009.

Ohio, tp. of Clermont co., O. Pop. 3381.

Ohio, tp. of Gallia co., O. Pop. 978.

Ohio, tp. of Monroe co., O. Pop. 1801.

Ohio, tp. of Allegheny co., Pa. Pop. 685.

Ohio, tp. of Beaver co., Pa. Pop. 1534.

Ohio Grove, tp. of Mercer co., Ill. Pop. 1125.

Ohio River, the largest of the affluents of the Mississippi in respect to its discharge of water, which averages 158,000 cubic feet per second, that of the Missouri being but 120,000 feet. The Ohio originates at Pittsburg, Pa., in the confluence of the Allegheny and Monongahela rivers. Its length below Pittsburg is 975 miles; total length to its ultimate source, 1265 miles. A straight line from Pittsburg to Cairo, Ill., at its mouth, measures 615 miles. Its drainage area is 202,400 square miles, according to Ellet, or 214,000, according to Humphreys. Its elevation at Cairo is 322 feet; at Pittsburg, 1021 feet. Its mean fall is .72 of a foot to the mile. Its mean rate of flow is about 3 miles an hour. Its mean rise in flood is some 30 feet above extreme low water; its maximum rise exceeded 60 feet. Above Cincinnati it is in many places fordable at low water, and is then for six or eight weeks scarcely navigable. It usually freezes in its upper course for some four weeks. It has two classes of islands; one kind is fertile, and the other mere sandbanks, called "tow-heads" by boatmen. With its numerous tributaries (some of them navigable the year through), it has fully 5000 miles of high-water navigation. It has no important rapids except at Louisville, Ky., where it falls 22½ feet in 2 miles. It was discovered in 1680 by the French under La Salle, and was called by them *La Belle Rivière* ("the beautiful river").

Ohio Wesleyan University, located at Delaware, O., was founded in 1843. Its presidents have been Rev. Edward Thomson, LL.D., elected in 1844, resigned 1860; Rev. Frederick Merrick, elected 1860, resigned 1873; Rev. Fales H. Newhall, D. D., elected 1873. Its faculty consists of the president, 8 professors, 2 tutors, and a principal of the preparatory department. The whole number of graduates in the classical course has been 550. Attendance the past year (1872–73), classical, 145; scientific, 28; unclassified, 23; preparatory, 180; graduating class, 46. The institution is liberally endowed, and is furnished with commodious and substantial buildings. The grounds, which are extensive and beautifully diversified, are tastefully laid out and planted with over 500 varieties of trees and shrubs, constituting an *arboretum* of rare excellence. This, when completed, is designed to contain a specimen of every species, native and foreign, which can be secured and made to grow in the latitude of its location. The museum of the university comprises two distinct cabinets: (1) the Prescott Cabinet, devoted to the general department of natural history; the zoological department contains over 6000 specimens; the botanical department has extensive collections of woods, grasses, and mosses; the mineralogical department has over 4000 specimens, arranged in the natural order. (2) The Mann Cabinet, devoted to the illustration of geology, contains several thousand valuable specimens, together with Ward's extensive collection of casts. Other departments are opening, and to all valuable additions are annually made. The laboratory is well furnished with chemicals and apparatus for a full analytical course. In the other departments the facilities for illustration are also ample. The location of the institution is pleasant, healthy, and easy of access, its courses of study are full and thorough, and its charges exceedingly moderate. From the first it has enjoyed a high degree of prosperity.

F. Merrick.

Ohm. See Electricity, by Prof. Henry Morton, Ph. D., M. N. A. S.

Ohm (Georg Simon), b. at Erlangen, Bavaria, Mar. 16, 1787; studied in his native city, and was appointed professor in physics in 1817 at the Jesuit college of Cologne, director of the Polytechnic School in Nuremberg in 1833, and professor in 1849 at Munich, where he d. July 7, 1874. He discovered the so-called Ohm's Law (which see), set forth in his *Galvanische Kette, mathematisch bearbeitet* (Berlin, 1827), which was translated into English in Taylor's *Scientific Memoirs* (vol. xi., London, 1841), and was rewarded with the Copley medal by the Royal Society of

London. Besides his principal work, *Beiträge zur Molecularphysik* (Nuremberg, 1849), he has written, among others, *Bestimmung des Gesetzes, nach welchem die Metalle die Contact-Elektricität leiten* (1826). He has also made important contributions to the subject of acoustics.—His brother, MARTIN OHM, b. at Erlangen May 6, 1792, studied at Berlin, and was appointed professor in mathematics in 1817 at Thorn, and in 1822 at Berlin, where he d. Apr. 1, 1872. He published *Versuch eines vollkommenen consequenten Systems der Mathematik* (9 vols., Nuremberg, 1822–52), and *Geist der mathematischen Analysis* (2 parts, 1842–45), of which the first part was translated into English by A. J. Ellis (London, 1843).

Ohm's Law. See ELECTRICITY.

Oil, tp. of Perry co., Ind. P. 1440.

Oil-Cake, the residue which is left after the expression of fixed oils from crushed or ground seed of any kind. It is used both as food and as a direct fertilizer. The cake is frequently pulverized before using, and is then called *oil-meal*. Linseed-oil cake is valuable for fattening cattle. It is largely exported from the U. S. to Great Britain. *Cotton-seed meal* is used for feeding cattle, and is a valuable manure. Rape-cake and colza-cake are fed to sheep or applied directly to the land. Stale and rancid cakes are fit only for manure. Well-selected linseed-oil cake is one of the best fattening materials for neat cattle, and its use is sadly neglected in the U. S.

Oil City, post-b. of Oil Creek tp., Pa., on the Allegheny River, is located in the centre of the oil district of Pennsylvania, and is the terminus of four railroads. It has 2 large schools, 11 churches, 5 banks, 2 oil-refineries, an oil exchange, barrel-works, several hotels, 1 daily and 1 weekly newspaper, and the usual stores. Pop. of b. 2276; of tp. 5098. FRANK H. TAYLOR, ED. "DAILY DERRICK."

Oil, Cod-liver, a fixed oil obtained from the liver of the common cod (*Gadus morrhua*) and other species of *Gadus*. Cod-liver oil is prepared on the coasts of Newfoundland, Nova Scotia, and New England in our own country, and of Britain and Norway abroad. Since its large consumption in medicine, much better means of obtaining the oil pure and sweet have been adopted than were formerly employed. For this purpose the fish caught in boats near the shore are promptly landed, and the oil is obtained from the perfectly-fresh livers by various processes involving the application of heat and expression. Oil thus prepared is called "shore oil" and "pale oil." It is a clear, light-yellow, thick oil, of a perfectly bland taste, but of a disagreeable fishy flavor and smell. Other varieties of oil are called "straits" and "banks," or "light-brown" and "dark-brown" oil from their respective colors. They are prepared from livers which are not perfectly fresh or have actually begun to putrefy; they have a rancid, offensive flavor, and are unfit for use in medicine. Cod-liver oil is a very complex substance, containing, besides the usual ingredients of fats, certain biliary principles and small quantities of iodine, bromine, chlorine, and phosphorus. It is used largely in the arts, especially in the preparation of leather. For over 100 years the oil has been employed more or less for rheumatism, gout, scrofula, etc., but its present prominence in medical practice is principally due to a treatise on the oil by Dr. J. Hughes Bennett of Edinburgh in 1841. It is now a staple remedy in consumption and the above-named diseases, and for all conditions where there seems to be a dyspepsia for ordinary forms of fat, with emaciation and anæmia. When the oil acts favorably, the patient grows fatter and ruddier and the morbid symptoms tend to recede. Apparently, the virtues consist simply in the fact that cod-liver oil is an animal fat which, for some unknown reason connected with its peculiar composition, can be digested and assimilated under circumstances where the ordinary fats of food cannot. Cod-liver oil may be taken in quantities of a tablespoonful two or three times a day, and its fishy taste is best disguised by enveloping the dose in the froth of porter. EDWARD CURTIS.

Oil Creek, post-b. and tp., Crawford co., Pa. Pop. of b. 428; of tp. 2041.

Oil Creek, tp. of Venango co., Pa. Pop. 5098.

Oil from Coal. See PETROLEUM, by C. F. CHANDLER.

Oil from Shale. See PETROLEUM, by C. F. CHANDLER.

Oil Gas. See GAS-LIGHTING, by C. F. CHANDLER.

Oil, Genesee, a local name for petroleum.

Oil, Mineral. See PETROLEUM, by C. F. CHANDLER.

Oil of Lin'seed has been mentioned before. (See LINSEED OIL.) We add that in the U. S. this industry is divided between the seaboard, where India seed is almost exclusively employed, and the interior, where the domestic seed is consumed. The total product of seed grown in the U. S. in 1875 is estimated at 2,500,000 bushels of 56 pounds. The India seed imported in 1875 was about 1,000,000 bags of 3 bushels each, or 3,000,000 bushels, making the total quantity of linseed prepared in the U. S. in 1875 = 5,500,000 bushels. The American seed yields from 28–29 per cent. of oil; the India seed, 33½ per cent. The oil of American seed is darker and heavier-bodied than that from Indian seed, which is preferred for some purposes. It has been observed that the oil from India seed exposed to a cold of $-6°$ to $-9°$ F. is congealed, and if in this state it is subject to agitation in transportation by railroad it is permanently injured, never returning to a completely homogeneous state again. The oil from American seed is not so affected. The importation of linseed into the U. S. is of comparatively recent origin. The first cargo came in 1838–39 from Odessa by the ship Hercules. The India trade followed in ships used for carrying out ice to Calcutta. The foreign seed costs in New York about $2, gold, per bushel. The total product of oil from both foreign and domestic seed is about 47,600 tons. The oil-value of a bushel of seed is about $1.50, currency, and the value of the cake from the same 89 cents, and the cost of its manufacture is 40–45 cents. The cake is very largely exported to London, and is worth about $45, gold, per ton. The process employed in the manufacture of linseed oil in the U. S. is almost exactly that described in Muspratt's *Chemistry*, and more fully in Ure's *Dictionary*. (The above facts are in a private communication to the writer from a well-known manufacturer in New York.)

The composition of linseed is given by Way in the *Journal of the Roy. Agr. Soc.*, x. pt. 2, from four sources, as follows:

	Nitrogen, per cent.	Fat, per cent.	Ash, per cent.	Water, per cent.
From Riga	3.60	34.70	5.25	9.45
" Memel	3.33	36.00	3.56	8.74
" the Black Sea	3.31	38.42	5.64	10.22
" England, 1847	4.60	36.66	2.68	12.33
" " 1848	4.29	38.11	4.03	8.37

Anderson (*Highland Agr. Soc. J.*, 2d series, No. 69, p. 376) found in linseed oil 24.44 per cent of albuminous substance, 34.00 oil, 30.73 gum, sugar, and cellulose, 3.33 ash, and 7.50 water = 100. Meurin (*J. Pharm.* [3], xx. 96) has analyzed the several parts of linseed, as follows:

Episperm...	Gum and soluble salts	14
	Soft resin and fixed oil	1
	Water	2
	Matter insoluble in water and ether..	4 = 21
Edosperm..	Soft resin and fixed oil	6
	Water	2
	Soluble in water	3
	Insoluble in water	12 = 23
	Fixed oil	30
	Water	5
	Matter soluble in water	3
	" insoluble in water and in ether...	18 = 100

Linseed also contains a large quantity of mucilage, which is in the outer layers of cells of the epidermis, and swells up when macerated in water, bursting the cell-walls; 1 pint of linseed boiled in 16 of water gives a mucilage so thick as to draw out in threads and form a dark-colored mass when dry. This contains, besides mucilage, legumine, albumen, an organic acid, perhaps malic acid, and ash of lime, potash, iron, partly as phosphates, partly carbonates. (*Schmidt*, as quoted by Watts.)

The so-called "caoutchouc of oils" may be prepared in several ways, as by exposing linseed oil in thin layers it dries up to a transparent, resinous, moderately elastic mass resembling caoutchouc, which does not melt by heat, but carbonizes and burns. Linseed oil, nut oil, or poppy oil, heated to about 600°–700° F., takes fire and burns quietly until only tar or coal remains. If the burning be arrested by closing the vessel, a brown turpentine-like body, adhesive as bird-lime, remains. This substance, boiled continuously with water containing nitric acid (more water being added from time to time to check the too rigorous action of the nitric acid), acroleine is evolved, and the body becomes solid, of the consistence of plaster, resembles caoutchouc, and does not adhere to the fingers. It is then fusible only in part; forms an emulsion in carbon disulphide; shrinks when boiled with concentrated caustic alkali; dissolves only on addition of water; and is reprecipitated by acids; it is soluble in alcoholic potash, swells in ether free from alcohol, and partly dissolves in a larger quantity of ether; alcohol precipitates it from this solution. It swells without dissolving in petroleum, but dissolves completely in an excess of turpentine, which in small quantity only softens it. Its solution in turpentine remains unaltered on evaporation.

Chloride of sulphur in the proportion of 12–15 parts to

100 of linseed oil produces caoutchouc-like products which more of the sulphur compound hardens; dilute acids and alkalies do not attack them, but they are saponified by concentrated alkaline solutions. B. SILLIMAN.

Oil of Tar. See TAR, by C. F. CHANDLER.

Oil of Turpentine. See TURPENTINE, by J. P. BATTERSHALL.

Oil of Tur'pentine, Medicinal Uses of. This oil is a powerful irritant, speedily producing redness and burning pain if kept too long in contact with the skin. Given internally, its most striking effect is a tendency in anything like overdose to cause great irritation, and even congestion, of the kidneys and urinary passages, with scanty and bloody urine, and severe pain in passing the same. Large doses act as an irritant poison, although death is rare. Oil of turpentine is used externally as a rubefacient to relieve pain or spasm of internal parts. For this purpose flannels wrung out in hot water are dipped in the oil previously slightly warmed, and after being again wrung dry are laid upon the skin. They should not be applied longer than from ten to twenty minutes, for fear of blistering or inflammation of the skin. Internally, the oil is given to control hæmorrhages, for which purpose it is often very efficacious. It is specially useful in bleedings from the stomach and bowels and in the ulceration of the latter organs in typhoid fever. Oil of turpentine is also used as a vermifuge and as an ingredient in cathartic enemata. The dose by the stomach ranges from a few drops to a fluidrachm, to be given in emulsion. The fumes of the oil, volatilized by the heat of boiling water, are inhaled to check bleeding from the lungs. EDWARD CURTIS.

Oil, Olive, is obtained from the fruit of the European olive (*Olea Europæa*), a tree grown for this purpose from the most ancient times, both in Europe and Asia Minor. Over thirty varieties of the olive are grown in France, a catalogue of which is given in the new *Duhamel.* The wild olive has no value except as a stock on which approved sorts are engrafted. In the several departments of Southern France, where the famed virgin oil of Aix is made, the olives are gathered in November and December, when about two-thirds ripe. The favorite olive of this district is called *caiion;* another sort is called *brun* (the brown sort). When ripe this fruit is of mixed red, green, and purple color. The fruit is crushed entire in an edge-wheel mill of stone, driven by animal power usually, care being taken not to crush the stones or kernels, which contain a bitter principle and a poor oil. The virgin oil is dipped out of the mill after the fruit is reduced to a pulp, and is seldom sold in commerce separately, bearing the highest price, and used either by the proprietors of estates or for enriching poorer sorts. After removing the virgin oil, the pumace or *marc* is placed in coarse linen bags or preferably in circular mats of palm-leaf, called *coussins* (cushions), which have a central opening and are about eighteen inches in diameter. These bags are then piled on each other, the bottom of each one closing the opening of that beneath, to the number of ten to twenty or thirty, as may be. The screw-press is then applied, and the oil trickling down is collected by a circular gutter and runs into a tank. This gives the best market oil, and is called *première qualité.* The marc is then taken from the coussins, broken to powder by flat wooden shovels, and repacked in a second set of bags. This process is twice repeated on the dry marc, and a little additional oil obtained each time. After the third pressing about two quarts of boiling water are poured in each coussin, and the fourth pressing then yields a considerable volume of a lower-grade oil, which is used either to mix with other oils or for lubricating and burning oils and in soap manufacture. This treatment by boiling water gives the oil known as *au chaud,* and the process may be repeated, but always with an inferior quality of oil. The total quantity of oil obtained by the four pressings in the department of Var is from 40 to 50 litres for each 5 bushels of fruit, or about 3 imperial gallons to the Winchester bushel. This includes the first *chaud,* but not the subsequent pressings. "The mean produce of a tree in France is about 10 pounds of oil, and in Italy 15 pounds, but single trees have been known in fruitful seasons to produce 300 pounds of oil." (*Hillhouse.*) Even the purest virgin oil is turbid when first pressed. It clears itself by simply standing in the tanks, which on large estates are masonry cisterns underground, where the oil is kept at an even temperature for a long time, air being excluded, the feculence settling. The color of the best oil of Aix and of Tuscany is greenish.

The adulteration of olive oil is made chiefly at Marseilles by adding colza, rape, sesame, cotton-seed, and above all groundnut oil. The groundnut (American peanut, *Arachis hypogæa*) is grown extensively on the African coast expressly for its oil, which is often sold in commerce under the name of olive oil, and, while bland and inoffensive, has nothing of the fruity flavor of the genuine olive oil. The "sweet oil" of olives has a peculiar flavor, due to the fruit, not to be mistaken, and, like other acquired tastes, much in favor. In all Southern Europe it replaces butter and other animal fats for table and culinary use, and its production is a very important industry. The trees attain a great age and large dimensions, and do not come to full bearing under thirty years; they are all grafted varieties. Some groves have an historic celebrity, and are preserved with scrupulous care by stringent laws. Severe pruning is needed to develop the best fruit.

The pickled olive is an important article of commerce. The commoner sorts are simply treated with brine made aromatic with fennel, coriander-seed, cumin, and rosewood. But the *picholines* of Provence (so named from the *Picciolini,* who invented the process), the best pickled olives, are gathered green in October, and after selecting the finest are thrown into a weak alkaline liquor prepared from soda made caustic by lime. In this solution they remain eight or ten hours, till the pulp ceases to adhere to the stone. They are then steeped during a week in cold water renewed daily, and after this treatment (which removes the bitterness of the unripe fruit) they are transferred to an aromatic brine. For luxury the stones are sometimes removed, and the fruit stuffed with capers, truffles, or minced sardines, and closed air-tight in bottles of the finest oil. The picholine is the fruit of Duhamel's eleventh variety (*Olea oblonga*), the *Olea minor lucensis.* N. D., ninth variety, is also esteemed for pickling. (For an extended account of the olive consult Augustus L. Hillhouse in Michaux's *North American Sylva,* i. 50–88.)

In the U. S. the olive is successfully grown in Southern California, where the Franciscan monks planted olive-yards near the close of the last century. Humboldt (*On the Geographical Distribution of Plants*) says the olive requires a climate of a mean temperature of 57.17°, and that its coldest month must not fall below 41.5°. Such a climate is found in California, but nowhere on the eastern coast of North America. New Smyrna in Florida was founded for the cultivation of the olive by an adventurer who led thither a colony of Greeks about the middle of the last century, but in 1783 hardly a trace of this settlement remained, although Bartram, who visited it in 1775, describes it as a flourishing town. There is, however, every reason in respect of fitness of soil and climate for the successful culture of the olive in California. The olive tree is usually, almost uniformly, a biennial, fruiting only in alternate years; but at Aix, where the olive-harvest is in November, it is annual and uniform. In California, where nearly all fruit trees bear twice yearly, the olive is a perpetual bearer. (For many of the facts in reference to the department of Var in this article the writer is indebted to an intelligent American long resident in Southern France.) B. SILLIMAN.

Oil, Palm. See ELÆIS and PALM OIL.

Oils [Lat. *oleum;* Gr. ἔλαιον]. The oils are liquid fats (see FATS) existing ready formed in nature. They are mostly fluid at ordinary temperatures, unctuous to the touch, stain paper with a permanent greasy spot, are insoluble in water, little soluble in alcohol (castor oil excepted), completely dissolved by ether, often, but not always, tasteless and odorless, and form soaps with alkaline bases, setting free glycerine. In short, the oils are glycerides, and fall under the general designation of fat-oils, including certain pasty sorts, like palm oil, cocoa oil, and other butter-like vegetal fats. The fat vegetal oils are all fixed, while the essential oils are all volatile. The volatility of some of the fatty acids forms no exception to this statement. The essential or volatile oils mostly exist ready formed in plants, from which they are obtained by distillation. They are distinguished from the fat-oils not more by their volatility and odor than by their action with alkaline bases, not being capable of saponification. The volatile oils are therefore separately considered (III.), while the fixed fat-oils are conveniently grouped with reference to their origin, as I. VEGETABLE OILS, and II. ANIMAL OILS.

I. *Vegetable Oils.*—In plants the fat-oils exist ready formed, secreted chiefly in the seeds, sometimes in the flesh or pulp about the seeds, as in the olive, dogberry, etc., and much more rarely in the roots, as in the earth-almond (*Cyperus esculentus*), which contains 26 per cent. of oil disseminated in minute globules in the cellular tissue. In the oil-producing seeds the oil is often associated with albuminous matters, gum and mucilage; as in linseed, for example. When such seeds are bruised or ground and diffused in water, these albuminous bodies suspend the oil, entangled in a milky *emulsion* of a glairy and mucilaginous consistency. Linseed is a prominent example of this sort of seeds. The vegetal oils are usually divided into two

groups: (1) *The drying oils*, like linseed oil, which on exposure to air absorb oxygen and dry to a resinoid surface or varnish; and (2) *the fatty or non-drying oils*, of which olive oil is an example. The latter class become rancid on exposure to air, but as a rule such oils do not dry up, although many of them thicken. This grouping of the vegetal oils is that usually adopted, and in its support is adduced the chemical evidence that there is a corresponding difference in the primary organic nucleus or molecular grouping of the atoms of carbon and hydrogen. Thus, the primary nucleus of the drying oils is $C_{32}H_{38}$, and its acid *linoleic acid*, $C_{32}H_{28}.O_4$, or, in the present notation, $C_{16}H_{28}.O_2$; while in the fatty or non-drying oils the primary nucleus is $C_{36}H_{34}$, giving *oleic acid* $C_{36}H_{34}.O_4 = C_{18}H_{34}.O_2$. (See LINOLEIC and OLEIC ACIDS, beyond.) Cloëz, who has elaborately investigated the fat-oils of plants (*Ann. de Ch. et Phys.* and *Bull. Soc. Ch.*, 1865), concludes that this distinction is one of degree rather than of kind, since he finds in the case of fifty oils of his own preparation, exposed during eighteen months to air, that all were changed, not only by absorbing oxygen (the usual statement), but also by losing carbon and hydrogen. In the so-called drying oils this change is much greater than in fatty oils, like olive oil. Cloëz has by proximate analyses determined the amount of oil present in over 200 sorts of grains or seeds, and has tabulated the results with reference to the weight of the hectolitre, the amount of water lost at 100° C., the ash, the quantity of oil in the normal and dry seed, and the density of the oil. Cloëz in his researches on the oils used an improved form of displacement apparatus, employing carbon disulphide in the state of vapor as the solvent. Ether, benzene, and chloroform also may be used to exhaust or displace oil from seeds, but are less efficient and otherwise less desirable than carbon disulphide, which also dissolves far less of the foreign bodies present than any other known agent. This agent may be completely freed of the disgusting odor of the commercial product (due to a sulphuretted hydrocarbon) by distilling it from caustic lime in powder (Silliman) or by digesting it for a time on powdered mercuric chloride (Cloëz). The use of carbon disulphide for removing the oil of corn (*Zea maïs*) before its treatment in the mash-tub, for producing whisky, with a view to improving the quality of the liquor, has been perfected by the Messrs. Tracy of New York, and is the subject of a patent. The following table, condensed from the memoir of Cloëz, presents his results upon fifty oils, showing the gain in weight of ten grammes of each oil exposed for eighteen months in tarred capsules of glass, and weighed every three months. These were covered with disks of filter-paper to exclude dust, and each oil was subjected to ultimate analysis both before and after the exposure. Some of the analytical results are cited in the large table on next page.

We select four examples of the analyses of oils by Cloëz, which show the gain in oxygen and the loss of carbon and hydrogen in each oil after eighteen months' exposure to air. Ten grammes of each oil were taken, and the gain in weight of this quantity is shown in the fourth column, and the differences in the fifth:

1. *Oil of Sesame.*

Fresh oil.		Aërated oil.		
Composition in 100 parts.		Pr. 100 p'ts.	Pr. 104.83 gr.	Diff.
Carbon	78.670	70.705	74.12	− 4.55
Hydrogen	11.678	10.636	11.15	− 0.528
Oxygen	9.652 = 100	18.695 = 100	19.56 = 104.83	+ 9.918

2. *Castor Oil.*

Carbon	74.361	72.125	74.058	− 0.303
Hydrogen	11.402	11.108	11.405	− 0.003
Oxygen	14.237 = 100	16.767 = 100	17.217 = 102.680	+ 2.980

3. *Linseed Oil.*

Carbon	77.57	67.55	72.299	− 5.271
Hydrogen	11.33	9.88	10.574	− 0.756
Oxygen	11.10 = 100	22.57 = 100	24.157 = 107.030	+ 13.057

4. *Poppy Oil.*

Carbon	77.497	66.68	71.381	− 6.116
Hydrogen	11.398	9.94	10.641	− 0.757
Oxygen	11.105 = 100	23.38 = 100	25.028 = 107.05	+ 13.923

It is plain from these analyses that the oils all absorb oxygen and eliminate carbon and hydrogen. A part of the loss is doubtless in the form of carbonic acid and water, but Cloëz remarks also the production of a volatile hydrocarbon analogous to acroleine, irritating, and staining the paper covers of the glass vessels of a brown color, resembling the like coloration seen on the pages of old books, in which, by a like process of oxidation of the oil in the printer's ink, a suffocating odor is evolved familiar to those who consult these volumes. Old engravings are stained by the same volatile hydrocarbon, doubtless.

Cloëz has also determined the ratio existing between the amount of oil present in the seed, as fixed by analysis, and that obtained by pressure and left entangled in the oil-cake ("*Tourteau*"). In well-regulated manufactories in France the oil left in the cake is about 10 per cent. of the total quantity in the seed. The following table condenses the results obtained in the treatment of five sorts of the more important oil-producing seeds, and shows the application of a formula deduced from experiment, capable of use in any case of a seed in which analysis has determined the total quantity of oil it contains:

Name of oil-producing seeds.	H.	R.	Oil produced by pressure.		Oil retained in cake.	
			Calculated.	Experiment.	Calculated.	Experiment.
Colza of Vendée	44.20	55.80	38.00	37.69	6.20	6.19
Gold-of-pleasure seed (Camelina)	31.64	68.36	24.05	27.27	7.59	5.26
Poppy	44.00	56.00	37.77	37.29	6.23	6.83
Linseed	37.95	62.05	31.06	30.15	6.89	7.81
Peanut (groundnut)	44.10	55.90	37.89	37.10	6.21	6.49

NOTE.—H = oil contained in 100 parts of seed; R = 100 — H; T (the weight of the cake) $= R + \frac{R}{9}$; hence $T = \frac{R}{9} + R = \frac{10R}{9}$, and the quantity of oil (h) to be obtained in pressing 100 parts of seed will be $h = H - \frac{R}{9}$.

Purification of Oils.—The crude oils come from the press more or less changed by the heat employed, and contaminated by albumen, resinous and coloring matter, which must be removed to fit the oils for nice purposes. The treatment originally proposed by Thénard in 1801 is still in general use—mixing the oil with 2 or 3 per cent. of concentrated sulphuric acid in a lead-lined vat, stirring it until it assumes a greenish tint, and finally as the mucilage is carbonized the whole mass blackens. After twenty-four hours' repose about 2 per cent. of its volume of water, of about 170° F., is added, and the whole agitated vigorously until the liquid appears milky, when the mixture is transferred for rest to large reservoirs at a constant temperature of about 80° F. After some days' rest the clear oil is decanted and filtered either through cotton, carded wool, or flannel, sometimes through river-sand and branches of trees free of leaves. The saturation of the acid is accomplished after Dubrunfaut by chalk without the use of so much water. The oil-cake itself is sometimes employed in a state of dry powder, to avoid filtration, 50 kilogrammes of the powdered cake being capable of clarifying 200 hectolitres of oil in successive portions of about 6 hectolitres each. Oils like cotton-seed and palm oil are treated in England by a mixture of nitric acid and potassic chlorate, which rapidly oxidizes the coloring-matters. About 1 to 2 per cent. of this mixture suffices, and an excess of chlorate is to be avoided as well as of nitric acid, which with alkalies gives a strong red color to the oil, very objectionable when used to make soaps. Many other methods of purification have been proposed for oils, of which we mention only that of *air-treatment* with acid by M. C. Michaud, who proposed in 1869 to blow air through the oil, while the acid is permitted to fall in, in numerous small streams. The oil charged with air forms with the feculence a mixture of less density, which gathers as a bulky scum on the surface, which is skimmed off, while the operation is repeated until this scum ceases to appear. The oil is then treated by a current of steam until it is warmed to 212°, and with a diminishing quantity of steam it is in half or three-quarters of an hour ready to separate from the water and filter.

Physical Properties.—All the oils are lighter than water (see the column of sp. gr. in the following table), but their densities vary greatly with temperature; *e. g.* olive oil at 12° C. has sp. gr. .919; at 26°, .911; and at 94°, .862. The congealing points of the oils vary also greatly, being for olive oil 2° (C.); colza, — 6.25°; groundnut, — 7°; almonds, — 10°; grape, — 16°; poppy and castor, — 18°; linseed, — 27.6°; pine, — 30°. The oils vary equally in electric conductivity, that of olive oil being 677 times less than the others. This peculiarity was made the basis of Rousseau's *diagometer*, an instrument designed to detect adulteration in olive oil by the varying intensity of an electrical current moving a magnetic needle.

Chemical Properties.—The effects of air upon the vegetable oils have already been given. In general, the non-drying, both vegetable and animal, become rancid by exposure to air, while the drying oils become gummy or resinous. This effect is quickened or intensified by boiling them with oxide of lead, peroxide of manganese, and borate or acetate of manganese—an operation attended with the production of a high color. For colorless varnishes drying oils are treated in the cold by oleate of lead prepared after the method of Bouis by acting on oleic acid by litharge. The same result is obtained by the use of protoxide of

manganese, precipitated by an alkali from a protosalt of manganese, rapidly washed, and incorporated with the oil. On driving into the mixture a finely-divided current of air the manganese is peroxidized in the midst of the oil, giving after washing with oil a colorless and very drying oil. The action of acids and alkalies upon oils is considered under OLEIC ACID, OLEINE, and also under SAPONIFICATION and SOAP. (For a fuller list of oils than above given see Watts's *Chemical Dictionary*, art. "Oils." For CASTOR OIL, LINSEED OIL, OIL, OLIVE, etc., see those articles.)

Table of Analyses of Fifty Species of Oleaginous Seeds, with the Results of their Exposure to Air for Eighteen Months. By M. S. Cloëz (Bull. de la Soc. Chem., iii. 46, 1865).

Names of plants.	Weight of 1 hectolitre of grain.	Fatty matter— in 100 parts by weight.	Fatty matter— in volume per hectolitre.	Loss in water at 100° C.	Ash in 100 parts.	Density of oil at 15° C.	Weight of 10 gr. of oil after 18 months' exposure to air.	Condition of the oil after exposure to air.
	kil.	gr.	gr.	gr.	gr.		gr.	
Cocoanut oil (*Cocos nucifera*)	57.84	69.300	42.900	5.04	1.36	0.934	10.280	No change in appearance.
Cardon oil (*Cynara cardunculus*)	64.80	20.010	14.005	9.02	3.46	0.926	10.758	Nearly solid, surface wrinkled.
Bardane oil (*Arctium lappa*)	51.64	19.032	10.559	11.12	3.08	0.930	10.776	" " " undulated.
Oil of madi (*Madia sativa*)	45.69	32.700	16.079	8.34	4.16	0.929	10.699	" " " wrinkled.
Sunflower (*Helianthus annus*)	44.00	21.810	10.374	9.30	3.20	0.925	10.689	" " " "
Ram-till (*Guizotia oleifera*)	66.80	35.100	25.414	7.94	3.84	0.923	10.733	" " " even.
Dulcamara (*Solanum dulcamara*)	48.75	23.86	12.524	7.44	2.82	0.929	10.802	" " " much wrinkled.
Stramonium (*Datura stramonium*)	58.48	25.00	15.940	8.56	2.92	0.922	10.698	Solid surface uniform.
Paulownia (*P. imperialis*)	6.70	21.98	1.592	10.18	3.15	0.925	10.812	Very thick, irregular surface.
Sesame of India (*S. Indicum*)	62.20	53.95	36.311	5.24	5.68	0.924	10.483	Thick uniform surface.
Oil of *Dracocephalum moldavicum*	64.00	21.32	14.634	10.04	5.60	0.932	10.835	Nearly solid, surface much wrinkled.
Olives (*Olea Europea*)	67.10	39.45	28.883	29.20	1.79	0.916	10.372	Liquid, scarcely thickened.
Holly (*Ilex aquifolium*)	59.80	25.905	16.796	7.62	1.96	0.922	10.802	Very thick, surface uniform.
Cotton (*Gossypium herbaceum*)	63.00	23.675	15.931	9.30	3.76	0.936	10.397	Liquid, hardly thickened.
Euphorbia (*E. lathyris*)	56.82	43.75	26.842	7.34	2.76	0.926	10.438	" " "
Bancoul-nuts (*Aleurites moluccana*)	46.87	62.12	31.166	5.14	3.18	0.934	10.742	Solid, wrinkled.
Castor oil (*Ricinis communis*)	56.10	68.81	40.073	3.76	2.56	0.963	10.268	Liquid, hardly thickened.
Croton (*C. tiglium*)	48.73	37.03	19.142	6.48	2.72	0.942	10.476	Very thick, uniform surface.
Linseed (*Linum usitatissimum*)	69.62	37.95	28.253	7.84	3.90	0.935	10.703	Solid, very wrinkled.
Pistachio-nuts (*P. vera*)	62.60	5.40	35.034	8.10	2.60	0.918	10.505	Liquid, little thickened.
Horse-chestnut (*Æsculus hippocastanum*)	57.40	5.215	3.243	12.65	1.75	0.923	10.542	" thickened.
Spindle tree (*Euonymus europæus*)	57.60	44.80	26.961	7.74	3.06	0.957	10.391	" slightly thickened.
Thlaspi oleifera	73.14	18.45	14.619	12.76	5.50	0.923	10.812	Solid, uniform.
Gold-of-pleasure seed (*Camelina sativa*)	67.04	31.64	22.784	8.84	4.16	0.930	10.810	Nearly solid, surface undulated.
Cress-seed (*Lepidium sativum*)	75.39	23.97	19.507	10.40	4.66	0.926	10.856	" " " uniform.
Colza (spring), (*Brassica c. oleif. præcox.*)	62.25	39.50	26.997	8.84	3.30	0.910	10.566	Liquid, thickened.
Colza (in season), (*B. campestris oleifera*)	68.80	43.42	32.770	7.64	3.56	0.912	10.572	" "
Cabbage (*B. sempervirens*)	69.87	39.25	29.721	9.08	3.60	0.922	10.536	" "
Rutabaga (*B. napobrassica*)	66.60	39.10	28.428	8.44	2.68	0.916	10.542	" "
Winter cabbage (*B. napus oleifera*)	66.79	40.97	29.891	8.70	3.36	0.915	10.537	" "
Summer cabbage (*B. asperifolia oleifera*)	69.93	40.62	30.98	8.72	3.32	0.916	10.539	" "
Turnip (*B. rapa*)	70.70	37.60	29.09	9.10	3.80	9.917	10.542	" "
Mustard (*Sinapis arvensis*)	72.55	25.70	20.24	7.74	4.36	0.921	10.524	" "
Mustard, black (*S. nigra*)	72.60	31.92	24.82	8.24	9.90	0.933	10.572	" "
Mustard, white (*S. alba*)	75.42	31.27	25.59	8.42	3.30	0.921	10.527	" "
Radish (*R. oleifera*)	68.60	36.13	26.57	8.40	4.16	0.932	10.537	" "
Glaucium flavum	65.00	37.75	26.84	6.84	8.40	0.924	10.773	Solid, very much wrinkled.
Red glaucium (*G. corniculatum*)	65.84	27.08	19.26	7.24	11.16	0.925	10.696	" " "
Poppy (*Papaver* ————)	60.80	42.30	27.74	7.40	6.48	0.927	10.705	" " "
Flax (Chênvre)	56.00	31.50	18.95	8.80	4.70	0.930	10.778	"
Cucumber (*Cucurbita perennis*)	38.70	39.22	16.23	6.44	3.96	0 934	10.740	Nearly solid, smooth, uniform.
Evening primrose (*Œnothera biennis*)	40.05	21.83	9.47	10.68	4.52	0.929	10.682	" " wrinkled.
Sweet almonds	58.92	55.69	35.88	5.64	2.85	0.918	10.459	Liquid, little thickened.
Apricot almonds	57.56	43.63	20.66	7.28	2.46	0.915	10.547	" " "
Groundnuts (*Arachis hypogœa*)	62.15	50.50	34.18	5.26	1.62	0.918	10.426	" " "
Groundnuts, without shells	44.16	64.32	30.58	4.68	2.00	0.928	10.747	Solid, very wrinkled.
Beechnuts (*Fagus sylvatica*)	63.45	43.52	30.05	9.14	3.30	0.918	10.621	Very thick, even surface.
Filbert, shelled (*Corylus avellana*)	54.45	60.35	28.37	6.64	2.16	0.919	10.434	Liquid, hardly thickened.
Spruce fir (*Abies excelsa*)	55.00	32.40	19.05	9.12	3.90	0.935	10.785	Solid, much wrinkled.
Pignon fir (*Pinus parviflora ?*)	54.80	44.73	26.30	7.88	4.10	0.919	10.825	Very thick, even surface.

II. *Animal Oils.*—The animal oils and fats have a constitution closely identical with the non-drying vegetal oils. They are in general propenylic ethers of the fatty acids (see FATS and GLYCERINE), so rich in oleic acid as to remain fluid at ordinary temperatures, while the corresponding glycerides of palmitic and stearic acids are more or less solid fats, as tallow, mutton suet, lard, etc. The animal oils have, as a class, a characteristic and very persistent odor, referable to their origin, which in some of the fish oils is peculiarly offensive. This animal odor adheres to the soaps made from even the sweetest animal oils with great obstinacy. The liquid animal oils are largely derived from marine animals. *Sperm oil* occurs in the cavity of the head of the sperm whale (*Physeter macrocephalus*), mixed with spermaceti, from which it is separated by crystallization and pressing in the cold. It is saponified with difficulty by potash, yielding the same fatty acids as spermaceti fat, with which it appears to be isomeric. It is esteemed the most valuable of animal oils, and bears the highest price. *Whale* or *train oil* is obtained from the blubber of the right whale (*Balæna misticetus*), from the black-fish, and from other species of whales. Its sp. gr. varies from .919 to .929. Dolphin oil and porpoise oil contain a peculiar fat called delphinine, phocenine, or dolphin fat. It is a neutral, very mobile oil, of sp. gr. 0.948–0.954, of a faint, peculiar, somewhat ethereal odor, like that of valeric acid. Phocenine is regarded as a mixture of valeveriens, and has been separated by Berthelot into valeric acid and glycerine. Seal oil, shark oil, sea-calf oil are fat oils obtained from the blubber of these animals, and having characteristics in common with whale oil. The menhaden of the Atlantic coast are extensively taken for the oil they furnish and the *fish-guano* produced from the compressed fish after boiling to separate the oil.

Cod-liver Oil. (See OIL, COD-LIVER.)

III. *Essential or Volatile Oils.*—The group or natural family of hydrocarbons which is known as the *aromatic group* embraces benzole and its homologues (see BENZOLE); hydrocarbons of the naphthalene series, C_nH_{2n-8}, and the terpenes, $C_{10}H_{16}$, of which turpentine oil and its isomeres are members, including also caoutchouc and gutta-percha. The volatile oils form a sort of appendix to the aromatic group, and to this appendix are referred also, properly, the resins and balsams, the bitumens, and allied substances. We restrict our remarks here to the volatile oils and essences found already formed in plants. The essential oils of plants consist chiefly of mixtures of hydrocarbons with acid or oxygenized bodies of the same class. They are mostly isomeric or polymeric with oil of turpentine, represented by $C_{10}H_{16}$. Turpentine oil is the product of various species of Coniferæ, and is obtained from wounds or incisions in the bark, from which it exudes in combination with the resin and other vegetable juices, and is separated from them by distillation. While all the volatile oils thus obtained from coniferous plants are alike in general properties, as of odor, solvent power, etc., they really differ much in density, and more especially in optical properties, some revolving the polarized beam to the right (dextro-rotatory), while others revolve it to the left (lævo-rotatory), and in unlike degrees. Most kinds of turpentine oils are mixtures of two or more isomeric or polymeric hydrocarbons, differing in physical and sometimes in chemical properties. The oxidized constituents of the essential oils are sometimes the direct products of the oxidation of the hydrocarbon itself, in which

case they are usually viscid resins; while in other cases the two classes appear distinct—*i. e.* not derivative of the same primary nucleus. Gladstone has lately carefully studied the volatile oils in view of their specific gravity, boiling-points, and optical properties (*Journ. Chem. Soc.*, 1864, xvii. 1, and again *Ibid.* [ii.], x. 1, 1872). The hydrocarbons from essential oils may be arranged in three polymeric groups, having the formulæ, respectively, $C_{10}H_{16}$, $C_{15}H_{24}$, $C_{20}H_{32}$. The first group comprises the greater number of these bodies—turpentine, orange, caraway, nutmeg, anise, thyme, etc.; the second, those from cloves, rosewood, cubebs, calamus, etc.; while the last group has only one representative, colophene. These groups are distinguished by the vapor-densities of the bodies belonging to them—viz. the first group requires a theoretical vapor-density of 4.71, while actual experiment on oil of turpentine, pepper, juniper, lemon, orange, etc. gives closely approximate results. For calamus and patchouli oils Gladstone got densities of 6.80 and 7.2, respectively, while theory requires for the formula $C_{15}H_{24} = 7.06$ sp. gr. Gmelin (*Handbook*) gives an experimental density for colophene greater than is required by the formula $C_{20}H_{32}$.

The volatile oils generally absorb oxygen rapidly, rarefying and gaining color in the process, and sometimes forming crystals of camphor-like bodies. Oil of turpentine in four months absorbs twenty times its volume of oxygen, and in forty-three months 128 volumes; it thus acquires the properties of ozone, and its bleaching power is seen on the cork used to stop the bottle containing it. Chlorine, bromine, iodine, and hydrochloric acid gas are all absorbed by turpentine and other oils of that group, which are thus changed generally into resins, balsams, or camphors. The oils of lemon, orange, etc. by exposure seem spontaneously to lose their delicate perfume and change to the odor of turpentine.

The volatile oils are generally obtained by distilling the parts of plants in which they exist, as the leaves, bark, roots, and even wood, either alone or more usually with water, the vapor of which carries over mechanically the oils of a higher boiling-point, which usually emit at 212° a vapor of considerable tension, which gives the characteristic odor of the plant, and is condensed with the steam, separating in the receiver into a milky or turbid layer, usually, but not always, lighter than the water. Many oils of delicate perfume, like oil of lemons, orange, etc., exist in cells in the skin of the fruit and leaves in a state sufficiently abundant to permit their separation by mechanical pressure, while heat would impair their delicacy. The *essences* are only the watery solutions of essential oils, and are often prepared in domestic economy, as rose-water, essence of pennyroyal, mint, etc., by distillation or by addition of the oils to a sufficient quantity of water to hold them in emulsion or hydration, forming the so-called *distilled waters* of the apothecary.

Some of the volatile oils contain acids, aldehydes, etc., the study of which has shed important light on organic chemistry—*e. g.* oil of winter-green (*Gaultheria procumbens*) and meadow-sweet (*Spiræa ulmaria*) furnishing salicylate of methyl and salycylic aldehyde. Bitter almonds furnish benzoic aldehyde, and aldehydes of analogous constitution are obtained from the essential oils of cumin (*Cicuta virosa*), oil of cinnamon and cassia, etc. Sulphur exists in certain oils, as of garlic and mustard. The number of the volatile oils of vegetable origin is very large. Gmelin describes over 170 in his *Handbook*. There are large areas of the earth where plants with a terebinthine or balsamic odor abound almost exclusively, as in portions of Nevada and California. The properties of the plants referred to remain, for the most part, to be investigated. A peculiar turpentine of the Sierra Nevada, called "theoline," and derived chiefly from *Pinus ponderosa* and *P. Sabiniana*, has a density of only about 690, ordinary turpentine being 870 or over.

The odors of volatile oils are by no means all agreeable. Many are pungent, irritating, and even repulsive; their taste is usually aromatic, often burning. Alcohol and ether are their proper solvents. Many volatile oils are the result of decomposition of other compounds by heat, fermentation, and the action of acids; such are eupione, creosote, naphthaline, fusel oil, oil of wine, etc.; while others which exist ready formed in plants, like those of *Spiræa ulmaria* and *Gaultheria procumbens*, may be formed artificially. There are some volatile oils of animal origin, as in ants, castoreum, skunk, etc.

The adulteration of volatile oils is often practised with fixed oils, when it may be detected by a permanent greasy stain left on paper after evaporation and warming; by distilling off the volatile oil, leaving the fixed oil behind; or by dissolving the volatile oil in three or four volumes of 80 per cent. alcohol, when the greater part of the fixed oil remains behind. Alcohol is also a frequent adulterant, and may, when the quantity is large, be detected by dilution of the adulterated oil with water, when it becomes very turbid. Oil of turpentine is often used to adulterate the costly oils of the same series, as of orange, lemon, neroli, etc. It may often be detected by the smell, or after setting fire to it and then blowing it out.

The odor of volatile oils is closely connected with their oxidation. Oil of turpentine, lemon, clove, and the like, when distilled in carbonic acid or nitrogen, and over lime, are nearly odorless. Air restores the odor. Moisture seems essential also to the development of the odor of volatile oils. All odorous flowers are more fragrant when moistened with dew, and in dry climates roses and other fragrant blooms are scentless after the dry season sets in and dew no longer falls. Violets dried over calcium chloride under a bell lose all odor, but regain it completely when moistened again with water; and paper moistened with a volatile odor and then perfectly dried ceases to emit odor until it is again moistened with a little water. Rose-leaves and other fragrant petals yield a much stronger water if distilled from a bath acidulated with sulphuric acid—a fact noticed by Albertus Magnus. It is a curious fact that many distilled waters when kept in well-closed bottles become slimy, lose their proper odor, and acquire an offensive smell; whereas if kept in loosely-covered vessels they remain unchanged, or even recover their proper odor when exposed, after change, to air again. Gmelin suggests that this is due to albuminous and mucous matters carried over in the distillation, which, when they putrefy, rob the volatile oil of a portion of its oxygen, depriving it of its proper odor. B. SILLIMAN.

Oil, Seneca, a local name for petroleum.

Oils, Essential. See OILS.

Oils, Volatile. See OILS.

Oint′ment [Lat. *unguentum*], a pharmaceutical preparation designed to be applied externally, and usually mixed with oily matter, but less fluid than a liniment. Ointments are often very useful local anodyne applications, are employed also as discutients, astringents, stimulants, and are especially useful in the treatment of skin diseases.

Oise, a river of France, rises in Belgium, in the Ardennes, and joins the Seine after a course of 158 miles, half of which is navigable.

Oise, department of France, along the Seine and the Oise. Area, 2218 square miles. Pop. 396,804. The surface is flat, and the soil rich and very well cultivated. The wine is of inferior quality, but large crops of wheat are raised, and enormous quantities of fruit and vegetables are brought to the market of Paris. Of 40,436 children, only 4191 remained without school education in 1852. Cap. Beauvais.

Oje′da, de (ALONSO), b. at Cuenca, Spain, about 1465; accompanied Columbus in his second voyage to America 1493; led a party of exploration to Cibao and through the interior of Hispaniola, or Santo Domingo, then supposed to be Cipango; explored the Vega Real in a second expedition (Apr., 1494); obtained command of an independent exploring expedition; set sail May 20, 1499, accompanied by Americus Vespucius; discovered in June the country which he named Venezuela, and returned to Spain; in 1501, again accompanied by Vespucius, made another voyage and discovered the Gulf of Uraba; returning to Spain in 1508, he obtained a royal grant of Nueva Andalucia (now Colombia); set out with 300 men, among whom was Francisco Pizarro; founded the town of San Sebastian on the Gulf of Darien; embarked for Hispaniola in quest of reinforcements; was put in irons by the treacherous owner of the vessel and carried to Cuba; was for some time engaged in toilsome wars with the Indians of that island; ultimately reached Hispaniola in broken health and spirits, and d. there in 1510 or 1511.

Ojibways. See CHIPPEWA INDIANS.

O′ka, a river of Central Russia and the chief affluent of the Volga, rises in the government of Orel, becomes navigable at the city of Orel, and joins the Volga at Nizhnee-Novgorod, after a course of 837 miles. As it runs through some of the most fertile and densely-peopled regions of Russia, it is of great importance as a road of traffic.

Okanagans, or **Cutsanim,** a tribe of American Indians residing upon a river of the same name in Washington Territory, E. of the Cascade Mountains. They belong to the Shushwap branch of the Selish family; have always been friendly to the white settlers; have become semi-civilized by missions established among them in 1846; have made some progress in agriculture, and number little over 300.

O′Kane (JAMES), U. S. N., b. Nov. 11, 1839, in Indiana; graduated at the Naval Academy in 1860; rose to commander in 1874; served in the Brooklyn at the passage of Forts

Jackson and St. Philip in 1862, and was wounded soon after the action commenced; and commanded the sailor infantry at the battle of Tulifinty Cross-roads, Dec. 6, 1864.

FOXHALL A. PARKER.

O'kaw, tp. of Bond co., Ill. Pop. 945.

Okaw, tp. of Coles co., Ill. Pop. 1711.

Okaw, tp. of Shelby co., Ill. Pop. 1280.

Okecho'bee, Lake, the largest lake in the Southern U. S., lies in Southern Florida, and mostly in Brevard co. It is 40 miles long, 25 miles wide, and only 12 feet in maximum depth. It contains but few fishes. It receives several streams, of which Kissimee River is the most important. A large part of the lake is grown up with grass and weeds. Its waters are discharged through the Everglades without any discoverable stream which can be called an outlet. Nearly all the shores of the lake are impenetrable, swampy jungle, and the lake itself is nearly inaccessible. It contains a few low islands. The reports of ruined buildings upon these islands are false. Area, 1200 square miles.

O'Keefe (JOHN), b. at Dublin, Ireland, June 24, 1747; became an actor and a prolific dramatic author. Several of his comedies were very popular at the close of the eighteenth century, especially *Wild Oats, The Castle of Andalusia, The Poor Soldier, The Young Quaker*, and *Peeping Tom.* In 1808 he became blind, received a pension from the Crown, published *Autobiographical Memoirs* in 1826, and d. at Southampton Feb. 4, 1833.

Okefino'kee Swamp, one of the largest swamps of the U. S., covers a large area in Charlton, Ware, and Clinch cos., Ga., and Baker co., Fla. It includes numerous lakes and forests of heavy timber, and is the abode of countless rattlesnakes, moccasins, and alligators, besides many species of game-birds.

O'ken [originally OCKENFUSS], (LORENZ), b. at Bohlsbach, Würtemberg, Aug. 1, 1779; studied medicine and natural science at Würzburg and Göttingen, and was appointed professor of medicine at Jena in 1807 and of natural science in 1812. In 1816 he commenced the publication of *Isis*, a periodical of a miscellaneous character, though chiefly devoted to natural history and philosophy. Some political criticisms which it contained gave the government an opportunity of interfering, and in 1819 Oken resigned his office and lived as a private teacher till 1828, when he received a professorship at Munich. In 1832 he removed to a similar position in Zürich, where he d. Aug. 11, 1851. His principal works are—*Lehrbuch der Naturphilosophie* (1808–11), translated into English by Dr. Tulk (London, 1847), *Lehrbuch der Naturgeschichte* (1813–27), *Die Zeugung* (1805), *Ueber die Bedeutung der Schädelknochen* (1806), etc. As a pupil of Schelling, the general character of Oken's works has not been acceptable to naturalists, speculation having been cultivated too much at the expense of observation, and his hypotheses now exist chiefly as a warning against "transcendental" excesses. Even the hypothesis of the vertebral composition of the skull, which he developed, after but independently of Goethe, has little in common with that now generally accepted.

Okhotsk', Sea of, a large inlet of the Pacific Ocean on the eastern shore of Asia, between the island of Saghalin, Siberia, Kamtchatka, and the Kurile Islands. Its northern part is frozen from November to April.

Okobo'ji, tp. of Dickinson co., Ia. Pop. 236.

Okolo'na, post-v. and cap. of Chickasaw co., Miss., on the Ohio and Mississippi R. R., has 2 weekly newspapers. Pop. 1410.

Okra. See GUMBO.

Oktib'beha, county of Central Mississippi. Area, 550 square miles. It is somewhat level and very fertile. Live-stock, corn, and cotton are leading products. Cap. Starkville. Pop. 14,891.

Okubo (JUSAMMI TOSHIMICHI), b. in the province of Satsuma, Japan, about 1829; belonged to the class of Retainers; received a good native education; early took an interest in the welfare of the empire, and was a counsellor of the prince of Satsuma; when the tycoon abdicated in 1868 became a national counsellor; was a member of the embassy which visited America and Europe in 1872; in 1874 was instrumental in putting down an insurrection at Saga; when the difficulty with China about Formosa was attracting universal attention took upon himself the task of carrying out the policy of the cabinet; went to China as a special ambassador, and was successful in securing an honorable peace and an indemnity, for which service he was greatly honored throughout the Japanese empire. He does not speak English, but is a profound Oriental scholar; is an advocate of education and agriculture, a leader in the national council, and at the present time minister of the interior. F. A. P. BARNARD.

O'laf, SAINT, the patron saint of Norway, b. about 995, a son of Harald Gränske, a grandson of Harald the Fairhaired, commanded a viking fleet when twelve years old, and was one of the most famous and most dreaded sea-kings of the North before he was nineteen. In 1014 he returned from a pillaging jaunt along the coasts of France and Spain, and installed himself in his patrimony, the throne of Norway. He now set about introducing Christianity among his countrymen, but his measures were so severe and violent that the Norwegians rose in rebellion against him, and when in 1028, Knud (Canute) the Great, king of Denmark and England, who laid claim to Norway, landed with an army near Drontheim, Olaf was compelled to flee to Russia. Two years afterwards he returned with aid from Russia and Sweden, and gave battle at Stiklestad, near Drontheim, July 29, 1030, but his army was routed, and he himself slain and buried on the spot. Subsequently, when Norway became thoroughly Christianized, his body was brought to the cathedral of Drontheim and enshrined behind the high altar. Great miracles were reported; crowds of pilgrims journeyed to his shrine; legends and folk-lore gathered around his name; and in the following century he was solemnly canonized and declared the patron saint of the country. Aug. 21, 1847, King Oscar I. instituted the order of St. Olaf.

O'land, an island of Sweden, in the Baltic, opposite the city of Kalmar. Area, 608 square miles. Pop. 40,000. It is well wooded and affords good pasturage, and has rich alum-mines and still richer fisheries.

Ola'the, post-v. and tp., cap. of Johnson co., Kan., 21 miles S. W. of Kansas City, has a commercial college, good public schools, 7 churches, 2 weekly newspapers, a deaf and dumb asylum, 3 railroads, 2 grist-mills, and stores. Pop. of v. 1817; of tp. 3022.

M. V. B. PARKER, ED. "MIRROR AND NEWS LETTER."

Ol'bers (HEINRICH WILHELM MATHIAS), b. at Arbergens, near Bremen, Oct. 11, 1758; studied medicine at Göttingen, and practised as a physician at Bremen, where he d. Mar. 2, 1840. His leisure hours he gave to the study of astronomy, especially comets. He invented a new method of calculating the orbits of comets from three observations, which proved easier and more accurate than the old one; and his calculations and observations of the comets of 1798, 1802, 1804, 1815, and 1821, collected and published in Bode's *Annuaire* (1782–1829) and in Encke's (1833), enjoy a great reputation. Of the planets between Mars and Jupiter, which were eagerly sought after by the astronomers in the beginning of the present century, he discovered two—Pallas, Mar. 28, 1802, and Vesta, Mar. 29, 1807. His excellent library on comets was bought by the Russian government, and is now at Pulkova.

Old'bury, town of England, county of Worcester, on the Tame. The vicinity is rich in coal and iron mines, and the town has extensive manufactures of iron and steel goods, locomotive engines, and machinery. Pop. 15,615.

Old'castle (Sir JOHN), BARON COBHAM, popularly known as "the good Lord Cobham," b. in England about the middle of the fourteenth century; fought with credit in the French wars; obtained the title of baron by marriage; was an early convert to the doctrines of Wycliffe; took part with John of Gaunt, duke of Lancaster, in his efforts to promote ecclesiastical reform, presenting a remonstrance on the subject in Parliament, entitled *Twelve Conclusions addressed to the Parliament of England;* wrote a number of discourses and satirical verses; declared the pope to be Antichrist; was consequently accused of heresy, and thrown into the Tower in the first year of Henry V. (1413); escaped to Scotland, and thence into Wales; was falsely accused of raising an army of 20,000 "Lollards" to overthrow the king; was thereupon outlawed by Parliament and a price set on his head. Being captured in Wales, he was hung in chains alive upon a gallows and burned to death by a slow fire at St. Giles's Fields, London, Dec. 25, 1417. (See his *Life*, by Gilpin, 1808.)

Old Catholics. See ROMAN CATHOLICS.

Ol'denburg, grand duchy of Germany, consists of Oldenburg proper, bordering N. on the German Ocean and surrounded on the other sides by Hanover, and comprising an area of 2149 square miles, with 243,978 inhabitants; the principality of Lubeck, wholly enclosed by Holstein and comprising an area of 180 square miles, with 34,353 inhabitants; and the principality of Birkenfeld, situated in Rhenish Prussia, and comprising an area of 143 square miles, with 36,128 inhabitants. Oldenburg proper is low and flat; large dykes have been erected along the shores of the ocean and the rivers Weser and Jahde. The soil is partly marshy, partly sandy, in some places covered with extensive forests, in other with heath. Agriculture and cattle-breeding are the chief occupations; of manufactures

there are none. Oldenburg was established as an independent state, ruled by a count, at the end of the twelfth century; in 1773 it was made a duchy, and in 1815 a grand duchy.

Oldenburg, city of Germany, capital of the grand duchy of Oldenburg, has several good educational institutions, museums, and scientific collections; a fine ducal palace with beautiful gardens; two large and much-frequented cattle and horse fairs; and an active trade on the river Hunte, here navigable for small vessels. Pop. 14,928.

Oldenburg, p.-v. of Ray tp., Franklin co., Ind. P. 160.

Old Field, tp. of Ashe co., N. C. Pop. 595.

Old Field, tp. of Wilson co., N. C. Pop. 1165.

Old Fort, p.-v. and tp., McDowell co., N. C. P. 1280.

Old'ham, town of England, county of Lancaster, on the Medlock, 6 miles from Manchester. In 1760 it consisted of only 60 houses, but the discovery of rich coal-mines in its immediate vicinity occasioned the establishment of large factories, and soon it became one of the leading manufacturing towns of England. Besides the cotton manufacture, several large machine-shops and brass and iron foundries are in operation. Pop. 82,619.

Oldham, county of Kentucky, bounded N. W. by the river Ohio, which separates it from Indiana. Area, 200 square miles. It is partly hilly, especially in the N. W., but is very productive. Tobacco, live-stock, wool, corn, and oats are leading products. The county is traversed by the Cincinnati and Louisville and the Louisville and Lexington R. Rs. Cap. La Grange. Pop. 9027.

Oldham (Capt. JOHN), b. in England about 1590; came to Plymouth, Mass., 1623; intrigued with Lyford to set up a separate worship 1624; lived afterwards at Hull and Cape Ann; represented Watertown in general court 1634; visited the Connecticut River country 1633; returned there with a vessel to trade with the Indians 1636, and was killed by them, the event leading to the first Pequot war.

Oldha'mia, a peculiar organism having a branching, plant-like form, thought by some to be a polyzoon, by others a vegetable; found in the Cambrian rocks of Ireland, and interesting as one of the first-known forms of life. It was named after Dr. Oldham, late director of the geological survey of India. J. S. NEWBERRY.

Old Harbor Isle, tp. of Hancock co., Me. Pop. 13.

Old Lutherans. See SEPARATE LUTHERANS.

Old Lycom'ing, tp. of Lycoming co., Pa. Pop. 475.

Old Lyme, tp. of New London co., Conn. Pop. 1362.

Oldmix'on (JOHN), b. at Bridgewater, England, in 1673; became collector of the customs at his native place; is thought to have visited America; wrote some dull plays and several historical works, among them *The British Empire in America* (2 vols., 1708), *A Critical History of England, Ecclesiastical and Civil* (2 vols., 1726), and a *History of England* (3 vols., 1730–39) comprising the period from Henry VIII. to George I., inclusive. Having attacked the literary merits of Swift, Gray, and Pope, the latter poet retorted by making him one of the heroes of the *Dunciad.* D. in London July 9, 1742.

Old Perlican, port of entry on Trinity Bay, Newfoundland, 28 miles from Heart's Content. Pop. 868.

Old Point Comfort, post-v. of Elizabeth City co., Va., on Hampton Roads, the estuary of James River, and in which is situated FORT MONROE (which see). The place belongs to the U. S. government. Pop. 313.

Old Red Sandstone, a name formerly used to designate the members of the Devonian system in Scotland and Wales. Here the most characteristic element in the formation is Red Sandstone, and the term Old Red was applied to this to distinguish it from the Triassic red sandstones, which overlie the carboniferous system, and which received the name of the New Red Sandstone. Later geological investigations have shown that the group of rocks which in other countries are the equivalents in age of the Old Red Sandstones of Scotland sometimes contain no red sandstone, and consist of limestones, shale, etc. The term which has been made so familiar through the writings of Hugh Miller has therefore been generally superseded by that which Sir R. Murchison first suggested, and "the Old Red Sandstone group" is now generally known as the Devonian system. The Old Red Sandstone series of Scotland has been estimated to have a thickness of from 6000 to 10,000 feet. According to Hugh Miller, it consists of the following members:

3. Upper.	3. Yellow sandstone, containing *Holoptychius*, etc. 2. Concretionary limestone. 1. Red sandstone and conglomerate.
2. Middle.	Gray sandstones and shales, containing *Onchus, Ctenodus, Osteolepis, Pterichthys*, etc.
1. Lower.	3. Red and variegated sandstone. 2. Bituminous schists, containing *Dipterus, Pterichthys, Coccosteus, Cephalaspis;* also the crustaceans *Eurypterus, Pterygotus*, etc. 1. Conglomerate and red sandstone.

As is shown in the above table, the Old Red Sandstone series of Scotland consists mainly of mechanical sediments deposited in shallow water, and were formed by the wash from near and older land; Prof. Ramsey has suggested that they were formed in bodies of circumscribed and perhaps fresh water. The characteristic fossils of the formation are fishes and large crustaceans. The fishes include many genera and species, of which graphic descriptions have been given by Hugh Miller in his charming books *The Old Red Sandstone* and *Footprints of the Creator.* There are also found here many traces of land-plants, but the flora of the age is much better represented in the Devonian rocks of other countries. In the S. of England, in Central Europe, and in N. America the Devonian system includes heavy beds of limestone, which are open-sea deposits and contain great numbers of mollusks, corals, etc., forming a very different fauna from that of the Old Red Sandstone of Scotland. Fishes are, however, the most characteristic fossils of the group wherever it has been examined. These were the highest forms of life which existed during the Devonian age, and they were so numerous and varied and attained so large size that this well deserves the name applied to it in geological history, *the age of fishes.* The first knowledge obtained of this remarkable fish-fauna was supplied by the admirable studies made by Hugh Miller of the Old Red Sandstone of Scotland. (See GEOLOGY and FOSSIL FISHES.) J. S. NEWBERRY.

Old Rich'mond, post-v. and tp., Forsyth co., N. C., on the Yadkin River. Pop. 833.

Old River, tp. of Arkansas co., Ark. Pop. 981.

Olds, tp. of Greene co., N. C. Pop. 2931.

Olds (GAMALIEL S.), b. at Granville, Mass., in 1777; graduated at Williams College 1801; was a tutor there, and then (1806–08) professor of mathematics; was a Congregational minister of Greenfield, Mass., 1813–16; mathematical professor in the University of Vermont 1819–21, in Amherst College 1821–25, and later in the University of Georgia; removed in 1841 to Ohio, where he was a preacher. D. at Circleville, O., June 13, 1848.

Old Say'brook, tp., Middlesex co., Conn. Pop. 1215.

Old Store, post-v. and tp., Chesterfield co., S. C. Pop. 1921.

Old Tex'as, tp. of Monroe co., Ala. Pop. 1067.

Old Town, tp. of Conecuh co., Ala. Pop. 1749.

Old Town, tp. of Dallas co., Ala. Pop. 983.

Old Town, tp. of McLean co., Ill. Pop. 1109.

Old'town, post-v. and tp., Penobscot co., Me., on the Penobscot River and on the European and North American R. R., has a large lumber-trade. Pop. 4529.

Old Town, tp. of Alleghany co., Md. Pop. 851.

Old Town, post-v. and tp., Forsyth co., N. C. P. 860.

Old Town, post-v. and tp., Grayson co., Va. Pop. 2240.

Ol'dys (WILLIAM), b. in London, England, July 14, 1696; assisted in editing the *Harleian Miscellany;* appointed Norroy king-at-arms 1755; distinguished for his bibliographical knowledge, accuracy, and integrity: author of *The British Librarian* (1737) and *A Life of Sir Walter Raleigh* (1740), besides contributions to magazines and biographical dictionaries, and left a valuable collection of MSS. D. at London Apr. 15, 1761. (See James Yeowell's *Memoir of Oldys*, 1862; also Disraeli's *Curiosities of Literature.*)

Olea'ceæ [from *Olea*, one of the genera], a natural order of exogenous trees and shrubs, now extended so as to include the jessamine family, mostly natives of warm temperate and tropical climates, the ash alone having a higher northern range. The leading character of the order is that of having regular monopetalous or sometimes polypetalous flowers, with the parts of the calyx and corolla four and hypogynous, while the stamens are only two, and the ovary 2-celled; but some are apetalous. The olive tree is far the most important representative of the order, and next to it the ash trees with their excellent tough timber, one species also yielding manna. Among the small trees or shrubs cultivated for ornament are lilacs, privet, fringe tree, Forsythia, and jessamine.
A. GRAY.

Oleacin'idæ [from *Oleacina*, the name of one of the genera], a family of terrestrial gasteropod mollusks of the order Pulmonata and sub-order Geophla. The animal has a long hernia-like protrusion of the viscera into a spiral sack enveloped in the shell; the mantle is thin; the respiratory orifice on the right side, beneath the margin of the foot; the head has a projectile and retractile buccal sack, and is furnished with peculiar labial processes developed as outwardly curved, fleshy, and elongated triangular feelers; there are four retractile tentacles, the two longer ones posterior and bearing eyes at their extremities, the shorter anterior; the lingual ribbon is long and narrow, armed with numerous nearly uniform sigmoidally curved and pointed teeth, with their apices directed backwards, and arranged *en chevron;* the jaw is wanting; the foot elongated and narrow, without any independent locomotive disk, and simple posteriorly; the vent is near the respiratory orifice, the orifice of the reproductive organs on the right side, some distance behind the occuliferous tentacles. The shell is spiral, and in most oblong and with a narrow aperture in some, but is depressed and heliciform, with a wide aperture. The family includes numerous species, and is distinguished by characteristics of the animal, especially the labial palpi, the absence of the jaw, and the peculiar dentition. The animals thus organized are disguised in quite different shells, some being like those of ordinary snail-shells and others most like actinias. The American species all have an oblong shell, and belong to the restricted genus Glaudina. By Messrs. Binney and Bland eight species are recognized as inhabitants of the southern or south-western sides of the Union. THEODORE GILL.

Olean', post-v. and tp., Cattaraugus co., N. Y., on the Alleghany River and the Genesee Valley Canal, and on the Buffalo New York and Philadelphia and the Erie R. Rs., has a large lumber and produce trade, and 1 weekly newspaper. Pop. of v. 1327; of tp. 2668.

Olean'der [Fr. *oléandre*], the *Nerium oleander*, an evergreen shrub of the order Apocynaceæ, a native of warm parts of the Old World, and now extensively cultivated. In colder regions it thrives as an ornamental shrub, but requires protection from frost. Its flowers are usually of a rich pale red, but are sometimes white. *N. odorum*, the fragrant oleander, a native of India, is a more tender species, with sweet-scented flowers. The wood and all parts have a poisonous action resembling that of digitalis, best treated by a judicious use of stimulants.

Oleander, post-v. and tp., Marshall co., Ala. Pop. 870.

Oleas'ter [Lat.], *Elæagnus angustifolia*, a small tree of the order Elæagnaceæ, a native of warm regions in the Old World, is planted as an ornamental tree for its silvery foliage. Its flowers are exceedingly fragrant.

Ole Bull. See BULL, OLE BORNEMANN.

Olefiant Gas. See ETHYLENE.

Olefines, hydrocarbons of the general formula C_nH_{2n}, homologous with ethylene, C_2H_4, so called from their property of forming oily compounds with chlorine, like Dutch liquid, $C_2H_4Cl_2$. They are found among the products of destructive distillation, and may be formed by the exposure of paraffines to high temperatures under pressure; thus:

$$\underset{\text{Butane.}}{C_4H_{10}} = \underset{\text{Ethane.}}{C_2H_6} + \underset{\text{Ethene.}}{C_2H_4}.$$

(See ETHYLENE, HYDROCARBONS, PARAFFINES, and TAR.) C. F. CHANDLER.

Oleg'gio, town of Northern Italy, province of Novara. It is a place of lively trade and much industry, and the silk and cotton factories are extensive. The churches are much praised for their architecture, and many fine old conventual buildings are now used for secular purposes. This town, first mentioned in the eleventh century, was fortified by the Visconti, and these defences have only recently been demolished. Pop. 8058.

O'leic Ac'id ($C_{18}H_{34}O_2$). This monatomic acid, discovered in 1811 by Chevreul, is the most important of the group of fatty acids of the general formula $C_nH_{2n-2}O_2$, set free by the saponification of oleine, the fluid component of most oils and natural fats. It is obtained by treating olive oil, almond oil, or animal oils by a caustic alkali, preferably by potash, decomposing the resulting soap by tartaric acid and heating the fatty acid, after first washing it with water in the water-bath with half its weight of oxide of lead in fine powder for some hours. The oleate of lead, separated by ether and filtration from the stearate, is decomposed by dilute hydrochloric acid in deficiency, and the ethereal solution of oleic acid is then separated from the acid-water, washed, and the ether distilled from it. Oleic acid is soluble in alcohol, and crystallizes from it on cooling in brilliant crystals which melt at 57° F. to a clear colorless oil. At 39° F. this fluid acid solidifies to a hard white crystalline mass, which expands as it cools. Oleic acid distils over unchanged in a vacuum, and is even soluble in strong sulphuric acid at ordinary temperatures without decomposition. It is without smell or taste when pure, and is insoluble in water. Alcohol and ether dissolve it in all proportions, and in solutions it reacts neutral. By air it is slowly oxidized at ordinary temperatures, but it rapidly absorbs oxygen when melted, becoming rancid both to smell and taste, and then develops a strong acid reaction. It dissolves the solid fats, and is itself dissolved by coleate of soda (as in bile), forming a soap with an acid reaction.

Very large quantities of crude and high-colored oleic acid are produced in the lime saponification of lard and tallow by Chevreul's method in the manufacture of stearine candles. The insoluble lime-soap formed in this process is decomposed by dilute sulphuric acid, and the cake of fatty acids which forms on the surface of the cooled mother-liquor holds the oleic acid entangled in the stearic and margaric acids, from which it is in great part freed by filtration at 32° in the hydraulic press. This impure oleic acid, which is found in commerce under the name of *red oil*, yields pure oleic acid after separation from its lead-salt, after a second saponification with an alkali, and is salted out with sodium chloride mixed with sodium carbonate, by which means only can it be freed from the associated coloring-matters. At 66° F. the sp. gr. of oleic acid is 0.898. Oleic acid burns when heated in air, combines with sulphur when distilled dry with that element, yielding a red-brown, bad-smelling oil, with evolution of much H_2S. With bromine and chlorine in presence of water, oleic acid forms dibromoleic and dichloroleic acids. Iodine does not act upon it. Tribromoleic acid ($C_{18}H_{31}Br_3O_2$) is formed when bromine falls drop by drop into oleic acid. Nitrous acid converts oleic acid into elaidic acid, an isomeric form of oleic acid, without forming a second decomposition product. Nitric acid acts on oleic acid with violence, evolving volatile acids of the general formula $C_nH_{2n}O_2$—namely, acetic, butyric, propionic, caproic, etc.—and mixed acids of the general formula $C_nH_{2n-4}O_2$, such as suberic, pimelic, adipic, etc.; the number and proportion of these depending on the activity and duration of the reaction. With the metals oleic acid forms neutral oleates $M'(C_{18}H_{33}O_2)$ or $M''(C_{18}H_{33}O_2)_2$, according to the equivalence of the metal. The neutral oleates of the alkali metals are soluble in water, and are not completely thrown down from solution, as are the stearates and palmitates, by the addition of another soluble salt. The acid oleates are liquid and insoluble in water. Absolute alcohol and ether dissolve the oleates in the cold, by which reaction they are distinguished and separable from the stearates and palmitates. By heating oleic acid in sealed tubes with glycerine in varying proportions three glycerides are produced—viz. *monoleine* $(C_3H_5)'''(OH)_2C_{18}H_{33}O_2$; *dioleine* $(C_3H_5)'''(OH)(C_{18}H_{33}O_2)_2$; and *trioleine* $(C_3H_5)'''(C_{18}H_{33}O_2)_3$. The two first are solids at 60° F. The oleine of various non-drying oils which become rancid or are converted into viscid masses with an acid reaction, as olive oil and some other vegetal and animal oils, appears identical with trioleine. Olive oil at and below 40° F. deposits a large quantity of curdled fat, mainly palmitine, and the liquid oil filtered from it is mainly oleine. Submitted to destructive distillation, oleine yields acroleine, sebacic acid, and gaseous and liquid hydrocarbons. The drying oils, as linseed, castor, nut, poppy, etc., as already observed, contain a different primary nucleus, and contain the glycerides of other series. We may here consider, out of its alphabetical order—

Linoleic Acid (*Papeveroleic Acid*, *Trockenölsäure*), $C_{16}H_{28}O_2$.—This monatomic acid of the fatty group exists in linseed and poppy oil, from which it is obtained by saponification with potash, and purified by repeated treatment with salt, and thrown down by chloride of calcium. The precipitated lime-salt is washed, pressed, and digested in ether, which dissolves out the linoleate of lime and leaves the salts of the solid fatty acids undissolved. The ethereal solution is decomposed by cold hydrochloric acid, whereby the linoleic acid is separated and remains dissolved in the ether; the solution is drawn off, and the ether distilled at as low a temperature as possible in a stream of hydrogen gas. Linoleic acid then remains as a dark-yellow liquid, soluble in alcohol, but precipitated by ammonia and baric chloride. The barium salt, washed and pressed, is dissolved in ether, and the granules gradually formed in the solution are repeatedly crystallized from ether. The acid is separated from its barium salt by agitating with ether and hydrochloric acid, withdrawing the ethereal solution and distilling off the ether; it is dried over oil of vitriol in a vacuum and a mixture of ferrous sulphate and lime. Linoleic acid is a limpid oil, more so than poppy oil, of sp. gr. 0.92 at 14° C., of a faint yellow color, a slight acid

reaction, and a high refractive power. It remains liquid even at —18° C. Taste, at first mild, becomes soon harsh. Its formula calls for carbon 76.19, hydrogen 11.11, oxygen 12.70 = 100. It absorbs 2 per cent. of oxygen by long standing, and thickens so that it will hardly flow, but remains colorless, and forms a varnish on wood, but on glass merely becomes tough. Linoleic acid is insoluble in water. The linoleates of sodium, barium, lime, zinc, magnesium, lead, and silver have all been studied; they are soluble in alcohol and ether, are white, for the most part uncrystallizable, and separate from their hot solutions in flakes; by spontaneous evaporation they are obtained in the form of a jelly.

Palmitic Acid ($C_{16}H_{32}O_2$), (otherwise known as *Cetylic Acid, Ethalic Acid, Olidic Acid*).—As already mentioned under FATS, Chevreul distinguished in 1820 the solid fatty acids resulting from the saponification of fats as *margaric acid* and *margarous* (afterward *stearic*) *acid*, the former melting at 60° C., the latter at 75°, and solidifying at 70°. Chevreul did not consider the difference between the two acids as fully established, but suggested that margaric acid might be a mixture of stearic acid with another more fusible acid and richer in oxygen. Accordingly, Heintz in 1852 showed the margaric acid of Chevreul to be a mixture of about 90 per cent. of *palmitic acid* and 10 per cent. of stearic acid. Meantime, palmitic acid and various mixtures of that with stearic acid and other acids received peculiar names. Heintz proved that (1) all the acids obtained in the saponification of fats contain an even number of carbon atoms divisible by 4 without remainder; (2) the margaric acid of most chemists is separable into palmitic and stearic acids; (3) fatty acids may be mixtures, and not definite compounds, even though neither their composition nor their melting-points can be altered by recrystallization; (4) such mixtures may, however, be separated by partial precipitation; (5) they differ from pure acids as regards their melting-points and mode of solidifying. (*Gmelin*, xvi. 351.) Palmitic acid is universally distributed in the fats of the animal and vegetable kingdoms. Combined with glycerine, it occurs abundantly in palm oil, the fat of certain palms, in Chinese tallow, in Japanese wax, and the wax of *Myrica cerifera*. (*G. E. Moore*.) In the animal kingdom it is combined with ethal in spermaceti (*J. L. Smith*); in the melissine of beeswax, etc. It is easily prepared from palm oil by saponification with caustic potash, decomposing the soap with sulphuric acid, and recrystallizing the fatty acid several times from hot alcohol till it gives a steady melting-point. From oleic acid it may be evolved, along with acetic acid, by fusion with potassium hydrate, $C_{18}H_{34}O_2 + 2KOH = KC_{16}H_{31}O_2 + KC_2H_3O_2 + H_2$. Palmitic acid is a colorless solid, lighter than water, crystallizes in small shining scales, and is without odor; insoluble in water, but freely so in hot alcohol and ether. The solutions are acid, and if concentrated solidify on cooling, or if dilute yield tufts of slender needles with an acid reaction. This acid may be distilled unchanged, and, gently heated, evaporates without residue from an open dish. It burns like other fats with a light smoky flame, and is attacked by warm chlorine with evolution of HCl and the formation of substitution products. It forms with the alkali metals acid-salts analogous to the acid-acetates, and it forms normal or neutral salts with other metals according to their equivalence. The potassium and sodium palmitates are soluble in water and alcohol; the rest are insoluble.

Palmitines or *glyceric palmitates* are ethers known as *mono-*, *di-*, and *tri-palmitine*, all crystalline fats which are artificially formed, of which the last is natural palmitine from palm oil and other fats.

Palm Oil comes chiefly from the African coast, and is an important article of commerce for the production of candles. When fresh it has an agreeable odor and a deep orange-red tint, which it loses by exposure to light and air, becoming at the same time rancid and developing both glycerine and oleic acid, with palmitic acid—a change analogous to saponification. B. SILLIMAN.

Oleine. See OLEIC ACID.

Ole'na, post-v. of Henderson co., Ill. Pop. 127.

Oleo-Margarine. See BUTTER.

Oleo-Phosphoric Acid, a phosphuretted fatty acid found in the brain. It is a yellow, gummy body, containing 1.9 to 2.0 per cent. of phosphorus. By long boiling with water or alcohol, more quickly with acidulated water, it gradually forms a pure oleine, while the liquid becomes decidedly acid from the phosphoric acid set free. Alkalies form oleates and phosphates with free glycerine. All parts of vertebrate animals contain this body, and a similar substance is found in the yolk of the eggs of cartilaginous fishes and other animals. (See article LECITHINE; also Frémy, *Ann. Ch. Phys.* [3] ii. 474, l. 172, Diaknow, *Zeit. f. Chem.* [2] iv. 154, and Strecker, *Zeit. f. Chem.* [2] iv. 437.) C. F. CHANDLER.

Oleo-Resins, natural mixtures of fixed or volatile oil with resins. The most important are those of capsicum, cubebs, the male fern, lupuline, black pepper, and ginger. They are prepared by exhausting the portion of the plant containing them with ether, and subsequently evaporating off the solvent. C. F. CHANDLER.

Oléron', an island of France, lies opposite to the mouth of the Charente, and belongs to the department of Charente-Inférieure. It is 20 miles long, 5 miles broad, and has a population of 16,800. It is fertile, produces wheat, maize, wine, and fruits, and has important salt-works and fisheries. It contains three lively and thriving towns, with from 3000 to 5000 inhabitants each, and considerable trade in corn, wine, salt, and fish—Château d'Oléron, St. Georges d'Oléron, and St. Pierre d'Oléron.

O'ley, post-v. and tp., Berks co., Pa. Pop. 1986.

Olhao', town of Portugal, province of Algarve, on the Atlantic, has a good harbor and valuable fisheries, in which almost all its inhabitants are engaged. Pop. 7025.

Olib'anum (*incense, frankincense*), a gum resin which exudes from a tree growing in Arabia and India. It occurs in oblong or rounded laminæ, opaque, of yellow or reddish color, dull and waxy on the fracture. It melts with difficulty and imperfectly when heated, and burns with a bright flame. It has a balsamic, resinous smell and an acrid bitter taste. Triturated with water, it forms a milky, imperfect solution. Alcohol dissolves nearly three-fourths of it. Braconnot (*Ann. Chim. Phys.* [2] lviii. 60) found 100 parts of it to yield 8 of volatile oil, 56 of resin, 30.8 of gum, and 5.2 of a glutinous body insoluble in water and alcohol, with some mineral matter. It is used for fumigation and in the preparation of plasters. It has been burned from antiquity in religious ceremonies. (See *U. S. Disp.; Jahresb.*, 1858, 482; *Ann. Chem. u. Pharm.*, xxxv. 306; *Zeit f. Chem.* [2] vii. 201.) C. F. CHANDLER.

Ol'ifant's River, or **Elephant's River,** a river of South Africa, flowing through the territory of Cape Colony, and entering the Atlantic in lat. 31° 38′ S. It is impeded by rocks, and not navigable, but its waters are available for irrigation.

Ol'igarchy [Gr. ὀλιγαρχία, "government by a few"] differs from aristocracy solely in the extent of the governing class. In an aristocracy a body of nobles or one of the estates or leading interests of the realm have a controlling voice in the management of affairs. In an oligarchy the ruling class is small. In point of fact, oligarchies have usually been among the most unjust and oppressive of governments. They have been usually gotten up by "rings" or cabals, by means of *coups d'état*, and have almost always been short-lived and unpopular.

Oligochæ'tæ [Gr. ὀλίγος, "few," and χαίτη, "lock of hair" or "bristles"], an order of the class of worms or annelids, including the common earth-worm and fresh-water worms, and distinguished by the union of the two sexes in the same individuals. The form exemplified in the familiar species is repeated in all; *i. e.* the body is elongated, cylindrical, and distinctly articulated, or ringed; each ring is furnished with setæ generally combined in a dorsal and an abdominal pair of setæ or bristles of variable length; the mouth is terminal or sub-terminal; the anus is at the posterior extremity; the alimentary canal straight and differentiated into a pharynx, œsophagus, and intestine; the nervous system has pre-oral cerebral ganglia, and is continued backwards along the inferior portion of the body into a double chain of ganglia closely united together; the sexes are combined in the same individual and situated towards the fore part of the body, the male organs anterior, the female a little farther behind. The order includes quite a large number of species, which have been grouped into two families, distinguished by the distribution of the setæ: (1) Lumbricidæ, with simple setæ, including the earth-worms, and (2) Naidæ, with bifid or hair-like setæ, embracing the fresh-water species. In the earth-worms (Lumbricidæ, Lumbricinæ) the setæ are isolated or grouped two by two; in the Lumbricidæ, Enchytræinæ, they are three or four in number, in bundles; in the Naidæ, Naiinæ, they are in four rows (exceptionally bi-serial), and then all hair-like; and in the Naiidæ, Chætogastrinæ, they are bi-serial, but never hair-like. Such is the division proposed by Vaillant (1868), who has recognized in the several groups twenty-five genera from various parts of the world, which are represented in nearly all regions of the globe. THEODORE GILL.

Olig'oclase [Gr. ὀλίγος, "brittle," and κλάσις, "fracture"], one of the feldspars, crystallizing in the triclinic system, and essentially a silicate of alumina and soda.

O'lin, post-v. and tp., Iredell co., N. C. Pop. 920.

Olin (Abraham B.), LL.D., b. at Shaftesbury, Vt., 1812, son of the late Judge Gideon Olin, one of the founders of Vermont; graduated at Williams College 1835; became in 1838 a lawyer of Troy, N. Y., where he was three years city recorder; was in Congress 1857–63; became in 1863 judge of the supreme court of the District of Columbia.

Olin (Henry), b. in Vermont in 1757; was a member of the general assembly continuously from 1799 to 1825, except four years; of the constitutional conventions of 1814, 1822, and 1828; associate judge of Addison co. 1801–06; chief-judge 1807 and 1810–24; member of Congress 1824–25; lieutenant-governor 1827–29, and councillor 1820–22. D. at Salisbury in 1837.

Olin (Stephen), D. D., LL.D., son of Judge Henry Olin, b. at Leicester, Vt., Mar. 3, 1797; graduated at Middlebury College 1820; entered the Methodist Episcopal ministry 1824; labored two years in Charleston, S. C.; was president of the Abbeville Seminary; held the chair of English literature in Franklin College, Ga., 1826–33; president of Randolph-Macon College 1832–37; was in Europe 1837–41; a delegate to the Evangelical Alliance 1846; president of the Middletown Wesleyan University from 1842 until his death, Aug. 16, 1851. He wrote *Travels in the East;* his works were published in New York in 1852, and *Life and Letters* in 1853.

Olin'da, town of Brazil, province of Pernambuco, on the Atlantic, is one of the oldest, and was in the sixteenth and seventeenth centuries one of the most flourishing, towns of the country. But it suffered much during the wars between the Dutch and the Portuguese, and when Recipe was founded it lost its trade. It is now a decaying, half-deserted place; no vessels visit its harbor, cattle feed in its streets. Pop. about 7000.

Olinda (Pedro de Araujo **Lima**), Marquis of, b. at Pernambuco, Brazil, in 1790; educated at the universities of Pernambuco and Coimbra; was a member of the Constituent Assembly of Portugal 1821; member of the Brazilian Parliament more than a third of a century; president of the Chamber of Deputies 1825–27, 1831–33, and 1835–37; one of the cabinet ministers 1823, 1827, 1832, and 1837; twice regent of the empire during the minority of Dom Pedro II.; made Viscount Olinda 1841, marquis 1854, and member of the council of state 1842. D. at Rio Janeiro June 7, 1870.

O'lio, tp. of Woodford co., Ill. Pop. 2508.

Oliphant (Carolina). See Nairne.

Ol'iphant (Laurence), b. in England in 1829, son of Sir Anthony Oliphant, who was appointed chief-justice of Ceylon 1838; educated in England; went to Ceylon in youth; accompanied Jung Bahadoor, the Nepaulese ambassador in London, on his return to his own country in 1850; wrote *A Journey to Katmandu, or the Nepaulese Ambassador at Home* (1852); studied law at the University of Edinburgh; made an extended journey in Southern Russia and the Crimea a few months previous to the Crimean war, which circumstance gave occasion to a large sale for his next book, *The Russian Shores of the Black Sea* (1853); became private secretary to Lord Elgin, governor-general of Canada; was subsequently superintendent of Indian affairs in Canada; travelled extensively in the U. S.: published *Minnesota, or the Far West* (1855); wrote an anonymous pamphlet, *The Coming Campaign*, soon afterwards re-issued under the title *The Trans-Caucasian Provinces the Proper Field of Operations for a Christian Army* (1855); accompanied the army of Omar Pasha to the region in question: wrote *The Trans-Caucasian Campaign of Omer Pasha* (1856); accompanied Lord Elgin as private secretary on his mission to China in 1857; wrote *A Narrative of the Earl of Elgin's Mission to China and Japan* (1860); was chargé d'affaires in Japan 1861, at which time an attempt was made upon his life by assassins; entered Parliament 1865; joined the semi-religious community established in 1868 by Thomas L. Harris in the township of Portland, Chautauqua co., N. Y., which he has continued to make his permanent residence; was correspondent of the London *Times* in Paris at the outbreak of the Franco-German war (1870), and was manager of the American interests of the Direct Cable Company, a submarine telegraphic enterprise, 1873–75. He has published two novels, *Patriots and Filibusters* (1861) and *Piccadilly* (1870).

Oliphant (Margaret **Wilson**), b. in Liverpool, England, about 1818; has published a large number of successful novels, consisting chiefly of delineations of Scottish life and character, most of which have been republished in the U. S. Among them are *Adam Graeme of Mossgray* (1852), *The Chronicles of Carlingford* (1863), *Salem Chapel, The Perpetual Curate* (1864), *The Minister's Wife* (1869), and *A Rose in June* (1864). She has also written biographies of Edward Irving (1862), St. Francis of Assisi (1870), and Count Montalembert (1872), and *Hist. Sketches of Reign of George II.* (2 vols., 1869).

Oliphant (Thomas Lawrence Kington), b. at Henleaze, near Bristol, England, Aug. 16, 1831; educated at Eton and at Baliol College, Oxford; studied law; was called to the bar at the Inner Temple, and inherited the estate of Gask, Perthshire, Scotland, in 1867. Author of a *Life of the Emperor Frederick the Second* (1862), *The Sources of Standard English* (1873), and *The Duke and the Scholar, with other Essays* (1875), the latter work chiefly biographies of the French archæologist, the duke de Luynes, and his secretary, M. Huillard-Bréholles.

Oli'va, town of Spain, province of Valencia, beautifully situated near the Mediterranean. Pop. 6984.

Ol'ive [Lat. *oliva*], an evergreen fruit and oil-producing tree, the *Olea Europæa* (but not originally European), of which many varieties have been developed by cultivation and differences of soil and climate. The olive is supposed to be indigenous in Northern India and in other temperate Asiatic regions, and there are large forests of wild olives on the southern flanks of the Himalayas. There are wild olive woods in the Tuscan Maremme and in the island of Sardinia also, but there are historical reasons for believing that all the olives of Europe, as well as of Northern Africa, are descended from plants originally introduced from Asia Minor by human industry. The tree and its oil were known in Palestine in very remote ages, and are familiarly spoken of by the Old Testament writers, the oil (which belongs to the class called *fixed*) being used for food, for anointing the hair and person, for sacrificial libations, and for illumination. They are also mentioned not infrequently by Homer, in whose time, however, oil seems to have been a comparatively rare and costly product among the Greeks, not employed as food, but only for simple anointing and as an ingredient in perfumed unguents. Neither the old Jewish nor the most ancient Greek writers, so far as we have been able to discover, refer to the drupe or berry as an edible fruit, and the art of pickling it for the table belongs apparently to later ages. The wood of the olive tree is often noticed by the ancients as fine-grained, hard, and durable, as well as beautiful. The slow growth of the olive made its wood rare and costly, and this quality, with the evergreen foliage and apparent imperishability of the tree and the importance of its annual products, rendered the olive not merely valuable, but even sacred, in the eyes of the ancient world. The olive-branch was the symbol of peace, and the destruction of the tree by a public enemy was regarded as a barbarous violation of the usages of civilized warfare. The olive tree occupies a conspicuous place in Roman agricultural literature and in the Carthaginian authors, whose works on rural husbandry were so highly prized by the Roman conquerors. For several centuries before the Christian era the olive subserved a vast variety of uses in most of the countries subdued by Rome. Its berries were pickled for the table, and the oil was employed for all the purposes for which it is now used, except for the manufacture of soap—an article not known to the ancient Roman toilet or laundry. In fact, olive oil was relatively much more important in Roman than in modern domestic economy, for butter was scarcely used in the Roman *cuisine*, and according to Pliny no "artificial" oils were known until after Cato's time, the oil of the olive being considered the only *natural* oleaginous fluid. Even in Pliny's days the few other oils manufactured in Italy or introduced by foreign commerce were neither abundant nor much used for economical purposes, though some of them, as well as other fragrant and spicy substances, were employed to give a piquant flavor to olive oil and to the olive berry. The Romans, as well as the Greeks, thought frequent anointing the body with olive oil highly conducive to health, and the consumption of it for this purpose, as well as for illumination, cooking, and other uses, was such as to give it, next to breadstuffs, perhaps the highest rank among agricultural products. At the present day, although lard is preferred for cooking, as more nutritious, and great quantities of it are imported from America and exchanged for oil in the southern provinces of Italy, yet olive oil is very generally used for frying the everlasting *frittata, frittella,* and *frittura,* as well as in dressing macaroni and other dishes of Italian tables; and it is almost the only fluid employed by the poorer and middle classes in that country for illumination, as well as generally for most purposes to which other fixed oils are applied elsewhere.

The olive is now extensively cultivated in Asia Minor and in Syria; in Tunisia, Algeria, and Morocco, where it is extremely productive; in all Southern Europe, including the Mediterranean islands, the Slavonic provinces on the

Adriatic coast, and even the Crimea, where a variety is grown which is alleged to be hardy enough to resist the severest winters of that climate. In Spain and Portugal the berry is large and superior to all others for the table, and the oil wants only more careful preparation to be of equal excellence. Much of the Hispanic peninsula is too elevated and too arid for the olive, but wherever the local conditions are favorable it thrives luxuriantly. In France its growth is confined to the southern departments, and though the olives and oil of Provence are in high repute, it is seriously questioned whether the cultivation of the olive is, on the whole, profitable even there, for the tree will not have repaid the cost of its cultivation before its thirtieth year, and it is cut down by frost as often, upon the average, as once in forty years. The severe winter of 1709 is often said to have killed all the olives in France and in the adjacent Italian provinces, but many trees must have escaped, for there are on the Ligurian coast, near Nice, olives of five, six, and even above seven feet in diameter, which must be the growth of several centuries. France produces but a small proportion of the olive oil it consumes, importing it largely from Algeria, from Sicily and the Neapolitan provinces, and from the Greek islands. In Italy the olive is cultivated extensively in all the provinces not too distant from the Mediterranean—for this tree loves the sea-air—except in those watered by the lower Po and those so elevated as to be much exposed to frost, which, even at inferior levels, kills the foliage and the young shoots as often as once in two or three generations, and occasions the loss of one, and sometimes, though rarely, of several successive crops.

Of all fruit trees, the olive is doubtless the hardiest, for scarcely any amount of mutilation, any severity of frost, or even sharp scorching by fire, suffices to destroy the life of the tree. The smallest strip of green wood or living bark, or, in the absence of that, the roots, throw out new shoots, and the stock becomes again productive. Nor does the olive seem liable to perish from natural decay. Such is its tenacity of life that it still survives for centuries after the heart and all but the outer layer of young wood are rotten and gone, and one may often see a large trunk not only hollow in the middle, but split vertically into several distinct stems, all alike flourishing and productive. The olives now standing in what is called the garden of Gethsemane at Jerusalem are alleged to be identified by tax-rolls as existing 1000 years ago, and the tradition which makes them contemporaneous with the Founder of the Christian religion is not altogether improbable.

The ancient methods of cultivating the tree and preparing the berry and the oil for use were much the same as those now followed, but if Hesiod was right in saying that no man ever lived long enough to gather fruit from an olive he had himself planted, the habits of the tree have been modified since his time, for it now produces berries at the age of seven years, and shoots grafted on old stocks bear much sooner. Columella describes ten varieties of the olive, and Pliny speaks of a kind grown in Africa and in Portugal, the dried berries of which were sweeter and more palatable than raisins. More than twenty varieties are now recognized in Italy, but only five or six are thought specially worthy of propagation. In Europe the olive does not often exceed fifteen, or at most twenty, feet in height, and for the convenience of gathering the fruit a low, spreading growth of the crown is preferred and promoted by pruning, but in Palestine and in some of the Mediterranean islands there are olives as lofty as the tallest oak, and apparently quite sound in trunk and ramification. Both ancient and modern writers speak of this tree as producing fruit only biennially, but in the opinion of good authorities the failure of the crop in the alternate year is the effect of bad husbandry in tillage and in pruning, and especially of the practice of beating the branches to shake off the fruit, by which the young shoots and buds designed by nature to bear the following year are bruised and made unproductive. The olive is propagated by sowing the stone or kernel of the berry; by grafting or budding, generally on a wild stock; by slips, and by planting the knots or eyes found in the trunk near the surface of the ground. The trees are planted at from fifteen to twenty or twenty-five feet apart, and the ancient writers recommend even a much greater distance. When the surface is not too rough it is usually cultivated for some annual field-crop, but, though the stirring of the soil may be advantageous to the trees, the abstraction of nutritive matter from the earth by the roots of small plants grown between them is believed to be injurious to their product. It is generally thought, however, that the damage to the olive-crop is compensated by the harvests yielded by grain or other vegetables cultivated in the olive orchards. Under exceptionally favorable conditions of soil, exposure, and treatment a well-manured tree may yield twenty-five pounds avoirdupois of oil, but according to Cosimo Ridolfi the average product in Tuscany is not above two pounds and a half. The best table oil is that of Lucca in Central, and that of Bari in Southeastern, Italy. The land occupied by olive orchards in Italy is estimated at 1,235,000 acres, and the quantity of olive oil annually produced at from 30,000,000 to 40,000,000 gallons. England imports from the Mediterranean countries about 20,000 tons of olive oil per year.

The olive prefers light, rich, warm ground—does not thrive on alluvial soils, but grows well on hilly and rocky surfaces. Hence, much land too rugged for other crops is turned to profitable account by olive plantations, and the steep mountain-slopes rising by narrow terraces, supported by dry walls, to the height of many hundred feet and clothed with the olive, form one of the most picturesque features in Italian scenery. The height to which these orchards can be carried is limited by the liability to frost. A temperature of 19° F., or 13° below the freezing-point, especially if accompanied with *vetrone* or glazed frost, or followed by alternate thawing and freezing, is injurious to the tree, and if the thermometer falls to 14° F., or 18° below freezing, and remains any length of time at that degree, the young shoots, and even well-grown branches, are generally killed.

For the table the berries are gathered when fully grown, but still quite green; steeped for twenty or twenty-four hours in weak ley of wood-ashes or lime-water; then in fresh water changed every twelve or twenty-four hours for four or five days, or until they have lost their bitter flavor and the water runs off clear and tasteless. They are now salted or pickled in strong brine, in which they are kept for use in close vessels, though sometimes preserved in oil. The harvest of the berries for oil begins as soon as the skin has turned to a dark wine color, and good husbandry requires that it be finished in two or three months; but in ordinary practice it is continued, according to convenience, through the whole winter, and even into spring. The berries are spread for a short time to dry off moisture from the surface, and immediately pressed, the best table oil being obtained from unground fruit. They are then ground, but as the oil is found only in the pericarp or pulp, the millstones should not be heavy enough to crush the hard kernel. They are now subjected to repeated pressure, sometimes aided at last by pouring warm water on the mass, an inferior quality of oil being produced by every repetition of these processes. Oil is also extracted from the *sansa*, or pomace, by mechanical and chemical means. The total yield of oil is estimated at from one-eighth to one-ninth of the weight of the berries. Oil for the table, for illumination, and some other purposes is refined by settling, filtering, washing, and by various chemical processes. French chemical skill imitates table oil by manipulating American lard, which is then re-exported from Marseilles to the U. S. as oil of Lucca or Provence. GEORGE P. MARSH.

Olive, tp. of Elkhart co., Ind. Pop. 1149.

Olive, tp. of St. Joseph co., Ind. Pop. 1560.

Olive, tp. of Clinton co., Ia. Pop. 1580.

Olive, tp. of Clinton co., Mich. Pop. 1156.

Olive, tp. of Ottawa co., Mich., on the Chicago and Michigan Lake Shore R. R. Pop. 612.

Olive, post-v. and tp., Ulster co., N. Y., on Esopus Creek and on the Ulster and Delaware R. R. Pop. 3083.

Olive, tp. of Meigs co., O. Pop. 1863.

Olive, tp. of Noble co., O. Pop. 1810.

Olive Hill, post-v. and tp., Person co., N. C. Pop. 1439.

Oliven′za, town of Spain, province of Badajoz, near the Portuguese frontier, is fortified. Pop. 5717.

Olive Oil. See OIL, OLIVE.

Ol′iver, tp. of Adams co., O. Pop. 1069.

Oliver, tp. of Jefferson co., Pa. Pop. 1117.

Oliver, tp. of Mifflin co., Pa. Pop. 1355.

Oliver, tp. of Perry co., Pa. Pop. 511.

Oliver (ANDREW), b. at Boston, Mass., Mar. 28, 1706; graduated at Harvard College 1724; was a representative of Boston in the general court 1743–46; member of the council 1746–65; secretary of the province 1756–70; distributor of stamps 1765, but compelled to resign that post at the "Liberty Tree;" succeeded his brother-in-law, Hutchinson, as lieutenant-governor 1771, sharing his opinions and political conduct. D. at Boston Mar. 3, 1774.

Oliver (ANDREW), son of Lieut.-Gov. Andrew, b. at Boston, Mass., Nov. 13, 1731; graduated at Harvard College 1749; possessed considerable literary and scientific talent; was an original member of the American Academy of Arts and Sciences, to whose *Transactions* he was a frequent contributor; author of an essay *On Comets* (1772); was a judge of common pleas for Essex county, member

of the general court for Salem 1766, and was a loyalist during the Revolution. D. at Salem Dec., 1799.

Oliver (Benjamin Lynde), son of Rev. Thos. F. Oliver and grandson of Judge Andrew, b. at Marblehead, Mass., in 1788; graduated at Harvard College 1808; became a lawyer; was author of several excellent legal treatises, and noted for his skill as a chessplayer. D. in 1843.

Oliver (Daniel), M. D., LL.D., grandson of Lieut.-Gov. Andrew and brother of B. L. Oliver, b. at Marblehead, Mass., Sept. 9, 1787; graduated at Harvard College 1806; practised medicine some years at Salem; was lecturer on chemistry 1815–20; professor of the theory and practice of physic in Dartmouth Medical School and of intellectual philosophy in Dartmouth College 1820–37; professor in the Medical College at Cincinnati, O., from 1840 until Mar., 1842; author of *First Lines in Physiology* (Boston, 1835). D. at Cambridge, Mass., June 1, 1842.

Oliver (George), D. D., b. at Papplewick, England, in 1782; graduated at Trinity College, Cambridge, 1803; took orders in the Church of England; became head-master of King Edward's grammar school at Great Grimsby 1809; became vicar of Scopwick 1831, incumbent of Wolverhampton 1834, and rector of South Hykeham, Lincolnshire, 1847; filled high posts in the Masonic order, and wrote several works upon Masonry which met with wide acceptance. Among them are *Historic Landmarks of Freemasonry*, *The History of Initiation*, *Antiquities of Freemasonry*, and *Institutions of Masonic Jurisprudence*. D. at Lincoln Mar. 3, 1867.

Oliver (Peter), LL.D., brother of Lieut.-Gov. Andrew, b. at Boston, Mass., Mar. 26, 1713; graduated at Harvard College 1730; held several offices in Plymouth county, and was appointed a justice of the supreme court Sept., 1756; became chief-justice 1771; was impeached by the house of representatives 1774 for refusing to subscribe an engagement to receive no pay or emolument except from the assembly; accompanied the British troops on their retirement from Boston 1776; subsisted some years in England on a grant from the Crown, and d. at Birmingham Oct. 13, 1791. Author of various political writings and of some poems.

Oliver (Peter), son of Prof. Daniel, b. at Hanover, N. H., in 1821; educated for the bar; edited his uncle, B. L. Oliver's, *Practical Conveyancing;* wrote a number of articles for the New York *Church Review* under the name of "William Pynchon Oliver," and d. in 1855, while on a voyage for his health. A posthumous work, *The Puritan Commonwealth* (1856), edited by his brother, Fitch Edward Oliver, exhibited historical research and literary skill in a criticism of the Puritan founders of New England. An answer was published by J. W. Thornton in 1857.

Oliver (Thomas), b. at Dorchester, Mass., Jan. 5, 1734; graduated at Harvard College 1753; was a distant relative of Andrew Oliver, on whose death he succeeded to the office of lieutenant-governor of Massachusetts and president of the council. Compelled by the people to resign his seat at the council board Sept., 1774, he took refuge with the British troops at Boston, and accompanied them finally to England. D. at Bristol, Eng., Nov. 29, 1815. Author of *Poem XXIX.* in the *Pietas et Gratulatis* (Boston, 1764).

Olives, Mount of, or **Mount Olivet,** now **Jebel et-Tûr,** is on the E. of Jerusalem, from which it is separated by the narrow valley of Jehoshaphat, and rises 2786 feet above the level of the sea, 453 feet above the valley, and 190 feet above the most elevated part of Jerusalem. It forms the middle summit of a ridge of hills which to the N. expands into a large elevated table-land, but which here contracts and terminates in a row of three hills. The southernmost of these hills is now called the "Mountain of Offence," because Solomon here instituted the pagan worship for his concubines. The northern hill was the place where Titus encamped when he came before Jerusalem. The middle summit is the proper Mount of Olives. At its foot, near the bridge over the brook of Kedron, lies the garden of Gethsemane. Its swelling sides are streaked with patches of bare rock between the olive groves, which are planted in terraces. The church of the Ascension, built upon its top by Helena, which was seen by Sir John Mandeville in 1327, has disappeared, and in its place is a small octagonal chapel within a paved court, connected with a mosque.

Ol'ivet, post-v. and cap. of Hutchinson co., Dak.

Olivet, post-v. of Walton tp., Eaton co., Mich., on Battle Creek and on the Peninsular division of the Chicago and Lake Huron R. R., has 1 monthly paper, and is the seat of Olivet College. Pop. 526.

Olivet (Joseph Thoulier), Abbé d', b. at Salins in 1682; entered the Society of the Jesuits; about 1714 abandoned them, and devoted himself to letters; was admitted a member of the French Academy in 1723, and took an earnest part in the discussions. His devotion to Latin literature enrolled him on the side of the defenders of the study of the classics. Among his numerous works may be mentioned an edition of Cicero with useful notes (Paris, 1740–42, 9 vols.; reprinted, Geneva, 1758, 9 vols., 4to, the notes separately in 3 vols., 8vo, London, 1819); translations of Cicero's *De Natura Deorum* and *Catilinariæ Orationes*, and of the *Philippics* of Demosthenes; *Poemata Didascalica*, and a history of the French Academy. Voltaire was received into the Academy by Olivet. D. 1768. Henry Drisler.

Oliv'etans, or **Brethren of our Lady of Mount Olivet,** a congregation of Benedictine monks, whose first general was John Tolomei, chosen in 1319 by authority of Pope John XXII. The congregation spread rapidly, but long since declined, and now numbers but very few houses.

Oliv'idæ [from *Oliva—i. e.* olive-shaped—the representative genus], a family of gasteropod mollusks of the order Pectinibranchiata, and sub-order Rhachiglossa, having polished shells much sought after by collectors. The animal varies considerably; the mantle is moderate, and has an elongated posterior filament fitting into a notch and groove round the spire; the siphon is recurved; the head small; the tentacles pointed; the eyes present on peduncles, connate with the external margin of the tentacles or wanting; radula with the teeth in three rows, the median or rachidian variously armed, the external versatile and with a single recurved or hook-like apex; foot very large, more or less covering the shell in extension (and producing the polished coat of the shell), and with a cross groove in front on each side. The shell is sub-cylindrical, smooth, and polished, with a short spire, whose sutures are channelled or covered with callus, with the aperture narrow, and with the pillar-lip obliquely plaited in front. The family is quite an extensive one, embracing species that closely agree among themselves in their shells, the chief differences being expressed in the form of the mouth (whether linear or expanded forwards) and the length of the spire. Three quite distinct types, however, are differentiated by the teeth of the lingual ribbon. (1.) In one (Olivinæ), the rachidian tooth is broad and convex, and armed at the middle with three teeth (the internal of which is smallest), and the lateral tooth is broad, with its extremity flexed inwards; this includes the large and most familiar species of the family. (2.) In the second (Ancillinæ) the teeth essentially agree with those of the first, but the median denticle of the rachidian tooth is enlarged, and between it and the lateral smaller ones intervene. (3.) In the last (Olivellinæ) the rachidian tooth has a convex base, is narrowed sideways, and has the margin armed with numerous denticles, and the lateral teeth are claw-shaped and recurved outwards, and at their bases square supplementary pieces. Theodore Gill.

Ol'ivine [Lat. *oliva*], a name given to an olive-green variety of chrysolite, a natural silicate of magnesia and protoxide of iron, glass-like in appearance. It occurs commonly in many basalts and lavas. Olivine has also been met with in meteorites. E. C. H. Day.

O'lla Podri'da ["putrid, ripe, or seasoned pot;" Fr. *pot pourri*], the Spanish name of a *ragout* or stew made of many ingredients. Hence a literary work of extremely miscellaneous character.

Ollivier', (Émile), b. at Marseilles July 2, 1825; studied law, and began to practise as an advocate at Paris in 1846. In 1848 he was sent as commissary-general to Marseilles to pacify the city, and shortly after he was appointed prefect, but in 1849 returned to his business in Paris. In 1857 he was elected a member of the Legislative Assembly, and made himself conspicuous by his courageous and eloquent opposition to the government of Napoleon III. Gradually, however, the emperor succeeded in winning him over to his side, and he was generally considered a political renegade, when on Jan. 2, 1870, he became Napoleon's prime minister. He was president of the cabinet when the war was declared against Prussia, but he retired Aug. 9, after the first reverses of the French arms.

Olm'stead, post-v. and tp., Cuyahoga co., O., on Rocky River, and on the Cleveland Columbus Cincinnati and Indianapolis and the Lake Shore and Michigan Southern R. Rs. Pop. of v. 383; of tp. 1570.

Olm'sted, county of Central Minnesota. Area, 648 square miles. It is fertile and somewhat uneven. Live-stock, grain, and wool are largely produced. The county is traversed by the Winona and St. Peter R. R. Cap. Rochester. Pop. 19,793.

Olmsted (Denison), LL.D., b. at East Hartford, Conn., June 18, 1791; graduated at Yale 1813; was a college tutor 1815–17; became in 1817 professor of chemistry, mineralogy, and geology, and executed what is believed to

have been the first State geological survey in this country (report published 1824–25); became in 1825 professor of mathematics in Yale College, and in 1836 professor of astronomy and natural philosophy; published in 1831, 1832, and 1842 textbooks on natural philosophy, several works on astronomy for schools, and a number of biographical memoirs; made important observations on hail, on meteors, the aurora borealis, etc.; his conclusions regarding the latter phenomenon are in vol. viii. of the *Smithsonian Contributions*. D. at New Haven, Conn., May 13, 1859.

Olmsted (FREDERICK LAW), A. M., b. at Hartford, Conn., Apr. 26, 1822; studied agricultural science and engineering at Yale 1845–46; became a practical farmer, first in Central New York, and then on Staten Island; was appointed, with Mr. Calvert Vaux, to superintend the construction of the Central Park, N. Y. (see CENTRAL PARK), a work upon which he was several years employed. In 1874 he was appointed to superintend the reconstruction of the grounds about the Federal Capitol, Washington: author of *Walks and Talks of an American Farmer in England* (1852), *Journey in the Seaboard Slave States* (1856), *Journey through Texas* (1857), *Journey in the Back Country* (1860), the *Cotton Kingdom* (1861); is widely known as a pungent writer and a skilful landscape-gardener.

Ol'mütz, city of Austria, province of Moravia, on the Marsch, is strongly fortified, and was the place of imprisonment of La Fayette. It is the see of an archbishop. It has a well-attended university, two military academies, a polytechnic school, extensive manufactures of linens, cloths, and porcelain, and a large trade in corn and cattle. Pop. 15,231.

Ol'ney, post-v. and tp., Pickens co., Ala. Pop. 959.

Olney, post-v. and tp., cap. of Richland co., Ill., on the Ohio and Mississippi and the Grayville and Mattoon R. Rs., has good schools, 11 churches, 2 newspapers, a national bank, several mills, 4 hotels, a fine court-house. Pop. of v. 2680; of tp. 1412.

H. H. LUSK, ED. "OLNEY LEDGER."

Olney (JESSE), A. M., b. at Union, Tolland co., Conn., Oct. 12, 1798; exhibited in childhood a remarkable fondness for geography, as well as aptness in classical studies; was for twelve years a teacher in the Hartford Grammar School, where he was the first American teacher to introduce the method, now generally adopted, of separating geography from astronomy, and beginning the former study by familiarizing the pupil with the description and surroundings of his own town, county, and State, advancing thence to national and foreign geography. His school *Geography and Atlas*, first issued in 1828, almost immediately became a standard throughout the country, has had a sale of several millions of copies, and has been the model of which all subsequent school geographies have more or less been imitations. In 1831 appeared the *National Preceptor*, a reading manual far superior to any predecessor in the U. S., which was followed by a series of readers and outline maps, an arithmetic, and a school *History of the U. S.* Mr. Olney was also author of a small volume of poems, anonymously published at Hartford. To perfect himself in his favorite studies he visited Europe several times, residing at Paris for considerable periods. Residing at Southington 1834–54, and at Stratford for the remainder of his life, he served ten terms in the Connecticut legislature, where he was an active worker in behalf of educational interests, and was elected State comptroller of public accounts in 1867. D. at Stratford July 30, 1872.

Ol'neyville, post-v. of Providence co., R. I., on the Hartford Providence and Fishkill and the Providence and Springfield R. Rs.

Olonetz', government of European Russia, S. W. of the government of Archangel, around the Lake of Onega. Area, 59,567 square miles. Pop. 302,490. The ground is low, flat, and marshy, containing many large lakes, and covered with immense forests. Rye, hemp, and flax are produced; marble and slate are found, but timber and furs are almost the only articles exported. Cap. Petrozavodsk.

Oloron'-Sainte-Marie, town of France, department of Basses-Pyrénées, on a river of the same name, has tanneries, dyeworks, wool-spinning factories, and manufactures of paper, linens, and horsecloth. Pop. 9362.

Olot', town of Spain, province of Gerona, stands on the Fluvia, at the foot of the Pyrenees, in a volcanic district, and carries on a lively manufacturing industry, comprising silken, woollen, and cotton fabrics. Pop. 9984.

Oloz'aga (SALUSTIANO), b. at Logroño, Spain, in 1803; educated for the bar; elected to the Cortés 1833; reporter of the constitutional commission 1837, when he insisted on the retention of the senate; proposed and carried laws providing for electoral reform, the suppression of monasteries, the abolition of ecclesiastical tithes, and a general amnesty; was ambassador to France three times; was the chief author of the constitution of 1855; retired from political life on the triumph of O'Donnell in 1856, but continued to reside in France; president of the Cortés Mar., 1869, and Apr., 1871. D. at Enghien, Belgium, Sept. 26, 1873.

Ols'hausen (HERMANN), b. at Oldeslohe, Holstein, Aug. 21, 1796; studied theology at Kiel and Berlin, and was appointed professor in 1821 at Königsberg, and in 1834 at Erlangen, where he d. Sept. 4, 1839. His *Biblischer Commentar über sämmtliche Schriften des neuen Testaments*, published posthumously in Germany, has been (in part) translated into English for Clark's *Foreign Theological Library*, and a revised edition of it (by A. C. Kendrick, D. D.) published in New York (6 vols.) in 1858.

Olug Beg. See ULUGH BEGH.

Olustee, post-v. of Baker co., Fla., a station on the Florida Central R. R., 47 m. W. by S. of Jacksonville, Fla.

Ol'vera, town of Spain, province of Cadiz, has some very picturesque ruins of a Moorish castle. Pop. 6492.

Olym'pia, a plain in Elis, Peloponnesus, on the banks of the Alpheus, where the Olympic games were held, containing the Altis or sacred grove, which was said to have been enclosed by Hercules, and which contained the temple of the Olympian Zeus, with his statue by Phidias, and many other public buildings. Connected with the Altis were the stadium and the hippodrome. (See GRECIAN GAMES.) At the time of the elder Pliny (23–79 A. D.) about 3000 statues were standing; now the space is occupied with cornfields, with a few scattered ruins. (See E. Curtius, *Internat. Rev.*, Nov., Dec., 1875.)

Olympia, city, cap. of Washington Territory, and seat of justice of Thurston co., on the De Chutes River, at its entrance into Budd's Inlet, the southern projection of Puget Sound, in 47° 3′ N. lat. and 122° 55′ W. lon., and 15 miles N. of Tenino, a station on the Pacific division of the Northern Pacific R. R. Tumwater, on the opposite side of the river, is connected with the city by a bridge 520 feet long, and another bridge connects the city with the western shore of the inlet, 2030 feet long. It was first settled in 1846, incorporated in 1859, is well laid out, the streets broad and regular, shaded with elms and maples, the residences generally surrounded with gardens, has good waterworks, the capitol, at present a two-story structure of wood, city hall, court-house, jail, 6 churches, an academy, 2 public libraries, with about 12,000 volumes, 2 public and 3 private schools, 1 private bank, 4 hotels, fine water privileges, utilized by several factories and mills, and 5 weekly newspapers. It is in communication by steamers with Victoria, on Vancouver Island, is the manufacturing and commercial centre for the surrounding country, and is in the midst of grand mountain-scenery. Pop. about 1500. FRANCIS H. COOK, ED. "ECHO."

Olym'piad [Ὀλυμπιάς], the period of four years between any two celebrations of the Olympic games. The Olympiad was early adopted as an æra for the recording of the dates of events. The Olympiads were designated by number, the first being reckoned from the victory of Corœbus in the foot-race, B. C. 776; or, again, they took the name of the principal victor in the next previous Olympic games. Events are recorded as having happened in such and such an Olympiad, or in such a year of a certain Olympiad. A new æra of Olympiads was established in the Roman empire in 131 A. D., which was sometimes used. (See GRECIAN GAMES.)

Olympic Games. See GRECIAN GAMES.

Olym'pus, the modern *Elymbo*, was the ancient name of a lofty range of mountains which separated Thessaly from Macedonia. Their sides are clad with beautiful forests, but the tops are covered with snow for nine months of the year. The highest peak rises 9754 feet, and on its broad, cloud-veiled summit stood, according to the oldest myths of Greece, the palace of Zeus and the other gods. Later, the abode of the gods was moved by a more refined sentiment to the celestial spheres, but Mount Olympus still retained its charm for the imagination.

Olyn'thus, now *Aio Mamas*, an ancient city of Macedon, on the Toronaic Gulf, was at different periods dependent on Athens or Sparta, acquired great wealth from its excellent commercial position, but was taken in 347 by Philip of Macedon, who sold the inhabitants as slaves and destroyed its buildings.

Ol'yphant, post-b. of Blakely tp., Luzerne co., Pa., on the Delaware and Hudson R. R. Pop. 2327.

Omadi, tp. of Dakota co., Neb. Pop. 552.

O'maha, city and cap. of Douglas co., Neb., situated on the W. bank of the Missouri River, 950 feet above sea-level, was laid out in 1854, and is now one of the leading

railroad centres of the North-west. The city contains a high school and several public schools, churches representing all denominations, a public library, gasworks, extensive machine and car shops, oilworks, silver-smelting works, foundries, pork-packing establishments, furniture-factories, several street railways, a fire department possessing 3 steam fire-engines, and a system of electric fire-alarm signals. The U. S. custom-house, post-office, Grand Central Hotel, and numerous private residences are examples of fine architectural skill and beauty. Omaha has 3 daily, 7 weekly, and several monthly papers, with a large number of business-houses, and a commercial industry employing an immense capital. Pop. 16,083.

ANDREW ROSEWATER, ED. "OMAHA BEE."

Omaha Agency, post-v., Blackbird co., Neb. Pop. 31.

Omaha Indians, a tribe of the Dakota stock, occupying a reservation of 295,000 acres in Blackbird co., Neb., their ancestral abode. They are peaceable, honest, and generally industrious. They number 969 souls.

Oman′, a large territory of South-eastern Arabia, extending from the Arabian Sea to the Persian Gulf along the Sea of Oman, and divided into several states, of which the most important is Muscat.

O′mar (ABU HAFSAH IBNUL-KHATTAB), the second caliph of the Moslems, a relative of Mohammed, b. about 581; was at first one of the bitterest adversaries of the Prophet, but became after his conversion one of the most zealous apostles of Islam. In 634 he succeeded Abubekr, assumed the title of *Amîr El-Mumenîn* ("commander of the faithful"), and by his great talents, both as a military commander and as a civil governor, he laid the foundation of the vast Arabian empire. In 637, Syria and Palestine were conquered, and a mosque was built on the spot where once stood Solomon's temple; in 639, Egypt was subdued; in 642, Persia. He kept standing armies on pay, instituted a city police, regulated the relation between master and slave, etc., and under his rule an internal consolidation of the empire went along with the conquests. In 644, while at prayer in the mosque of Medina, he was stabbed by a Persian slave (a magian) for not remitting or lessening a daily tax imposed upon him for adhering to a false religion. Omar was buried at the side of the Prophet.

O′mar Pa′sha, b. at Plaski, Croatia, in 1806, a son of an Austrian officer; was educated at the military school of Thurn, and served for some time as a cadet in one of the Austrian frontier regiments; but fled in 1833 to Bosnia, changed his true name, MIKAIL LATTAS, embraced Mohammedanism, and became tutor to the sons of Hussein Pasha. With them he went to Constantinople, became teacher in a military school, and writing-master to the heir-apparent, Abd-ul Medjid, and when, in 1839, Abd-ul Medjid ascended the throne, Omar rose rapidly. In 1842 he was appointed military governor of Lebanon; in 1843 he was made a pasha, and in the following years he distinguished himself by putting down with great skill and energy the rebellions in Albania, Bosnia, Koordistan, and other places. In the war between Turkey and Russia he commanded the army on the Danube, defeated the Russians several times, compelled them to give up the siege of Silistria, and finally to withdraw from the principalities. In the beginning of 1855 he then transferred his army to Eupatoria, repelled with great success a Russian attack, but failed in relieving Kars, whither he was sent in the same year. After the peace he was appointed governor of Bagdad, but having been accused of maladministration he was discharged, and even banished to Kharpoot in 1859. He was soon recalled, however, and sent to Bosnia in 1861, and to Crete in 1867, to put down rebellions. In 1869 he had charge for a short time of the ministry of war, and continued a member of the council of the sultan to his death, Apr. 18, 1871.

Ombay′, an island of the Malay Archipelago, N. of Timor, in lat. 8° 2′ S. and lon. 124° 17′ E., is 50 miles long, 30 miles broad, high, volcanic, and inhabited by savage tribes of a mixed negro and Malay origin. At Alor the Dutch have a settlement and carry on some trade in wax, edible birds'-nests, and pepper. The pop. of the island is estimated at 194,000.

O′Mea′ra (BARRY EDWARD), M. D., b. in Ireland about 1780; entered the British army as assistant surgeon to the 38th regiment; served in Italy and Egypt; was surgeon to the man-of-war Bellerophon in 1815; became medical attendant to Napoleon at St. Helena; obtained his friendship; quarrelled with Sir Hudson Lowe in consequence of his treatment of his prisoner, which he denounced to the admiralty, and published several books relating to the captivity of Napoleon. D. at London June 3, 1836.

Ome′ga, post-v. and tp., Marion co., Ill. Pop. 1298.

O′men [Lat.], among the ancient Romans, a sign by which the gods were believed to indicate their favor or opposition to any proposed public or private action. The omens were publicly observed by the magistrates, assisted by haruspices and augurs, the former observing signs of the first, the latter of secondary importance. In the time of Cicero, and even before it, the whole matter of taking omens, of divining, soothsaying, and the like, had fallen into disrepute among the intelligent, but with the vulgar these arts grew in importance as the empire sank in corruption. Ancient Greece abounded in oracles, soothsayers, interpreters of dreams, and the like. Chaldæa, Persia, Egypt, and Etruria were also celebrated for the attention they gave to these arts. In more recent times judicial astrology was cultivated with similar objects. Such pursuits are at present chiefly confined to half-civilized, barbarous, and savage races, but among enlightened peoples such superstitions are not unknown. It is remarkable that in modern India many of the old Roman omens are still observed.

Omen′tum, a membranous sheet extending between certain abdominal organs and distinguished as the great omentum, a quadruple fold protecting the small intestine; the gastro-hepatic, a double fold extending from the liver to the stomach; and the gastro-splenic, a double fold extending from the great pouch of the stomach to the spleen.

Omish. See MENNONITES.

Ommy′iades [from *Ommeyah*, one of their ancestors], the second dynasty of the Arabian caliphate. They were fourteen in number; reigned at Damascus from A. D. 661 (41 Hejira) till 750. MOAWIYAH I. was the founder (reigned 661–680); ABD-UL-MELEK (685–705) and WALID I. (705–716) were the most powerful of the family; and MERWAN II. (744–750) was the last of the dynasty. There were, however, twenty-seven Ommyiade caliphs in Spain (755–1031), and others in the S. E. of Arabia. In the latter region they maintained a limited authority until after 1500. After the final overthrow of the Damascus caliphate in 750, the Abbasides came into power, and transferred the seat of government to Bagdad.

Omnibus. See CARRIAGES, by L. P. BROCKETT, A. M., M. D.

Omnis′cience, an attribute of God, in consequence of which he knows of all that has been, all that is, and all that shall be. In its last phase, as FOREKNOWLEDGE (which see), it has occasioned several very subtle theological distinctions.

Om′ro, post-v. and tp., Winnebago co., Wis., on the Milwaukee and St. Paul R. R., 10 miles W. of Oshkosh. It has 2 schools, 5 churches, 3 saw and shingle mills, 1 planing and 1 grist mill, an elevator, 2 carriage-factories, 1 woollen-mill, a glass manufactory, 1 newspaper, and stores. Pop. of v. 1838; of tp. 3216.

REYNOLDS & WORCESTER, EDS. "WEEKLY JOURNAL."

Omsk, town of Asiatic Russia, government of Tobolsk, is situated at the confluence of the Om and the Irtish, in lat. 54° 57′ N. and lon. 73° 40′ E. It is fortified, and the seat of the governor-general of Western Siberia. It has several military schools, manufactories, and mining-works, and carries on a considerable trade. Pop. 26,722.

Onagra′ceæ [from *Onagra*, a former genus], a natural order of exogenous herbs and shrubs which are found mainly in temperate climates, and especially in America. It is distinguished from related polypetalons with inferior ovary by having the lobes of the calyx valvate and the petals convolute in the bud, a single slender style, stamens only as many, or twice as many, as the calyx-lobes, and seeds without albumen. The leading genus is *Œnothera*, or evening primrose (the English name alluding to the resemblance of the corolla of the earliest known and commonest species to a primrose, and to the time when it opens), a specially American genus, of which many ornamental species are familiar in cultivation. *Fuchsia*, a well-known genus of shrubs, in which the calyx is as showy as the corolla, is still more important and familiar in horticulture. The order is destitute of active properties; one or two herbaceous species have been somewhat used as potherbs. An aquatic form, *Trapa*, of Europe and Asia, produces a large fleshy embryo, which is used for food under the name of water-chestnut. The Halorageæ, a group of mostly water-plants, long regarded as a degraded form of Onagraceæ, are referred to a separate order. A. GRAY.

Onalas′ka, post-v. and tp., La Crosse co., Wis., on the Mississippi River and the Minnesota division of the Chicago and North-western R. R. Pop. 1532.

Onan′cock, post-v. of Accomack co., Va., on the bay of the same name, has 1 weekly newspaper.

Onar′ga, post-v. and tp., Iroquois co., Ill., on the Illinois Central R. R., 85 miles S. of Chicago. It contains a

public library of 1000 vols., the Grand Prairie Seminary, 7 churches, an incorporated live-stock importing company, 1 newspaper, 3 grain-elevators, lodges of Masons, Odd Fellows, and Good Templars. Incorporated in 1863. Pop. 2822. M. H. MESSER.

Onawa, post-v., cap. of Monona co., Ia., on the Sioux City and Pacific R. R., 3 miles from the Missouri River, has a good school, 3 churches, 1 bank, a newspaper, 1 manufactory, several hotels, and stores. Principal employment, farming and stock-raising. Pop. about 1000. MCCASKY & ALDRIDGE, EDS. "GAZETTE."

On Bow'ie, a v. of Perry co., Miss. Pop. 360.

Onchid'idæ [ὀγχιδίον, a "little tubercle," from the wart-like tubercles], a family of gasteropod mollusks of the order Pulmonata and sub-order Geophila, including naked slug-like forms. The body resembles that of the ordinary garden-slugs, but has a large, shield-like, coriaceous mantle, which entirely covers the back; the respiratory orifice is posterior, at the right side and under the margin of the mantle; the vent posterior; head continuous with the body; the eyes at the extremity of non-retractile cylindrical peduncles, arising near the antero-lateral margins; tentacles none; lingual ribbon broad, with the teeth nearly uniform, "in numerous straight, transverse rows; the central, single, short, narrow, equilateral; the lateral numerous row nearly equilateral, with a broad, flat, sub-central tip," foot narrow, elongated, simple posteriorly; shell completely wanting. The family includes several genera, the species of which, for the most part, live in damp places near the water, either fresh or salt, and are supposed to be herbivorous. The species are mostly inhabitants of the tropical or warm countries. One species, however (*Peronia celtica*), is British. THEODORE GILL.

Onck'en (JOHANN GERHARD), b. at Varel, Oldenburg, Germany, about 1800; was in early life a domestic servant; lived for a time in England, where he married and became a member of an Independent church; opened a bookstore at Hamburg as agent of the Edinburgh Bible Society and the Lower Saxony Tract Society; organized a Baptist church, of which he became pastor 1834; was appointed a missionary of the American Baptist Convention 1835; visited many parts of Germany, Austria, Switzerland, and Denmark, preaching, baptizing, distributing the Scriptures, founding churches, and promoting the erection of chapels; was several times imprisoned; edited religious journals in English and German; visited the U. S. in 1852 and in 1865, had established 76 churches, with a membership of more than 11,000, and nearly a hundred Sunday schools.

On'derdonk (BENJAMIN TREDWELL), D. D., LL.D., b. in New York City in 1791; graduated at Columbia College in 1809; was ordained to the Protestant Episcopal priesthood 1813; was a professor in the General Theological Seminary 1826–30; bishop of New York 1830–45, when he was suspended by the House of Bishops. D. in New York Apr. 30, 1861.

Onderdonk (HENRY, JR.), b. at Manhasset, N. Y., June 11, 1804; graduated at Columbia College 1827; was principal at Union Hall Academy, Jamaica, L. I., 1832–65; author of a series of works of value, mostly illustrative of the history of Long Island.

Onderdonk (HENRY USTICK), M. D., LL.D., b. in New York Mar., 1789; graduated at Columbia College 1805; studied medicine in London and took his medical degree at Edinburgh 1810; was for a time associated with Dr. Valentine Mott in the editorship of the N. Y. *Medical Journal*; was ordained in 1815 as deacon in the Protestant Episcopal Church; was engaged in labors at Canandaigua, N. Y., 1816–20; rector of St. Ann's, Brooklyn, N. Y., 1820–27; consecrated assistant bishop of Pennsylvania 1827; on the death of Bishop White became bishop of Pennsylvania; suspended 1844, restored 1856, but never resumed episcopal functions. D. at Philadelphia Dec. 6, 1858.

O'Neal', tp. of San Joaquin co., Cal. Pop. 1719.

O'Neal, tp. of Greenville co., S. C. Pop. 1348.

O'Neall (JOHN BELTON), LL.D., b. at Bush River, S. C., Apr. 10, 1793; graduated at South Carolina College 1812; was a teacher in the academy at Newberry, S. C.; served for a time in the war of 1812–15; came to the bar in 1814; was four times sent to the South Carolina legislature, and twice chosen its Speaker; became a judge 1828, a judge of the court of appeals 1830, presiding judge of the courts of errors and appeals 1850; later was chief-justice of South Carolina. Author of a *Digest of Negro Law* (1848), *Annals of Newberry, S. C.*, *Biographical Sketches of the Bench and Bar* (1859), etc. D. near Newberry Dec. 27, 1863.

O'Neal's, tp. of Johnston co., N. C. Pop. 1294.

One'co, post-v. and tp., Stephenson co., Ill. Pop. 1401.

One'ga, a large lake in the government of Olonetz in Western Russia. Next to Lake Ladoga, it is the largest lake of Europe, covering an area of 4830 square miles. It is connected with the Volga and the Dwina by canals, and communicates with Lake Ladoga by the Sweer. It is very rich in fish.

One'glia [*Unelia*], a maritime town of Italy, in the province of Porto Maurizio, in lat. 45° 53′ N., lon. 8° 9′ E. The old harbor of this town was destroyed in the wars of the seventeenth century, but the new one has been constructed since 1825, and about 2000 vessels, total tonnage 100,000, now enter this port annually. The commerce and industry of the place are thriving. Some of the churches and other public buildings are very respectable, and the charitable institutions numerous and well endowed. The neighboring country is very fertile, and the hills that partially encircle the town are terraced with rich gardens and olive orchards. Oneglia originally stood at some distance from the sea, but being destroyed by the Saracens in 935, its fugitive inhabitants sought the seashore for food, and here rebuilt their town, which afterwards shared the prosperity and reverses of other Ligurian towns. Pop. 8047.

Onei'da, county of S. E. Idaho. It is mostly mountainous, but contains some fertile valleys well adapted to grazing and farming. The county contains medicinal, thermal, and salt springs of much prospective value. Cap. Malade City. Pop. 1922.

Oneida, county of Central New York. Area, 1215 square miles. Its centre is occupied by a broad and very fertile valley, extending E. and W. The N. and S. parts are hilly. The county is traversed by the Mohawk River, the Erie and other canals, and the New York Central and many other railroads. Building-stone, iron ore, gypsum, marl, peat, etc. are produced. Live-stock, wool, hops, grain, hay, and dairy products are among the great agricultural staples. The manufactures include furniture, wooden wares, lime, cement, cotton, woollen, and metallic goods, machinery, saddlery, farming tools, boots, shoes, lumber, carriages, flour, leather, and many other goods. In wealth and prosperity this is one of the first counties in the State. Caps. Utica and Rome. Pop. 110,008.

Oneida, post-v. of Ontario tp., Knox co., Ill., on the Chicago Burlington and Quincy R. R. Pop. 1034.

Oneida, tp. of Delaware co., Ia. Pop. 1484.

Oneida, tp. of Tama co., Ia. Pop. 715.

Oneida, tp. of Eaton co., Mich. Pop. 2047.

Oneida, post-v. of Lenox tp., Madison co., N. Y., at the junction of the New York Central and Hudson River and the New York and Oswego Midland R. Rs., in a fine farming region, noted for hop-raising, has 2 banks, 5 churches, 3 weekly newspapers, a seminary, and a brisk trade. The celebrated ONEIDA COMMUNITY (which see) is in the immediate vicinity. Pop. 3262.

Oneida, tp. of Huntingdon co., Pa. Pop. 386.

Oneida Castle, post-v. of Vernon tp., Oneida co., N. Y., has 1 church and 1 academy, and is the residence of a small remnant of the Oneida tribe, one of the "Six Nations" of Indians. Pop. 262.

Oneida Community, a communistic society established on Oneida Creek, Lenox tp., Madison co., N. Y., and constituting the chief establishment of the religious organization known as BIBLE COMMUNISTS or PERFECTIONISTS. They are the disciples of John Humphrey Noyes, who made a first unsuccessful attempt to found a community at New Haven, Conn., in 1834, organized the existing association at Putney, Vt., 1837, and removed to the present locality in 1847. The Community numbers about 300 members, owns a fine estate of 650 acres, has a commodious mansion, several mills and manufactories, and is understood to be in prosperous circumstances, the chief industrial occupations being the manufacture of traps and the preservation of fruits. Another smaller community, with about 60 members, is settled at Wallingford, Conn. The distinctive doctrines of the society are stated by the founder to be the same as those of the Gospels and the writings of Paul, and his own agency to be confined to a restoration of the primitive Christian ideal, which ceased to exist about 70 A. D., at which date Mr. Noyes places the second advent of Christ. The cardinal principles are four in number: I. Reconciliation to God, II. Salvation from sin, III. Recognition of the brotherhood and equality of man and woman, and IV. Community of labor and its fruits. The latter item embraces a scheme of "pantagamy," by which all the male and all the female members of the community are held to be in a sense married to each other—a circumstance which has exposed them to the obnoxious name of "free-lovers," but the system as regulated by the "principle of sympathy," and controlled by that free pub-

lic opinion which constitutes the supreme government of the society, is far from being amenable to the reproach of immorality, in any ordinary sense of the word. A distinguishing feature of the religious belief of the "Bible Communists" is their rejection of all laws and rules of conduct, except those which each believer formulates for himself, subject to the free criticism of his associates. They hold that the Mosaic law and ordinances were abrogated by the second coming of Christ, at which time the reign of sin was concluded, and the true believers have since been free to follow the indications of the Holy Spirit in all things, nothing being good or bad in itself. The great object to be attained is holiness, which consists in the entire extinction of all selfish desires, and this goal is thought to have been reached by a large number of the Community. (See Hepworth Dixon's *New America* (1867), J. H. Noyes's *History of American Socialisms*, and C. Nordhoff's *Communistic Societies of the U. S.* (1875).) PORTER C. BLISS.

Oneida Lake, in Oneida, Oswego, Madison, and Onondaga cos., N. Y., is 20 miles long and 6 miles wide. Its surface is 369 feet above the sea and 141½ above Lake Ontario. It abounds in fish. It formerly, with its outlet, Oneida River, was the channel of an important navigation, but it is superseded by railroads. The river is a deep, sluggish, tortuous stream, 18 miles long, with low banks. It falls into Oswego River.

Oneidas, one of the Five Nations of the Iroquois confederacy, resided in Central New York near the lake and in the county to which they have given name; were engaged, like the other allied nations, in protracted hostilities with the Hurons and the Canadian French, but were less warlike and better disposed towards the French than their neighbors, and at different periods allowed the residence of Jesuit missionaries among them. During the French wars of the eighteenth century they were faithful allies of the English, but joined with the Tuscaroras in refusing to fight against the colonists during the war of the Revolution, owing to the influence of the missionary Kirkland, who had resided some years among them. Their lands and homes were consequently ravaged by the British and Tories, for which they received compensation from the U. S. government in 1794. They ceded most of their lands to the State of New York by treaties of 1785 and 1788, retaining a reservation at Oneida Castle, where about 250 still reside. A large number emigrated to the Thames River in Canada, and subsequently, in 1821, to Green Bay, Wis., where they have a large reservation. There are now about 650 Oneidas on the Thames and 1250 at Green Bay, making a total of above 2000, or more than double the number at the close of the Revolution. They have become Christians, maintain schools and churches, and are well advanced in the arts of civilization, as well as the Brotherton and Stockbridge Indians, who reside with them.

Oneida Valley, post-v. of Lenox tp., Madison co., N. Y. Pop. 273.

O'Neil (CHARLES), U. S. N., b. in 1842 in England; entered the navy as a master's mate in 1861; became an acting master in 1862, an acting volunteer lieutenant in 1865, a lieutenant in the regular navy in 1867, a lieutenant-commander in 1868; served on board the Cumberland when sunk by the Merrimack, Mar. 8, 1862, and in the Rhode Island participated in both attacks on Fort Fisher, "discharging his duty with special credit."

FOXHALL A. PARKER.

O'Neill (CHARLES), b. at Philadelphia, Pa., Mar. 21, 1821; graduated at Dickinson College 1840; was admitted to the bar 1843; was a member of the Pennsylvania house of representatives 1850–52, of the State senate 1853; again a member of the lower house 1859–60; was a Republican member of Congress for the 2d Philadelphia district 1863–71; again elected 1872, and re-elected 1874.

Onekama, post-v. and tp., Manistee co., Mich. Pop. 255.

Oneon'ta, post-v. and tp., Otsego co., N. Y., on the W. bank of the Susquehanna River and on the Albany and Susquehanna R. R., has a union school, 5 churches, 1 opera-house, several hotels, 2 weekly newspapers, 2 banks, 1 grist and 1 saw mill, a sash and door factory, 1 foundry. The round-house, repair and machine shops of the Delaware and Hudson Canal Company are located here. Pop. of v. 1061; of tp. 2568.

J. L. BURTIS, ED. "ONEONTA COMMERCIAL."

Oneo'ta, post-v. and tp., St. Louis co., Minn., on St. Louis Bay and on the Lake Superior and Mississippi and the Northern Pacific R. Rs. Pop. 594.

On'ion [Lat. *cepa; unio*], a cultivated biennial herb and its bulbous foot, the latter composed of leaf-elements in a thickened condition; the *Allium cepa*, a plant of the order Liliaceæ, cultivated in Egypt and Asia from immemorial time, and thence introduced into nearly all civilized countries. The onion differs from the garlic especially in having the elements of its bulb disposed in concentric layers and not in separate cloves. There are many varieties, all milder in flavor than the garlic. Among the marked varieties are the potato onion, grown from off-set bulbs growing near the root, and the top onion, produced from similar bulbs growing at the top of the flower-stalk. Ordinary onions are raised in the first season from seed, or in the second year from the small *sets* or imperfectly-grown bulbs of the previous year's crop. Danvers, Mass., Wethersfield, Conn., and the Bermuda Islands are famous for their onions. The onion has an aromatic sulphur-oil containing allyl. The bulb is highly nutritious, and is eaten raw, or cooked in various ways. The crop requires a mellow, fertile soil and clean culture. In medicine it is a stimulating expectorant, valued in domestic practice, and especially in diseases of children.

Onomatopœ'ia [from the Gr. ὄνομα, a "name," and ποιεῖν, to "make"] means, in grammar, the formation of a word—in rhetoric, of a whole sentence—imitating the natural sound of the object spoken of. Such words are, in the English language, cuckoo, pewit, pee-wee, buzz, hum, hiss, crackle, crash, whirl, etc.; instances of onomatopoetic sentences may be found, some of wonderful power, in Edgar Allan Poe's *Bells*, others of exquisite delicacy in Tennyson's *Brook*. The ancient rhetoricians considered onomatopœia as an ornament of speech of high rank; instances both striking and curious are of frequent occurrence with Homer, Aristophanes, Virgil, Plautus, and Ovid. The following verse by Ovid,

Quamvis sint sub aqua, sub aqua maledicere tentant,

imitating the croaking of the frogs, was very famous in olden times. And the Greek grammarians considered onomatopœia as the fundamental principle in the formation of language, or, rather, they believed that all primitive words were onomatopes.

Onondaga, county of Central New York. Area, 812 square miles. It is level in the N., but hilly in the S. The soil is generally very fertile. The county contains great amounts of limestone, peat, gypsum, and marl, and has very valuable salt springs, the property of the State. The streams in the N. are deep and sluggish. The county abounds in deep lakes with precipitous sides, their stagnant green waters many feet below the general surface. The county produces great quantities of grain, fruit, dairy products, live-stock, wool, hay, etc. The manufactures include salt, lime, cement, cooperage, carriages, flour, clothing, lumber, furniture, saddlery, metallic and wooden wares, agricultural tools, brick, castings, malt liquors, etc. The county is traversed by the Erie Canal and by numerous railroads. Cap. Syracuse. Pop. 104,183.

Onondaga, post-v. and tp., Ingham co., Mich., on the Michigan Central R. R. Pop. 1229.

Onondaga, post-v. and tp. of Onondaga co., N. Y. There are five post-villages within the township, and a reservation on which some hundreds of the Onondaga Indians reside. Pop. of v. 176; of tp. 5530.

Onondaga Lake, in Onondaga co., N. Y., is 5 miles long, 1 mile wide, and has a maximum depth of 65 feet, but its S. part is very shallow. Its waters are stagnant, and their level is 361 feet above tide. They flow into Seneca River. The lake has a natural puddling of marl, which keeps the brine of the Onondaga limestone from its waters. The lake was probably formed by the dissolving out of salt rock, and the subsequent falling in of the roof of the cavern thus formed.

Onondagas, one of the Five Nations of New York, often called **Iroquois,** resided chiefly within the county and township to which they have given their name, their capital being Onondaga Castle, 5 miles S. of Syracuse, where a remnant of about 350 still reside. This locality was also the place of meeting of the whole Iroquois confederacy, the Onondagas, or "Men of the Mountain," being charged with the custody of the "long house" and the wampum-belts and the maintenance of the council-fires. Though less numerous than the Senecas or the Mohawks, the Onondagas seem to have occupied the most honorable position in the confederacy, of which their *atotarho*, or great sachem, is regarded as having been the head, and their language, used at the grand councils, was deemed the noblest of the kindred dialects. They waged implacable war with the Hurons and Algonkins of Canada, and afterwards with the French, and their territory was repeatedly devastated by formidable expeditions from Montreal, which were repaid in kind. They were allies of the English during the French war of 1756–63 and in the Revo-

lutionary war, in which they suffered heavily, and in 1788 ceded most of their lands to the State of New York; 400 members of the tribe now reside in Ontario, Canada.

Onondaga Valley, post-v. of Onondaga tp., Onondaga co., N. Y., has 2 churches and an academy. Pop. 571.

Ono'ta, post-v. and tp., cap. of Schoolcraft co., Mich., on the S. shore of Lake Superior, near Grand Isle and the Pictured Rocks.

O'noville, post-v. of South Valley tp., Cattaraugus co., N. Y., on the Alleghany River.

Ons'low, county of North Carolina, bounded S. E. by the Atlantic Ocean. Area, 700 square miles. Part of its surface is covered with pine forests and a part is marshy. Corn, cotton, and forest products are the staples. Cap. Onslow Court-house (Jacksonville P. O.). Pop. 7569.

Onslow (George), b. July 27, 1784, at Clermont, Auvergne, France; lived mostly on his estate near Clermont, occupied with musical studies, and d. there Oct. 5, 1853. His three operas, *L'Alcalde de la Vega* (1824), *Le Colporteur* (1827), and *Guise* (1837), are now forgotten, but his quintets, quartets, and concertos for pianoforte, with orchestra accompaniment, are often performed and heard with great interest.

Onslow Court-house, a v. (Jacksonville P. O.) of Jacksonville tp., cap. of Onslow co., N. C., on New River. Pop. 60.

Onta'rio, one of the provinces of the Dominion of Canada, British North America, comprising all the Canadian part of the valley of the St. Lawrence lying W. of the river Ottawa (which separates it from Quebec), except the counties of Vaudreuil and Soulanges, which occupy the S. E. angle, formed by the Ottawa and the St. Lawrence, and belong to the province of Quebec. Ontario was formerly called Upper Canada or Canada West. It is the most populous, but not the largest, of the Canadian provinces. Area, 121,260 square miles. Its eastern boundary, the river Ottawa, and southern and western, the St. Lawrence and the great lakes, afford a great extent of navigable waters, and many of its lakes and rivers are also navigable; so that few lands are so favored with natural facilities for commerce—an advantage which has been greatly increased by artificial means. (See art. Canals of Canada, by A. J. Russell, C. E.)

Geology and Description of the Country.—A spur of the Laurentian hills N. of the province of Quebec runs southward and joins the Adirondacs, dividing the valley of the St. Lawrence from that of the great lakes. From near Kingston these hills are continued westward to the S. W. angle of Georgian Bay (Lake Huron), constituting the great northern hill-region, with its boundless supplies of timber and its splendid mineral wealth. Among these hills of hard Laurentian rock are belts of calcareous and fertile valley-land, which are well settled. The N. W. has a region of Huronian formation, much resembling the Laurentian. S. of these regions lies the Great Plain of Canada West, an extremely fertile and valuable region underlaid by Silurian and Devonian limestones, sandstones, and shales, on which are found beds of clay and gravel. Excepting the prairie along Lake St. Clair, which is often overflowed, nearly all this splendid region is naturally or very easily drained. It abounds in hard-wood forests, and is fertile in wheat, corn, and all kinds of farm products. Among the mineral products of Ontario are white marl (valuable as a fertilizer on some soils), gypsum, crystalline lime-phosphate (Laurentian), brick, pottery, and drain-tile clays, limestone, hydraulic lime, building-stones of all the best kinds, marble, roofing-slate, iron ores, copper, silver, sheet-mica, burr-millstone, lithographic stones, hones and grinding stones, ornamental stones of many kinds, etc. Of late the silver, copper, and other mines of the Lake Superior (Huronian) region have been yielding handsome returns, scarcely if at all inferior to those of the Northern Michigan mining-region. The lower Devonian limestones of S. W. Ontario produce considerable petroleum.

Natural History.—Among the animals of Ontario are the common deer, elk, cariboo, beaver, musquash, mink, marten, raccoon, otter, fisher, wolverene, fox, wolf, hare, bear, porcupine, various squirrels, mice, and other rodents. Among the valuable food-fishes are trout, whitefish, black bass, the great Huron and other catfishes, the muscalonge and other pikes. The salmon and shad have lately been introduced into the streams flowing into the great lakes. Wild-turkeys, grouse, ducks, swans, geese, and partridges are among the game-birds.

Vegetation.—In general character the flora is much like that of the Northern U. S., but especially in the northern hill-country it has sub-arctic elements, though far less so than has the flora of Quebec. The coniferous trees grow most abundantly in the hill-country, the hard-wood in the plains. On the Laurentian hills the timber is often stunted except in the ravines and hollows. The forests of Ontario, like those of the other provinces, are under legal supervision and protection, as are its game and fur-bearing animals and fishes. The prospect is that the forests and their animals, as well as the streams and their inhabitants, will, under proper care, long continue to be, as at present, great sources of wealth to Ontario as in the U. S.

Ecclesiastical Affairs.—The Methodist Church of Canada and other Methodist bodies constitute the leading denomination. The M. E. Church in Canada and the British M. E. Church have each a bishop. The Anglicans have three dioceses—Toronto (with a see-house at Toronto), Ontario (see-house at Kingston), and Huron (see-house at London). The Roman Catholics have an archbishop at Toronto, and bishops at London, Hamilton, Kingston (Regiopolis), and Ottawa. The Presbyterians, Baptists, Congregationalists, and many minor bodies are also quite numerous.

History.—Ontario was a part of French Canada, and in 1760 passed with the rest of that province into English possession. Previously, it had been the theatre of much activity on the part of Roman Catholic missionaries. There were a few forts and trading-posts established by the French. Champlain visited Lake Ontario and Lake Nipissing in 1615. Lake Superior was visited by traders in 1660. Perrot took possession of the Lake Huron country in 1671. La Salle founded Niagara in 1679, and in the same year the lakes were explored to Lake Michigan. The fort at Toronto was built in 1749. After 1760, the Indians, who had been generally friendly for many years to the French, mostly accepted the friendship of the English, their old enemies, and in the war with the U. S., which soon followed, the Indians generally joined the English and Canadians against the more southern colonists. Ever since then the Indians have been generally very peaceable. Upper Canada was the field of a number of engagements during the war of 1812–15 between the British and the U. S. In 1837 the Canadian rebellion broke out, but was soon quelled. The provinces of Upper and Lower Canada were united in 1840. In 1867 they were separated as provinces, but with New Brunswick and Nova Scotia they were united into the new Dominion of Canada. (See Canada, Dominion of.)

Government.—Ontario has 24 senators in the Dominion Parliament, appointed by the governor-general, and 82 elective members of the House of Commons. The provincial government is under a lieutenant-governor, who is appointed by the governor-general of the Dominion. The legislative assembly of Ontario consists of but one house, of 82 elective members. The province contains the following counties and other divisions: *Counties.*—Essex, Kent, Bothwell, Lambton, Elgin, Middlesex, Norfolk, Oxford, Brant, Haldimand, Monck, Welland, Lincoln, Wentworth, Huron, Bruce, Perth, Waterloo, Wellington, Grey, Halton, Peel, Cardwell, Simcoe, York, Ontario, Durham, Victoria, Northumberland, Peterborough, Prince Edward, Hastings, Lennox, Addington, Frontenac, Leeds, Grenville, Dundas, Stormont, Glengarry, Cornwall, Prescott, Russell, Carleton, Lanark, and Renfrew; and the provisional districts of Algoma, Muskoka, Parry Sound, and Manitoulin. Some of the above counties are for judicial purposes united in such a way that two are as one. In other cases one county is divided into two or three ridings. The principal cities are Toronto, the capital of the province; Ottawa, the capital of the Dominion; London, Kingston, Hamilton, Brockville, Cobourg, Belleville, Cornwall, etc. Each of the counties, cities, and principal towns is described in this work under its own head. The population of Canada is largely of English, Irish, and Scotch descent. Many loyalists from the U. S. settled here during the Revolutionary war. The French language is by no means as prevalent in any part of the province as in Quebec and parts of some other provinces. The people of different nationalities are far from being as much blended as in the U. S. There are numerous public schools, supported partly by public moneys, partly by assessments and fees, and partly by private liberality. The "separate system," which gives to schools established by each denomination their appropriate share of the school moneys, has prevailed since 1851.

Internal Improvements.—In addition to the great system of canals (see Canals of Canada, by A. J. Russell, C. E.), which has done so much to increase the prosperity of Canada, Ontario has a fine system of railways, which is rapidly extending. Besides the completed roads, the Canadian Pacific Railway will traverse the province from Mattawa, on Ottawa River, to the W. boundary of the province. The population of what is now Ontario was in 1852, 952,004; in 1861, 1,396,091, and in 1871, 1,620,847. The increase per annum between 1852 and 1861 was 4.34 per cent.; from 1861 to 1871, 1.61 per cent. The reason

of this decline in the rate of increase was principally the suspension of the reciprocity treaty with the U. S. But the natural resources of the province are so great that, beyond question, Ontario has a brilliant future before her. Her increase in intelligence, wealth, liberal public spirit, and true independence has been greater than in any previous decade, and cannot be estimated by any census reports. CHARLES W. GREENE.

Ontario, a fertile county of Ontario, Canada, extending between Lakes Ontario and Simcoe. It is traversed by the Grand Trunk Railway, and is divided into two ridings. Cap. Whitby. Pop. 45,890.

Ontario, county of Central New York. Area, 640 square miles. Its surface is finely diversified, and in part broken. The soil is varied in character, but for the most part highly fertile. Live-stock, fruit, grain, wool, hay, and dairy products are the leading agricultural staples. The manufacturing interests are of secondary importance, but include lumber, carriages, flour, cooperage, saddlery, agricultural implements, metallic wares, etc. The county contains several beautiful lakes, much resorted to in summer. It is traversed by the New York Central, the Northern Central, and other railroads. Cap. Canandaigua. Pop. 45,108.

Ontario, post-v. and tp., Knox co., Ill. Pop. 1942.

Ontario, post-v. of Lima tp., La Grange co., Ind. Pop. 277.

Ontario, post-v. and tp. of Wayne co., N. Y., on the Ontario Shore branch of the Rome Watertown and Ogdensburg R. R., 50 miles from Oswego, has 2 churches, 1 newspaper, 1 foundry, 1 mill, 2 hotels, and a number of stores and repair-shops. It is located in the fruit-region of Northern New York; considerable deposits of iron ore exist here. Pop. 2295.—ONTARIO CENTRE, 1 mile distant, contains 2 churches and stores. Pop. 2295.
G. M. HARDY, ED. "ONTARIO SUN."

Ontario, Lake, the easternmost and smallest of the great lakes of the St. Lawrence system, has the Canadian province of Ontario on the N. and W. and the State of New York on the S. and E. It has an area of 7300 square miles. Its mean elevation above tide is 233½ feet, which is 334 feet below that of Lake Erie, although both are subject to variations of surface—a slight *annual* variation, due to rains and droughts, a larger *secular* variation, occurring in the course of several years, and certain sudden and unexplained changes, due perhaps to strong winds. The Niagara River is its principal feeder, and from its lower extremity the St. Lawrence arises. It is 190 miles long, 55 miles in maximum breadth, and 606 feet in maximum depth. It is, except in winter, the channel of an extensive commerce. It seldom freezes except near the shore. Its fisheries are of much importance.

Ontelau'nee, tp. of Berks co., Pa. Pop. 1339.

Ontenien'te, town of Spain, province of Valencia, on the Albayda, has extensive manufactures of woollen and linen fabrics, paper, brandy, and cloth. Pop. 7793.

Ontol'ogy [from ὄν and λόγος, "science of being"], the science of being in general or of the essence of things. It is sometimes identified with metaphysics, but is usually made one of its divisions, and co-ordinate with rational psychology, cosmology, and theology, according to the nomenclature of Wolf, who established this fourfold division of metaphysics. The earlier Aristotelians and the Scholastics treated under physics the problems of rational cosmology, and under metaphysics those of ontology. Aristotle called the latter πρώτη φιλοσοφία, and included under it also theology. His *De Anima* may be regarded as the first work (and as still the best, according to some) on rational psychology. But psychology was generally classed among the natural sciences by his followers. Logic, however, as treating of the mere forms of thought, should belong under psychology, and be contrasted with ontology, which treats of real being and of the essence of things: (*a*) *of being*, as quality, quantity, infinite and finite, etc.; (*b*) *of essence*, as identity and difference, form and matter, ground and sequence, noumenon and phenomenon, cause and effect, substance and attribute, possibility and necessity, and similar relations. The general problem of ontology is to find the highest principle, or that which is true in and for itself—the Absolute. Inasmuch as psychology, with the problem of certitude, has come to the front rank in modern philosophy, it has happened that the latest systems of ontology, notably those of Germany since Kant, have striven to unite ontology with psychology, and thus create an ontological logic which should give the *a priori* laws and conditions of thought and being. Kant's work was negative in this respect, and denied the possibility of knowing things in themselves; it confined all *a priori* knowledge to the forms of the mind, and made all objects of knowledge subjective and phenomenal. But since he included among these subjective forms of the mind such universal, logical conditions of existence as time and space, quality, quantity, relation, and mode—these categories being the *a priori* conditions of existence *for us*—it was possible to construct a science of ontology within the subjective or psychological province. In fact, no room was left for the possibility of objective being outside of mind. Hence arose the systems of Schelling and Hegel and their followers, whose ontology is based on psychology.
WILLIAM T. HARRIS.

Ontonag'on, county of Michigan. Area, 2300 square miles. It is uneven and covered with forests. Copper-mining is the leading industry. It is bounded N. by Lake Superior and S. by Wisconsin. Cap. Ontonagon. P. 2845.

Ontonagon, post-v., cap. of Ontonagon co., Mich., on the Marquette Houghton and Ontonagon R. R., has a good school, 1 newspaper, 2 saw-mills, a tannery, copper-smelting works, 5 hotels, and stores. It is the shipping-point for the copper-mines of the county, and has a fine harbor. Pop. 739. ALFRED MEADE, ED. "MINER."

Ont'wa, tp. of Cass co., Mich. Pop. 995.

Onus'tidæ [from the generic name, *Onustus*], a name used sometimes for the family PHORIDÆ (which see).

Onychoteuth'idæ [from ὄνυξ, ὄνυχος, a "claw," and τευθίς, a "squid"], a family of cuttle-fishes (cephalopods), of the order Dibranchiata and sub-order Sepiophora. As limited by Adams and some others, it includes those forms which have the eyes naked with a sinus above, an internal shell, which is horny, solid and very elongated or lanceolate; the body variable in form, being in some quite elongated and with a terminal fin only, in others short and with a lateral fin extending more or less upon the back; the mantle with three internal cartilages, one dorsal and two ventral; the siphuncle provided with a valve, and the head moderate and sub-cylindrical; the arms are provided, to a greater or less extent, with claw-like hooks (and hence the name), and in the typical forms the long tentacular arms have, besides the ordinary cups, a simple unarmed sucker at the bases of the expanded extremities, by which, when applied to one another, according to Owen, "the tentacles are firmly locked together at that part, and the united strength of both the elongated peduncles can be applied to drag towards the mouth any resisting object that has been grappled by the terminal hooks." The family thus defined includes rather heterogeneous forms, which will probably be eventually separated into two or more families. *Onychoteuthis*, *Abralia*, *Ancistroteuthis*, and *Enoploteuthis* are like the common cuttle-fishes (*Loligo*) in form; *Ancistrocheirus* is pointed behind, and has dorsolateral fins; *Octopodoteuthis* has a thimble-like body with lateral fins; and *Ommastrephes* has an elongated body, and includes the forms known to sailors as "flying-squids" or "sea-arrows." The last is represented by a species (*O. Bartramii*) which is largely used as bait for codfishes on the Banks of Newfoundland. THEODORE GILL.

O'nyx [from ὄνυξ, a "finger-nail"], a variety of chalcedonic quartz composed of parallel layers of chalcedony of different colors, generally some shade of brown, but sometimes shades of green or red, alternating with layers of white. When the red is a rich brownish-red chalcedony (*sard*) and the white bands pure and translucent, the variety is known as *sardonyx*. The varieties of onyx, valued somewhat at the present day, and much used in jewelry, were highly prized by the ancients for the manufacture of cameos, one of which, said to be the largest known, measuring eleven inches by nine, is preserved in the Museo Borbonico at Naples. EDWARD C. H. DAY.

O'olite ["egg-stone," so called because it seems to resemble petrified fish-roe], (1) a variety of limestone, magnesian or otherwise, which appears to be composed of spherical granules, which are sometimes solid and sometimes hollow. Some oolites are prized for building purposes and others for lime-burning. (2) A name given in Europe to the Jurassic strata above the Lias and below the Wealden. There are three principal groups of the Oolite, called the Lower, Middle, and Upper groups. The oolitic strata yield lime, cement, building-stone, slate, fuller's earth, oil-shale, pyrites, etc., and at Brora in Scotland the Lower Oolite affords a supply of good coal. In Australia and South America the corresponding strata are coal-bearing also. In North America the Oolite is but little developed.

Ooltewah, post-v., cap. of James co., Tenn., situated on the East Tennessee Virginia and Georgia R. R., 15 miles E. by N. of Chattanooga, Tenn.

Oor'fa, or **Urfa.** See ORFA.

Oost, van (JACOB), THE ELDER, b. at Bruges in 1600;

studied at Rome. His works are mostly on sacred subjects. D. at Bruges in 1671.—His son (JACOB), THE YOUNGER, was b. about 1637; studied under his father, and visited Italy and France; was an excellent portrait and historical painter. D. Dec. 29, 1713.

Oos'terhout, town of Netherlands, province of N. Brabant, has large breweries and tanneries, manufactures of tiles and pottery, and important cattle-markets. P. 8669.

Opah. See KINGFISH.

O'pal [Gr. ὀπάλλιος], natural soluble silica, generally combined with water up to as much as 11 per cent. Several varieties of opal are recognized; of these *precious opal* is the most highly esteemed, stones of moderate size having realized as much as diamonds of the same dimensions. Its value arises from the property it possesses of displaying within itself a remarkable and indescribable play of colors. This appearance is known as opalescence, and is not seen in *common opal.* Fire opal is a variety presenting hyacinth-red and yellow reflections. *Wood opal* is a variety of *semi-opal* (a common opal deficient in translucency), presenting tracts of ligneous structure, and in many localities, as in Egypt, Tasmania, etc., fossil trees, the remains of ancient forests preserved in this mineral, occur in great abundance. Precious opal and common opal are met with in volcanic, amygdaloidal, and porphyritic rocks, the former being principally obtained from Hungary, Honduras, Mexico, Ceylon, and the Faroe Islands. Fire opal has been obtained in the U. S. from Washington co., Ga. (See HYALITE.) EDWARD C. H. DAY.

O'patas, a nation of American Indians, living in the southern part of the State of Sonora, Mexico, near the Gulf of California, and chiefly upon the rivers Yaqui and Mayo, by which names they are frequently known. They are peaceful agriculturists, have made some progress in civilization, preserve their independence, and number about 30,000.

Opeli'ka, post-v., cap. of Lee co., Ala., 20 miles from West Point, Ga., and 28 from Columbus, is the great railroad centre of the State, has an extensive commercial trade, and is the main distributing point in the State for dry goods and groceries. Large quantities of cotton are sold here annually. It contains 2 seminaries, 5 churches, 2 national banks, 6 extensive cotton-warehouses, 1 carriage repository, 2 weekly newspapers, a large flouring-mill, a skating-rink, a fire department, 1 wagon and carriage manufactory, and numerous other industries. Pop. 5085.
THOMAS E. GORMAN, M. D.

Opelou'sas, post-v., cap. of St. Landry parish, La., about 250 miles from New Orleans, has an academy and several schools, 5 churches, 2 weekly newspapers, a convent, a hotel, and stores. Principal business, farming and stockraising. Pop. 1546. LEONCE SANDOZ, ED. "COURIER."

O'pequan, tp. of Frederick co., Va. Pop. 4414.

Opequan, tp. of Berkeley co., West Va. Pop. 1665.

Op'era [It.] is the name given by the Italians, and after them by other nations, to a drama which is sung with accompaniment of instrumental music. Dramas occasionally interspersed with songs to familiar airs are called vaudevilles; dramas occasionally accompanied by symphonical music are called melodramas. On its dramatic side the form of the opera does not differ widely from that of the spoken drama. Inasmuch, however, as it is to be sung, the text of an opera, the *libretto*, must be of much smaller extent than that of an ordinary drama.

It is on its musical side that the opera presents its most clearly-marked peculiarities of form. To speak first of the vocal part of operatic music, we find that there are several sharply-distinguished forms which serve to make up the composition. The chief of these are recitative, aria, duet, trio, and chorus. The recitative is the least elaborated musical form of the opera, and is designed for the more rapid prose passages of the dialogue, as opposed to the finished lyrical parts. It is not, strictly speaking, melody at all, but the voice moves through a few notes only, including frequent chromatic intervals, and having little unity of key or tonality. Moreover, there is no clear division of time, such as is secured by the division into bars, but the series of notes proceeds with abruptly changing movement, divided merely by a few strongly accentuated resting-points. The aria is a theme for a solo voice, being a complete melodic subject, and having divisions of strophe, verse, etc. Duets and trios (*duetti, terzetti*) are combinations of two or three voices in a complete melodic subject. In addition to these there are the ensemble pieces, in which all the principal actors and singers (commonly from four to six in number) unite in some harmonized strain. The finale is an example of an ensemble movement. Lastly, there is the full mass of harmonized voices as given in the chorus. In this the several parts are each rendered by a number of voices, supplied by a band of subsidiary actors specially set apart for this purpose. The instrumental part of operatic music is rendered by a band of musicians, the orchestra. Orchestral instruments include string and the several varieties of wind, both in wood and in metal. The orchestra furnishes a continuous accompaniment to the several vocal parts of the opera, this accompaniment being highly finished in the case of the aria, the chorus, etc., and consisting of only a few leading chords in the case of the recitative. In addition to supplying an accompaniment to the vocal parts, the orchestra has to perform independent compositions, the principal of which is the overture. This piece resembles other instrumental compositions, such as many of the opening allegro divisions of the symphony and the grand sonata, and is built according to what is called the "sonata-form" of composition. This form falls into three movements, of which the first sets forth the leading theme and counter-theme, the second "develops" these elements into a variety of shapes, and the third constitutes a final reversion to the opening theme. Besides the overture, the orchestra supplies a musical introduction or prelude to each succeeding act of the opera.

The opera is pre-eminently a modern art, being developed, as might be expected, later than the simple forms of modern music itself. It grew up in Italy at the beginning of the seventeenth century, during the period of the Renaissance, and when polyphonic music had pretty well exhausted its resources, and a basis had been laid by Palestrina for our present system of harmony. It was in Florence, about the year 1600, that the first opera appeared. Certain patrons of art set themselves in the spirit of the Renaissance to rediscover the vocal music of the Greek drama, and by the help of certain singers and composers, among whom were Caccini and Peri, they invented recitative as the nearest representative of Greek dramatic intonation. This first opera, the earliest known example of which is a piece entitled *Eurydice*, consisted of recitative, or, as the Italians called it, *aria parlante*, choruses, a few duets and trios, together with instrumental prelude and interludes. This early recitative has more of equal-time division than our present mode. The instruments used for accompaniment are, oddly enough, assigned in lots to the different *dramatis personæ*. Thus, Orpheus has two stringed instruments, and Pluto four trombones. For fifty years this opera remained the luxury of nobles, being performed only before courts during special festivities; after that it gradually became a popular entertainment. The instrumental part of the opera was greatly improved by Monteverde, who added the overture (*toccata*). Later in the century the melody of the aria was enriched by two composers named Cavalli and Cesti. It was indeed in connection with the opera that our modern style of melody developed itself. Before the invention of this new form of art music had consisted almost exclusively of skilful combinations of distinct themes in intricate contrapuntal arrangements, with little regard to harmony and no thought of a single ruling melody. The opera, by stimulating solo-singing and by reviving a taste for the beauties of popular melody, supplied the necessary incentive for the elaboration of sweet-sounding and finished melodic themes. In the following (the seventeenth) century A. Scarlatti clearly marked off the aria from the recitative, and gave it the triple division which it retained for nearly a century. The later Italian operas—namely, the works of Piccini, Paesiello, and Cimarosa, and those of the numerous composers of the present century—do not display any great change of style.

In France the earliest operas, those of Lulli (end of the seventeenth century) and of Rameau (beginning of the eighteenth century), were little more than imitations of the Italian style. The basis of French opera was laid by Gluck (1773–87), who set himself to rectify the evils of the existing Italian opera by confining the exercises of the vocal art within due limits, and by bringing into greater prominence the dramatic character of opera. Thus, he shortened the aria-form, and expunged the numerous bravura passages with which it was laden. Further, he reduced the number of airs in the opera by elevating the recitative to a higher rank, rendering it much richer in a musical aspect and more impressive dramatically. Gluck also greatly improved the quality of the operatic chorus, and made it a much more conspicuous element of the opera. Lastly, he added considerably to the instrumental part of the opera, seeking to bring it into closer unity with the dramatic subject. The French classic opera ("grand opera") after Gluck scarcely fulfils the expectations raised by such an admirable foundation. At the same time, it must be admitted that the French school has always been faithful to the teaching of Gluck in seeking to do justice to the dramatic claims of opera. More especially, the French recitative is characterized by great energy and freedom of movement, and admirably adapted to dramatic effect.

Among those composers who have written solely or mainly for the French stage are Méhul, Cherubini, Spontini, Meyerbeer, Rossini, and among contemporary composers Gounod and Thomas. Perhaps, however, it is in the lighter style of opera that the French have excelled. The early vaudeville, which is the forerunner of the opera bouffe, was light, graceful, and piquant. Rousseau's *Devin de Village* is a good example of this genre. The first composer of the opera comique, strictly so called, was A. F. Boieldieu. Other writers of this lighter style of French opera are Hérold, Halévy, Auber, Adam, and in recent times Offenbach.

In Germany the opera has perhaps been marked by less of national originality than in France. Passing over the earliest writers, such as Keiser, who did little more than carry out Italian traditions, we come to Mozart as the first great opera-writer in Germany. Mozart united Italian sweetness of melody with German richness and depth of harmony, and his operatic music, as pure music, has never been surpassed, or even equalled. Passing by Beethoven's *Fidelio*, we find that the German opera after Mozart sank for a while to a low ebb. The one worthy attempt to raise its character came from the Romanticists—namely, Spohr, Weber, and Marschner—who sought to give a national tone to German opera by taking half-legendary subjects from early German history. Wagner is, in a sense, a follower of the Romanticists, since he selects his subjects from the obscure and legendary periods of German history. He inherits something of his force and vivacity of dialogue and of his scenic splendor from the French school, more especially Meyerbeer. JAMES SULLY.

Ophidi′idæ [from *Ophidium*, ὄφις, "serpent," and εἶδος, "likeness"], a family of teleocephalous fishes belonging to the suborder Acanthopteri, and distinguishable from all others by a peculiar modification and position of the ventral fins. The body is more or less elongated, little tapering, and compressed, with the caudal portion forming nearly or quite two-thirds of the length; the scales small but conspicuous; the lateral line concurrent with and near the back, obsolete behind; the head more or less compressed, oblong, oval in profile; opercula unarmed; nostrils two on each side and approximated; teeth villiform on the jaws as well as palate; branchial apertures ample, arched over above by the membrane which is attached near the axilla of the pectoral fin; branchiostegal rays seven; dorsal and anal elongated and united with the caudal; pectorals with branched rays; ventrals bifid, articulated, inserted under the chin and in advance of the eye; the stomach destitute of pyloric appendages. The family is composed of three very distinct genera: (1) *Ophidium*, with a number of species in the European and American seas, especially the warmer ones; (2) *Leptophidium*, with a single species (*L. profundorum*), the only known specimen of which was obtained with a sounding-line at the depth of 30 fathoms off the coast of Florida; and (3) *Genypterus*, one species of which has been obtained at the Cape of Good Hope and others on the western coast of South America. The several species of *Ophidium* are extremely alike in external appearance, but (some at least) are differentiated by remarkable modifications of the air-bladder. THEODORE GILL.

Ophid′ians [ὄφις, "snake," and εἶδος, "likeness"], an order of reptiles. (See SERPENTS.)

Ophiocephal′idæ [from *Ophiocephalus*—ὄφις, "serpent," and κεφαλή, "head"—the chief genus], a family of teleocephalous fishes of the suborder Acanthopteri, distinguished by a peculiar union of characters. The body is elongated and anteriorly subcylindrical; the scales of moderate size; the lateral line with an abrupt curve; the head depressed, oval above, and covered with shield-like scales; the eyes lateral; the opercula unarmed; the nostrils ———— ; dorsal and anal fins long, and without spines; caudal round, separated from the dorsal and anal; pectoral fins with branched rays; ventrals thoracic (and composed of one simple but partly articulated and five branched rays) or absent. The skeleton has numerous (52–61) vertebræ; the caudal are provided with ribs, the abdominal cavity being continued to below the caudal portion; four gills are developed, but no pseudo-branchiæ; a cavity accessory to the gill cavity is developed, in which water is retained, but no super-branchial organ is present; pyloric appendages may be either present (two in number) or absent. The family is composed of fresh-water fishes peculiar to Southern and South-eastern Asia. Above thirty species are known, which belong to two genera: (1) *Ophiocephalus*, in which the ventrals are present and two pyloric cæca are developed, and which includes almost all of the species, and (2) *Channa*, which is destitute of ventrals and without pyloric appendages, with a single species (*C. orientalis*), found in Ceylon. The peculiar accessory gill cavity contains a supply of water, which serves to keep moist the gills of the fish for a long time after being taken out of water. The species are therefore well adapted to withstand prolonged deprivation from that element. THEODORE GILL.

O′phir, the name (in Gen. x. 29) of the eleventh of the thirteen sons of Joktan, all of whom appear to have settled in Arabia. Also the name of a place or region famous in the commercial history of the Hebrews, from which, or perhaps only by way of which, came gold, almug-wood, and precious stones (1 Kings x. 11). The voyage thither and back, or perhaps the voyage which only took Ophir in its way, required three years (1 Kings x. 22). Ophir can hardly have been a general name for remote southern countries, nor can it have been any such far-off place as Peru, but should be looked for either in Africa (Bruce, Robertson, Petermann), or in India (Vitringa, Reland, Ritter, Ewald), or, more probably, in Arabia (Michaelis, Niebuhr, Forster, Knobel, Kalisch). R. D. HITCHCOCK.

Ophir, a famous volcano of the island of Sumatra, lies directly under the equator, and is 9939 feet high. It is cultivated from its basis to its peaks.

Ophir, tp. of Butte co., Cal. Pop. 2430.

Ophir, tp. of La Salle co., Ill. Pop. 1085.

Ophir, tp. of Washoe co., Nev. Pop. 110.

Ophir, post-v. of Tooele co., Ut., has rich gold-mines.

O′phites [Gr. ὄφις, a "serpent"], or **Serpent-Worshippers,** a sect of Gnostics who joined the worship of the serpent to the general characteristics of the faith and practice of other Gnostics. They honored the serpent because he tempted Eve to eat of the forbidden fruit—an act which they believed to be highly advantageous to the human race. They kissed the serpent and fed it with the Eucharistic bread; but others rejected Christianity, and honored Cain, Judas Iscariot, and other wicked personages.

Ophiurans. See STAR-FISH.

Ophor, tp. of Montgomery co., N. C. Pop. 451.

Ophthal′mia [Gr. ὀφθαλμός, "eye"], inflammation of the eye. This term, once widely comprehensive, is now usually restricted to inflammations of the membrane lining the eyelids and covering the exposed surface of the eyeball, the conjunctiva. It is divided into (1) catarrhal, (2) granular, (3) purulent.

Catarrhal Ophthalmia, or conjunctivitis, is the mildest form of inflammation of the conjunctiva. It may be caused by over-use of the eyes, by the application of the catarrhal discharges of "sore eyes," by the contact of dust, smoke, or any irritating substance, by riding in the wind, or by "catching cold." Its most common symptoms are inability to use the eyes, an itching, smarting, or burning sensation, an unpleasant dryness of the eyes, or, on the other hand, an unusual quantity of mucous secretion, causing the lids to adhere to each other. The eyeballs usually become red, and upon everting the eyelids their lining membrane is found to be still more reddened. This affection does not imperil the eyesight if properly treated.

Granular Ophthalmia, or granular lids, as it is popularly called, is a much more serious affection. It may be brought on by any of the causes which produce catarrhal ophthalmia, and is also contagious, being carried from eye to eye through the medium of towels, wash-basins, etc. It is characterized by numerous small elevations or granulations upon the conjunctiva of the lids, producing a roughness. These granulations act as a foreign body, and by rasping the sensitive surface of the cornea during the act of winking produce a superficial inflammation of the cornea called *pannus*. The sight is then obscured, the eyes are lachrymose, painful and sensitive to light, and sometimes, resisting all treatment, go on to hopeless blindness.

Purulent Ophthalmia, or conjunctivitis, is a more dangerous disease. About 10 per cent. of the eyes affected with it are lost. It is usually produced by contagion, but may come from "a cold." It is characterized by great swelling and tenderness of the eyelids, and by a very copious discharge of a thick, purulent secretion from between the lids.

The first of these affections—viz. catarrhal ophthalmia—usually demands very little treatment beyond simple cleansing of the eyes with tepid water. Maltreatment often aggravates the affection. Every form of poultice, such as bread and water or milk, alum curds, slippery elm, etc., should be scrupulously avoided, as they weaken the inflamed membrane and convert a simple, self-limiting malady into a destructive one. The "best eye-wash" in existence is water containing in solution common table-salt in the proportion of a teaspoonful to the pint. Its effects may be indefinitely varied by changing its temperature from 32° to 100° F., and usually the patient may be al-

lowed to choose that temperature which gives the most comfort. In granular ophthalmia long and careful treatment is required at skilful hands. In purulent ophthalmia the treatment must be prompt and vigorous from the start. In that of infants almost incessant cleansing is needed; and here the best wash is warm water, followed once or twice a day by a solution of one or two grains of nitrate of silver dissolved in an ounce of pure water, or five or ten grains of alum in the same quantity of water. Competent advice should, however, be early sought to apply more active measures in bad cases. In the purulent ophthalmia of adults, whether "Egyptian" or gonorrhœal, active treatment is needed early—leeches, ice, nitrate of silver. Where the lids are much swollen, and by their stiffness and weight prevent free cleansing or the easy escape of pus, an incision at the outer angle of the eyelids horizontally down to the temporal edge of the orbit should be early made. Such an incision "lets blood" freely, and relieves the eyeball from damaging pressure. The occurrence of catarrhal, purulent, or granular ophthalmia in a school, reformatory, or other public institution among children or adults is usually due to ignorance or carelessness on the part of some one responsible for the police of said institution, and should be subjected to rigid inquiry and correction. Many scores of children contract eye diseases in the schools and reformatories of our large cities which ultimately result in hopeless blindness. Overcrowding and insufficient provisions for isolating initial cases are mainly to be blamed for this sad result. So great is this evil in some of the large institutions near this city (New York) that it becomes a grave question whether on the ground of economy, to say nothing of humanity, it would not be well to scatter the inmates in rural families that are ready to take them, and abolish the institutions. C. R. AGNEW.

Ophthalmol′ogy [Gr. ὀφθαλμός, "eye," and λόγος, "discourse"], the science of the eye. The eyeball, which is nearly spherical in shape, rests upon a cushion of fat in the orbital cavity of the skull. It is moved freely about a centre by means of six muscles, four of which are called straight from their course, and two oblique. The eyelids, the bony rim of the orbit, and the nasal bones protect it from direct blows. A mucous membrane called the conjunctiva covers the exposed portion of the eyeball and lines the eyelids. The lachrymal gland, lodged behind the supero-temporal edge of the rim of the orbit, pours its secretion, the tears, by several openings upon the conjunctiva. This moisture aids that which the conjunctiva itself produces in lessening the friction in the movements of the eyeball, and in washing away such foreign substances as may have passed the eyelashes and lodged behind the eyelids. At the nasal angle of the edges of the eyelids are two minute openings called *puncta*, communicating with the tear-sac by two canals. The tear-sac empties its contents into the cavity of the nose through the nasal duct. The canals, sac, and duct are lined with mucous membrane.

The eyeball consists properly of three layers or coats—(1) the sclerotic, (2) the choroid, (3) the retina. The sclerotic is the hard or firm layer, and is completed in front by the cornea, which is transparent. It is perforated behind by the optic nerve. The choroid, which lines the sclerotic from the optic nerve entrance to the edge of the cornea, is largely composed of blood-vessels, and contributes in a great degree to the nutrition of the organ. The iris, a continuation of the choroid, is a diaphragm suspended in the anterior part of the eye in front of the crystalline lens. It is perforated at its centre by the pupil, the function of which is to regulate, by its muscular mobility, the amount of light admitted to the eye. The iris and choroid are so darkened by pigment in their substance as to prevent annoying transmission and reflection of the rays of light. The retina lines the choroid, and receives visual impressions. The fibres of the optic nerve which are widely distributed through the texture of the retina conduct these visual impressions to the brain. Behind the cornea is a chamber filled with the aqueous humor. Behind the iris, and imbedded in the front of the vitreous humor, is the crystalline lens. The vitreous humor occupies the greater part of the cavity of the eye. The cornea, aqueous humor, crystalline lens, and vitreous humor are the refractive media of the eyeball, and together maintain its shape.

Refraction.—The normal or emmetropic eye, in a state of rest, unites parallel rays upon its retina. An eye which in a state of rest would bring parallel rays to a focus posterior to the retina is said to be hypermetropic, while one whose focus for parallel rays is anterior to the retina is called myopic. An eye whose different meridians have different foci is said to be astigmatic. Persons under the age of forty with emmetropic eyes usually do not need spectacles. All persons with hypermetropic eyes should wear convex glasses sufficiently strong to correct the hypermetropia. The glasses selected for constant use in these cases should be the strongest with which the person can see distinctly in the distance. Persons with myopic eyes should select the weakest concave glasses with which they can see well in the distance. These may be worn constantly, or may be removed while engaged in work requiring near vision, whichever is most agreeable to the individual. Persons with astigmatic eyes should be fitted with glasses after the most careful examination by an expert physician. Many myopic eyes are diseased, and when the myopia becomes progressive it is a most serious malady. When a young person discovers that his nearsightedness is increasing, he should cease all use of his eyes for near vision, and seek competent advice without delay. A prolific and preventible cause of nearsightedness is too much eye-work by the young at the near point of vision.

Accommodation.—All eyes not diseased have the power of so increasing their refraction that the farthest point of distinct vision is brought nearer to the eye. This is called the power of accommodation, and is brought about by the contraction of the ciliary muscle and the consequent increased convexity of the crystalline lens. As we grow older and the crystalline lens becomes harder our power of accommodation gradually diminishes, until at about the age of forty the nearest point of distinct vision in emmetropic eyes usually recedes to beyond eight inches, and we need the aid of weak convex glasses for reading. Persons with hypermetropic eyes will then require stronger glasses for reading than for the distance, while persons with myopic eyes may need concave glasses for distant vision, and at the same time convex glasses for near vision. When old persons find it necessary to change their spectacles frequently for stronger or weaker glasses, they should suspect some grave disease of the eye and consult a physician. Persons with "weak eyes" should suspect some error of refraction and seek competent advice.

Conjunctivitis.—Persons who "catch cold in their eyes," the eyes becoming reddened, "running water and matter," frequently apply poultices to their eyes, and the eyes are almost invariably made worse. Such persons should bear in mind the adage, "Poultices spoil eyes." The only application for such eyes until a physician can be consulted is water, warm, tepid, or cold, according to the sensibilities of the patient. The water may be rendered more soothing by the addition of one teaspoonful of common salt to the pint. Proprietary eye-washes should be avoided. If simple or catarrhal conjunctivitis is neglected, it is apt to go on to granular lids, an obstinate and dangerous disease.

Foreign Bodies.—If a cinder or speck of dirt lodge upon the eyeball or beneath the eyelid, the latter should be turned inside out and the irritating substance carefully removed by means of the corner of a handkerchief or a little flock of raw cotton twisted about the end of a small stick. Eyestones, so called, are to be avoided. If a foreign body, such as a bit of metal or stone, enter the eyeball, no time should be lost in consulting a physician, as it may be necessary in such cases to remove the eyeball containing the foreign body in order to avoid blindness from sympathetic inflammation of the fellow eye. The foreign body can sometimes be removed without destruction of the eye.

RULES FOR THE USE OF THE EYES.—(1) In reading, the book should be held at a distance of from twelve to sixteen inches from the eye. (2) A stooping posture should be avoided in reading and writing. It is better to read with the head erect, or thrown a little back, so that the circulation of blood may be free. (3) The position of the person reading should be such that the light may shine over the left shoulder upon the page. (4) Reading by insufficient light is bad. (5) Dark rooms and colored glasses should, as a rule, be avoided, except after certain operations upon the eye. (6) "Eye-sharpeners" and patent eye-salves should be eschewed as dangerous. (7) Blackboards, charts, diagrams, and large objects should be more constantly used in the machinery of schools, and thus the exercise of the eyes upon the printed or written page be greatly shortened. When the nearsightedness-rate in a school rises above 6 or 8 per cent. there is a grave fault somewhere—in the method of instruction, in the sanitary conditions of the school-room, in the home habits of the scholars, or in all combined. More teaching and less mere lesson-hearing is greatly needed in schools and colleges to arrest the alarming increase of eye diseases among the young.

C. R. AGNEW.

Ophthal′moscope [Gr. ὀφθαλμός, "eye," and σκοπεῖν, to "view"], invented by Heinrich Helmholtz, professor of physics in the University of Königsberg, in 1851. The discovery of the principles upon which this invention was based was the result of close observation, careful experiment, and mathematical calculation. "Its origin," says Zander (*The Ophthalmoscope*, 1864), "may be traced to successive endeavors to solve two problems—the first being why the eyes of men and animals sometimes shine with a

reddish lustre; and the second, why the interior of an eye more usually appears dark." Among those who aided in the solution of these problems may be mentioned the names of Prevost, Rudolphi, Gruithuisen, Esser, Hassenstein, Behr, Cumming, Brücke, Coccius, Méry, De la Hire, and Kussmaul. Since its invention this instrument has undergone numerous modifications. The most important of these was by a mechanician named Rekoss, who adjusted to it what is called the Rekoss disk. The latest improvements have consisted principally in modifications of this disk, and in adding to the number of lenses it originally contained.

Description of the Instrument.—The ophthalmoscope, in its simplest form, consists of a small circular mirror with a central perforation. That in most common use, Liebreich's, is a concave mirror of 8 inches focal length, with a central perforation about 1 line in diameter, mounted on a handle about 6 inches long. If we place back of this mirror a Rekoss disk, its margin set with numerous convex and concave lenses of suitable focal lengths, and so made to revolve that each of these lenses may be readily brought opposite to the central hole in the mirror, we have an ophthalmoscope of the most approved pattern.

Uses.—In examining the eye with the ophthalmoscope, the interior of the organ is illuminated by reflecting through the pupil, by means of the ophthalmoscopic mirror, the rays from an argand-burner placed a little behind and to one side of the patient's head, in such a position that the light falls upon his temple, but not upon the eye. If the observer thus illuminates the eye, resting the rim of the ophthalmoscope against his brow and looking through the hole in its centre, the pupil of the illuminated eye will appear red. This is the reddish reflex from the bottom of the eye. Let the observer now approach to within one inch, or less, of the eye he is examining, keeping the red reflex in view, and (there being no error of refraction or exercise of accommodation in either the observed or the observing eye) he will distinctly see a small portion of the fundus under an enlargement of some seventeen diameters. This is called the *direct* method, and the image seen is called the *virtual* erect or upright image. If the observer places his eye at a distance of twelve or fifteen inches from the observed eye, and, having obtained the red reflex, interposes a two-inch double convex lens at a little less than its focal distance from the eye, he will see a much larger portion of the fundus than by the method already described, but much less magnified, the enlargement being only about three diameters. This is called the *indirect* method, and the image seen is the *real*, inverted, aërial image. By these methods we may examine the crystalline lens, the vitreous humor, the optic nerve, the retina, and the choroid, and any deviation from a condition of health may be readily detected. The optical condition of an eye may also be determined by means of the ophthalmoscope, independently of the statements of the patient. This is of great advantage in examining the eyes of young children, as well as eyes that are partially or totally blind. In examining the interior of the eye for the causes of impairment of vision, we not infrequently find appearances which lead to the detection of grave diseases of other important organs, as, for instance, the kidneys and heart. Anomalies of refraction are also frequently discovered by means of the ophthalmoscope which would otherwise remain undetected, and by a suitable combination of spherical and cylindrical glasses good sight is restored.

Wonderful as are the results obtained by the use of this instrument, it is, nevertheless, a mistaken idea, now somewhat popular, that we can with it readily determine the state of the health of the brain. Light may be thrown by the ophthalmoscope upon the diagnosis of cases of tumor of the base of the brain and of inflammatory changes at the base of the brain. But inflammation of the optic nerve, a disease of frequent occurrence, is rarely accompanied by mental aberration. Many of the statements of those who profess to determine questions of insanity by the use of the ophthalmoscope as a method of ascertaining the vascular condition of the brain, are entirely destitute of scientific basis. DAVID WEBSTER.

O'pie (JOHN), b. at St. Agnes, near Truro, England, in 1761; gave proofs of artistic talent in childhood which attracted the attention of Dr. Wolcott of Truro ("Peter Pindar"), by whom he was carried to London; acquired great fame by his skill in portraiture; was called the "Cornish wonder;" received from leading members of the nobility more commissions than he could execute; acquired a handsome competence; married the daughter of a wealthy pawnbroker, from whom he was soon divorced; married as his second wife (1798) Miss Alderson, a celebrated authoress; devoted himself successfully to severe study to correct the defects of his earlier style of painting, which were now sufficiently obvious; produced several admired historical pictures; became professor of painting at the Royal Academy 1806, and commenced a series of lectures Mar., 1807, but d. at London, before completing the first course, Apr. 9, 1807. Four *Lectures* were published, with a memoir by his widow, in 1809.—His wife, AMELIA ALDERSON OPIE, b. at Norwich Nov. 12, 1769, acquired a great reputation by her delineations of English home-life in a series of novels long since forgotten; joined the Society of Friends after her widowhood. D. at Norwich Dec. 2, 1853.

Opisthobran'chiates [ὄπισθε, "behind," and βράγχια, "gills"], a name given to certain gasteropods, distinguished by the posterior position of the gills. (See GASTEROPODS, and also NUDIBRANCHIATA and TECTIBRANCHIATES.)

Opisthocom'idæ [after *Opisthocomus*—ὄπισθε, "behind," and κόμη, a "lock of hair"—the only genus], a family of birds represented by a single S. American species, concerning whose affinity great doubts and much diversity of opinion have prevailed. In form it resembles a small pheasant about as much as any other bird; the head is moderate and feathered, except round the eye, and provided with a recurved crest (whence the name); the bill is moderate, rather broad at the base, with the culmen decurved towards the tip, over the lower mandible; the gomys of the latter is short, ascending, and terminates in a strong angle posteriorly; the nostrils are lateral, sub-median in the bill, round, and enclosed in a membrane; the wings have their quills graduated towards the sixth and longest; tail lengthened towards the middle; legs with robust tarsi, which are covered by reticulated scales, and with the toes long and slender; the posterior insistent or on a level with the anterior; the claws long and rather curved. By some writers this form has been referred to or near the Musophagidæ, or plantain-eaters, and by others to or near the gallinaceous birds or between the pigeons and typical Gallinacea. The most recent and elaborate exposition of its affinities has been published by Prof. Huxley, who appears to have demonstrated that it is on the whole most closely related to the gallinaceous types, but marked by its peculiarities as a type of an independent group or superfamily (Heteromorphæ) of equal rank with the Gallinacea (Alecteromorpha), pigeon-like forms (Peristromorphæ), and Pteroclomorphæ. The skull most resembles that of the gallinaceous birds, and especially in the imperfect development of the maxillo-palatines, the femur that of the pigeons; the leg is also like that of the pigeons in the femur and tarso-metatarsus; "the last very closely resembles that of the pigeons, though the form of the distal articular surface of the metatarsal of the hallux is more like that of corax;" the pelvis is quite different, and the sternum and its appendages peculiar. The only known species (*O. cristatus*), known under the name hoatzin, lives in small troops on or near the banks of rivers, which, when alarmed, fly for a short distance to a tree, on the branches of which they huddle close together. They feed by preference on the leaves of an arum tree (*A. arborescens*), which imparts to their flesh a strong musky smell. (See Huxley, *Proc. Zool. Soc.*, London, 1868, pp. 304–311.)
THEODORE GILL.

Opisthomes, a recently created order of the typical fishes or TELEOSTS (which see).

Opisthomi [ὄπισθε, "behind," and ὦμος, "shoulder"], an order of fishes of the sub-class of teleosts, distinguished by the separation of the shoulder-girdle or scapular arch from the head, and its consequent posterior position, whence the name. The skull has its several bones developed in nearly the same manner as the ordinary Teleocephali; the supraoccipital projects forwards between the parietals; the jaws are normally developed, the maxillary arch being bounded above by the premaxillary, and at the sides by the supramaxillary bones; a distinct symphitic bone exists; the branchial apparatus is complete, the superior branchihyal and pharyngeal bones ossified, four superior pharyngeals, three basal branchihyals, and a pair of inferior pharyngeals being developed; the scapular arch is entirely dissevered from the connection exemplified in most fishes, and (in some cases at least) is connected with the anterior vertebræ; the mesocoracoid is absent; no interclavicles are developed; the ventral fins either abdominal (the pubic bones being far removed from the scapular arch) or wanting. The order is represented by two families, Mastacembelidæ and NOTACANTHIDÆ (which see).
THEODORE GILL.

O'pitz (MARTIN), b. at Bunzlau, Silesia, Dec. 23, 1597; studied at Frankfort-on-the-Oder and Heidelberg; lived as secretary, historiographer, court-poet, diplomatic agent, etc. at the courts of the duke of Liegnitz, Bethlen Gabor of Transylvania, Karl Hannibal of Dohna, the emperor Ferdinand II., Ladislaus IV. of Poland, etc., and d. of the plague at Dantzic Aug. 20, 1639. He wrote several large poems, among which the *Trostgedanken in Widerwärtigkeit-*

en des Kriegs is the best, and he enjoyed a great fame as a poet. Nevertheless, his poems cannot be read now without weariness: they belong to that kind of poetry which originated with the revival of letters in Europe, and which generally was written in Latin or Greek, produced by scholars and formed in close imitation of classical models. But Opitz wrote in his vernacular tongue; bestowed great attention, knowledge, and taste on the use of the German language; established the metrical system, employed after him in all Teutonic languages, weighing syllables according to their accentuation, instead of simply counting them; founded a school of educated men who extended his views: and thereby gained the title of the "Father of German poetry."

O'pium [Gr. *ὄπιον*, "poppy-juice"], a well-known drug, being a concrete juice obtained from the unripe capsules of the poppy (*Papaver somniferum*). Opium has been known as a drug from a remote period, distinct accounts of its collection as a branch of industry in Asia Minor being found in the writings of Dioscorides, about the year 77 B. C. From the countries bordering on the Mediterranean the use of opium was carried East throughout Asia, probably by the Arabians. Though the poppy is naturalized as a garden flower in Europe and America, yet opium is produced as an article of commerce only in India, Persia, Egypt, and Asia Minor. Our own market is supplied almost exclusively from the latter locality through Smyrna and Constantinople. China is supplied partly by importation from India and Asia Minor, and partly by her own production. Opium is obtained by making a shallow horizontal incision in the unripe poppy-head a few days after the fall of the petals. This is done in the afternoon, and the milky juice that oozes from the cuts is scraped off next morning and made into lumps of varying size, ranging in weight from an ounce to several pounds. Good Turkey opium is a hard, tenacious solid of compact texture and a reddish-brown or fawn color. It has a strong, peculiar odor and a rather bitter, somewhat acrid, taste. Opium is an exceedingly complex body. Its medicinal virtues reside in certain alkaloids, of which *morphine* is the most important, as it occurs in greatest quantity and most perfectly represents the properties of the crude drug. This alkaloid was discovered by Sertürner, an apothecary in Hanover, in 1816. It exists in opium combined with a peculiar acid called *meconic*, and in good Turkey opium is found in the proportion of from 12 to 15 per cent. Pure morphia is in small, colorless, shining crystals—is inodorous, but of a bitter taste. It is almost wholly insoluble in water, but its salts are readily soluble, and hence are used in medicine in preference to the pure alkaloid. The acetate, sulphate, and chloride (muriate) are officinal in the U. S. Pharmacopœia. The other alkaloids of opium known to affect the human system are *codeine*, *narceine*, and *papaverine*, but besides these no less than twelve others have been obtained from the drug. For various reasons these seem to be only chemical and physiological curiosities. The most interesting are *thebaine* and *cryptopine*, which by experiments on the lower animals are found to produce effects quite opposite to those of opium or the alkaloids of the morphine type on man. Thus, thebaine produces simply violent tetanic convulsions, and cryptopine wild delirium with *dilated* pupils. Besides these sixteen alkaloids, a neutral principle, *meconine* or *opianyl*, and pectine, albumen, mucilage, sugar, and wax are all constituents of opium. The effects of opium upon the animal system are as complex as the composition of the drug, and cannot be summarized in any single expression. In general, the influence of the drug falls upon the nervous system, the symptoms being all functional nerve-disturbances, and these prove by their peculiar character that, in kind, the opium influence is a conjoint irritation and paralysis. The resultant clinical effect of this singular duplex influence varies in different parts of the nervous system, and also is modified by circumstances of dose, individual idiosyncrasy, temperament, habit, etc. The symptoms produced by opium under ordinary circumstances are briefly as follows: With a small dose there is little experienced beyond relief from any feelings of discomfort that may be present at the time of taking. Physical fatigue, mental exhaustion or distress, small pains and aches, hunger, etc. all tend to disappear, leaving a feeling of general comfort, calm, and peace. When these effects have passed away there may be some little tendency to loss of appetite, coated tongue, slight headache, and constipation, as after-results. With larger quantities the feeling of relief from discomfort is speedily succeeded by the characteristic feature of opium narcosis —namely, a conscious intellectual dulness, accompanied by a drowsiness, which upon every opportunity casts the subject into a state of unconsciousness analogous to ordinary sleep in very many respects, but differing from it in certain others. When thus affected the perceptive cerebral centres are plainly blunted, since a pre-existing severe pain will now not be so acutely felt. After a number of hours, varying with the dose, the taker awakes to a feeling of general misery, with disordered stomach, dry coated tongue, headache, and constipated bowels. Indeed, under the opium influence all the natural secretions, save that of the skin, tend to diminish. But all these symptoms vary widely according to many circumstances, most notable of which is the influence of temperament or idiosyncrasy. Thus, many persons of very "nervous" temperament, instead of experiencing calm followed by drowsiness, are thrown by opium into a state of morbid wakefulness with excessive agitation, their minds being filled with horrible imaginings. So great is the distress experienced that persons thus affected will endure almost any pain rather than seek relief from opium. Others, of highly imaginative temperament, like the Orientals, pass into a beatific state of mind, with pleasing fancies and visions of delicious and gorgeous imagery, as so graphically described by De Quincey. But with matter-of-fact Americans these tempting effects are rarely produced, simple progressive stupefaction being the whole expression of the cerebral influence of the drug. Still others, especially among children, manifest a strong convulsive tendency, which may even culminate in severe general convulsions, with tetanic rigidity of the whole body. And it is interesting to note that in some of the lower animals, as in frogs, tetanus is the normal expression of the opium influence. Intolerable itching of the whole skin, vomiting, syncope, are severally other abnormal effects of opium occurring in certain individuals. The influence of bodily state and habit upon the effects of the drug is truly astonishing. In severe pain, in the prostration from great loss of blood, and other morbid states, the relation between dose and effect changes so that quantities fatal in health may produce no more than a mild opium influence. Precisely the same result follows the habitual taking of opium, and confirmed opium-eaters often take in a day enough to kill ten or twenty ordinary persons. Of the alkaloids, the effects of morphine differ only in minor points from those of crude opium, and those of narceine and codeine also conform to the same general type. The properties of papaverine are not yet thoroughly known. But none of these alkaloids compare with morphine in power or general usefulness. Large doses of opium or morphine may be fatally poisonous, though many circumstances conspire to make the effects exceedingly uncertain, such as vomiting or non-absorption of the whole quantity taken. Enormous draughts of opiates, administered with deadly intent, are therefore often recovered from. But generally four grains of opium or their equivalent are reckoned as a dangerous quantity, and five grains have killed. The salts of morphine are estimated as six times more powerful than the same quantity of opium. Children, it must be remembered, are proportionately more susceptible to the poisonous effect of opium than adults. The prominent symptoms of opium-poisoning are deep coma, with flushed or pale and ghastly face, contracted pupils, slow, stertorous breathing, and slow, full pulse. Death occurs from stoppage of breathing through paralysis of the "respiratory centre" in the brain. The treatment, after evacuation of the poison left in the stomach through emetics or the stomach-pump, is especially directed towards keeping up the breathing. For this end the great desideratum is to keep the patient from sinking into stupor. Hence he is to be aroused by any means, however rough, such as the cold douche, forced walking, shouting, thrashing, and the like. If he can swallow, strong coffee is to be given freely. If in spite of all means he sink into coma and the respirations begin to fail, artificial breathing and hypodermic injections of atropine (a powerful excitant of respiration) are to be cautiously employed. No case should be given up till actual death. Opium is used as a medicine, and also, but principally among the Orientals, as an article of luxury and debauch. In India, besides its use as a mere luxury, the drug is much employed in non-narcotic doses simply to sustain the strength in lieu of food and sleep during hard physical work. In China opium is consumed to an enormous extent by all classes, the mode of taking it being to smoke an aqueous extract in a peculiarly formed pipe. Opium-smoking began in China in the latter half of the seventeenth century, and in spite of all government efforts to prevent it rapidly spread till it may now be called a national practice. China thus consumes nine-tenths of all the opium exported from India, besides considerable from Asia Minor, and the whole of that produced within her own dominions. In medicine opium and morphine fulfil a variety of purposes, some of which could hardly be divined from the effects of the drug on the healthy system. These may be summarized as the support of life, and invigoration and maintenance of the heart's action in cir-

cumstances of great prostration and where ordinary food cannot be digested; the cure or relief of pain, spasm, and general nervous irritability; the induction of sleep; repression of excessive secretion, as in diarrhœa, and curative influence of an unknown character in certain inflammatory diseases. In the fulfilment of most of these indications the induction of the physiological narcotic effects of opium is both unnecessary and harmful. The pharmaceutical preparations of opium are very numerous: the two most familiar are *laudanum*, a simple tincture of opium, of which thirteen minims (about twenty-five drops) is the equivalent of a grain of opium; and *paregoric*, a camphorated tincture, compounded of opium, camphor, benzoic acid, oil of anise, honey, and dilute alcohol. Half a fluid ounce of this tincture represents very nearly the virtues of a grain of opium. The salts of morphia are also very largely used, and their administration in solution by hypodermic injection has in certain circumstances advantages over opiates given by the mouth. EDWARD CURTIS.

Opobalsamum. See MECCA BALSAM.

Opodel'doc, the common name of the "camphorated soap liniment" of the *U. S. Pharmacopœia* of 1850. It is compounded of common soap, camphor, oil of rosemary, oil of origanum, and alcohol. When cold, it has the consistence of a soft ointment. It is essentially the same thing as the "soap liniment" of the present *Pharmacopœia*, and may be used as an anodyne and gentle rubefacient application in sprains, bruises, etc. EDWARD CURTIS.

Opop'anax [Gr. ὀποπάναξ], the inspissated juice of the *Pastinaca opoponax*, a plant closely resembling the common parsnip. It is a fetid gum-resin, resembling assafœtida in its powers, but much feebler. It has a very limited use in medicine. The best comes from the Levant.

Opor'to, city of Portugal, capital of the province of Entre Minho e Douro, is situated on both sides of the Douro, 2 miles from its mouth. The entrance into the Douro is difficult on account of a shifting sandbank in its mouth, but at Oporto it forms an excellent harbor, lined with elegant quays and crossed by many beautiful bridges. Oporto is one of the most picturesque cities in the world, built on a steep acclivity, which it climbs through terraces covered with strikingly colored houses. Some of the streets are narrow, crooked, dirty, and so steep that no carriage can pass through them, but others are broad, airy, clean, and lined with magnificent houses. Its manufactures of gold and silver ware, glass, pottery, leather, linen, woollen, silk, and cotton fabrics are not unimportant; upwards of 6000 people are employed in its industrial establishments. But its chief importance Oporto derives from its commerce. In 1857 the value of its imports amounted to 46,529,000 francs, and that of its exports to 39,984,000 francs. Its trade is chiefly with England and Brazil, and the principal article of exportation is wine, the so-called port wine, red and white, of which 40,483 pipes in 1866 and 34,679 pipes in 1867 were exported to Great Britain. Pop. 89,194.

Opos'sum [a word derived from the American Indians], the name of the *Didelphis Virginiana* and other animals of the same genus, North and South American marsupial mammals of the family Didelphidæ. The common opossum of the U. S. is found in most of the States, except in New England, where no opossums exist, and in Texas and the Pacific States, where the smaller *D. Californica* takes its place. These animals have a well-developed pouch, a prehensile tail, and a remarkable habit of feigning themselves dead when captured. The opossum is much relished as food. It is omnivorous, and about the size of a large cat. There are numerous South American species, some of them with no pouch. The skins have become an important article of commerce.

The Common Opossum.

Op'peln, town of Prussia, province of Silesia, on the Oder, has some manufactures of linen, leather, pottery, and tiles, and an important trade in timber and cattle. Pop. 11,879.

Op'penheim, post-v. and tp., Fulton co., N. Y., has several cheese-factories. Pop. 1950.

Op'pert (JULES), b. July 9, 1825, at Hamburg, of Jewish parentage; studied first law at Heidelberg, then Oriental languages at Bonn and Berlin, where in 1847 he published *Das Lautsystem des Altpersischen;* was appointed professor in German at the lyceum of Laval in 1848, and at that of Rheims in 1850; accompanied the scientific expedition to Mesopotamia, sent out in 1851 by the French government, and was appointed professor in Sanskrit at the schools of the national library in 1857, devoting himself chiefly to the study of the cuneiform inscriptions. His principal works are—*Les Inscriptions des Achéménides* (1852), *L'Expédition scientifique de France en Mésopotamie* (1858–64), *Grammaire sanscrite* (1859), *Grande Inscription du Palais de Khorsabad* (1864), *Histoire des Empires de Chaldée et d'Assyrie* (1866), *L'Immortalité de l'Âme chez les Chaldéens* (1875).

Oppia'nus, b. at Anazarba, Cilicia; flourished in the latter part of the second century of our era, and is the author of a didactic poem on fishing, Ἁλιευτικά, in 3500 Greek hexameters. Another didactic poem on hunting, Κυνηγετικά, containing a little over 2100 Greek hexameters, but much inferior in style to the former, was for a long time ascribed to Oppianus, but is now generally believed to have been written by a younger poet who bore the same name. Editions of both poems by J. G. Schneider (Leipsic, 1813) and Lehrs (Paris, 1846).

Op'pido Mamerti'na, town of Southern Italy, province of Reggio di Calabria, in an unhealthy position at the root of the Aspramonte. The old town, not on the present site, was entirely destroyed by an earthquake in 1783. It is a bishop's see. Pop. 6494.

Op'tics [Gr. ὀπτικός; pl. τὰ ὀπτικά, "things relating to vision"], the science which treats of light and vision. The subject admits of being considered from two points of view. 1. The laws and properties of light, as ascertained by observation, may, by applying the principles of pure geometry, be employed to explain the phenomena; or, 2. A definite theory having been adopted in regard to the nature of the luminiferous medium, the phenomena may be expounded as the necessary consequences of their assumed physical cause. In the first aspect, the several branches into which the subject naturally divides itself are considered in this work under their appropriate heads, as REFRACTION, REFLECTION, DISPERSION, SPECTRUM, DIFFRACTION, RAINBOW, POLARIZATION; THIN PLATES, COLORS OF; DOUBLE REFRACTION, etc., and the titles of the several optical instruments; and in the second under LIGHT, INTERFERENCE, UNDULATION, UNDULATORY THEORY, VIBRATION, etc. The present article will be confined to a brief outline of the history of optical discovery.

A notion was for a very long time prevalent among the ancients that vision is effected by means of rays proceeding from the eye to the object. This idea is not found in Aristotle, but it was introduced into the school of Plato, and continued to be received for many centuries. The persistency of the doctrine is remarkable, inasmuch as the light which is self-evidently indispensable to vision proceeds from sources foreign to the observer. The element-

ary phenomena of reflection and refraction suggest a natural division of the science of optics into two principal branches; and this distinction is made by the earliest systematic writer on the subject whose works have descended to us. This was Euclid, supposed to have been the geometrician of that name, who lived about 300 years before our era. The general laws which govern the reflection of light, being comparatively easy of detection, were stated by him with tolerable correctness; but what he has written on refraction is of little value. Ptolemy, the astronomer of Alexandria, who was born about the year 70 of our era, attempted to discover the law of refraction by experiment. His apparatus was ingenious, and was not different in principle from that which has been employed by Silbermann, Soleil, and others, in our own time, for the same purpose. He measured the angles of refraction corresponding to various angles of incidence, between 0° and 90°, for both water and glass, and left his measurements recorded in his *System of Optics*. We may judge of the degree of accuracy attained by him by comparing the indices of refraction (see REFRACTION, INDEX OF) deducible from his determinations with those of the same bodies fixed with severe exactness by more modern observers. The ascertained index of refraction for water is 1.33582. If we make a computation of its value from the measured angles of Ptolemy, we find a mean of 1.30147. But if we take his measurements at the incidence of 50°, where the relative variations of the angles of incidence and refraction are most marked and most easily measured, we obtain 1.33555, which is exceedingly near the truth. The true index of refraction for glass is between 1.48 and 1.60, according to the materials and density. Crown glass varies from below 1.50 to about 1.525. Ptolemy's mean determination would be 1.484. But at 50° he approaches nearer the truth, his angles giving 1.5321. For rays passing from water to glass the relative index computed from his measurements would be 1.1390, the true being 1.14145. The near agreement of these numbers with modern determinations is remarkable, especially considering that Ptolemy's measures are given only to the nearest half degree. Ptolemy was unable, however, to derive any practical advantage from these results, since the magnitude of the angles seemed to be governed by no law which he could detect, and in this unsatisfactory condition the whole subject of refraction remained for the fifteen succeeding centuries. As an astronomer, Ptolemy could hardly fail to notice the effect of atmospheric refraction upon the apparent positions of the heavenly bodies; and he has the merit of having recognized the fact, which others after him disputed, that the displacement is always in a vertical plane, and also that it attains its maximum in the horizon and is zero in the zenith. About half a century later than Ptolemy flourished Claudius Galen, the celebrated Greek physician. In a treatise on the uses of the members of the human body he speaks at some length of the phenomena of vision, and lays down the fundamental law, on which the stereoscope has been very recently constructed, that the picture which we see of a solid body is made up of two pictures dissimilar to each other, one seen by each eye separately.

But it was impossible that optical science should make any important progress so long as the law which determines the path of a ray in passing from one medium to another remained unknown. We are compelled, therefore, to descend to the earlier portion of the seventeenth century before we find a practicable ground on which to build a systematic science. In 1626, Willebrord Snellius, professor of mathematics at Leyden, died at an early age, leaving behind him manuscripts, among which was contained a statement of the important law in question, which he expressed as follows: When a ray passing from one medium to another undergoes refraction at the common surface, the ratio of the co-secant of the angle of incidence to the co-secant of the angle of refraction is constant. As the co-secants of angles are inversely as the sines of the same angles, the law may be more conveniently expressed by saying that, in the circumstances supposed, the *sines* of the angles mentioned are in a constant ratio. It was in this form that the law was first published by Descartes, eleven years after the death of Snellius. It is, therefore, frequently referred to as the law of Descartes. It may be proper to mention that, previous to the discovery of this important law by Snellius, it had been remarked by the illustrious Kepler that for incidences below 30° a ratio almost constant exists between the angles of incidence and of refraction themselves. This is true, because for small angles the increments of the arc and of the sine are nearly proportional. But when the incidence is moderately large, the divergency of the two ratios becomes very wide.

The next important step in the progress of optical discovery, after the detection of the general law of refraction, was made by the illustrious Newton, who in 1672 communicated to the Royal Society the experimental researches by which he established the compound nature of light and the unequal refrangibility of its component rays. He held that the common white light of the sun is made up of elementary rays differing at the same time in color and in refrangibility. The number of tints which he considered sufficiently distinct to be regarded as independent components is seven. It seems unnecessary, however, to suppose the existence of more than three elementary colors, it being possible, by mingling these in various proportions, to produce all the rest, while the degrees of refrangibility between the extreme limits vary through an infinite number of infinitely small differences. This phenomenon of the separation of the component colors of light by refraction has been called *dispersion*. Newton was of opinion that the dispersive powers of all bodies are equal, or, in other words, proportional to their refractive powers, and that, the mean refractive powers of two bodies being equal, their refractive powers for each particular color must be equal also. Both these suppositions were ascertained by subsequent discovery to be incorrect.

The dispersion of light by refraction furnishes an easy explanation of the interesting natural phenomenon of the rainbow. This beautiful meteor had before Newton's time been the subject of many unsatisfactory speculations; and though De Dominis, as early as 1611, had conceived a true theory of the manner of formation of the inner bow, he had not been able to account for its colors. He showed that there is a certain incidence at which, if the parallel rays of the sun fall upon the anterior surface of a transparent globe, they will be reflected from within so as to emerge, still parallel to each other, at a point on the other side of the centre. The emergent rays will form a constant angle with the incident rays, and, entering the eye of the observer standing with his back to the sun, will form the same angle with a line supposed to be drawn from the sun through the eye. This line from the sun through the eye being made an axis, and the above supposed reflected ray being revolved around it, there will be traced out in the heavens a circle, from every part of which, if raindrops are present, there will come an amount of light above that which is reflected from the surrounding cloud. This explanation satisfactorily determines the *locus* of the bow, but it fails to account for its tints or the extent of surface over which they are spread. It would require that the arc should be white, and that it should be no broader than the sun; that is to say, that its breadth should be only about half a degree. The actual breadth of the inner bow is, however, two degrees and a quarter, and that of the outer three degrees and three-quarters. Newton's discovery furnished the necessary supplement to the theory.

In 1665 there was published at Bologna a posthumous work by Francis Maria Grimaldi, an Italian Jesuit, in which were for the first time described certain phenomena now very familiar under the name of *diffraction*. He stated that if any very small object be placed in a pencil of divergent light, admitted through a minute aperture into a dark room, its shadow will appear materially larger than it ought if light passes its edges in straight lines, and, moreover, that any opaque object, large or small, exhibits along the edges of its shadow a border of at least three distinctly tinted fringes, the brightest and broadest of which is next the shadow. He also observed that when two minute pencils of light are admitted through apertures very near to each other, the screen on which the blended pencils fall, and which, as he supposed, ought to be uniformly illuminated with a light equal to the sum of the two intensities, is streaked with lines absolutely dark. He was led by this observation to announce the paradoxical proposition that there are circumstances in which the union of two rays of light produces darkness. Bold as this announcement must have originally appeared, the progress of scientific discovery has fully confirmed its truth. This phenomenon, being attributed to the bending of the rays of light in the immediate vicinity of the opaque body, was distinguished by the name *inflection* or *diffraction*. It was carefully studied by Newton and others, and has occupied a prominent place in all the discussions which have since arisen in regard to the nature of light.

Not far from the time of the discovery of Grimaldi, just mentioned, the attention of the scientific world was called to a case of new and extraordinary refraction observed to take place in crystals of carbonate of lime—a species of refraction which, from the circumstance of its dividing an incident beam into two beams entirely distinct, or of presenting two images of any object seen through the crystal, has been called *double refraction*. The first publication on this subject was made by Erasmus Bartholinus, a physician of Copenhagen, who gave to the mineral the name of Iceland spar, from the circumstance that his specimens

had been obtained from that island. It is now known that this property of double refraction is exceedingly common, being possessed by most crystallized bodies, and capable of being produced, transiently or permanently, in any transparent solid whatever, whether organic or mineral, in which it does not naturally exist. It is only in Iceland spar, however, that it manifests itself in a degree remarkable enough to attract the attention of a casual observer, and in most cases it can only be detected by special arrangements. Soon after his announcement of the compound nature of light, Sir Isaac Newton made public the results of his ingenious investigations in regard to the colors exhibited by *thin plates* of transparent substances, such as soap-bubbles, films of moisture upon glass and upon polished opaque solids, laminæ of air confined in fissures of transparent minerals, etc. He showed that the tints displayed by such thin plates, when viewed in common light, depend upon three conditions, viz. the thickness of the plate, its refracting power, and the obliquity under which it is viewed.

The next important step in the progress of optical science was the discovery of the progressive motion of light and the determination of its velocity. Though every theory which had ever been suggested to account for the phenomena of light presumed that there must be a progress from the luminous origin, and therefore that time must be an element in the solution of every optical problem, still so nearly instantaneous are all the effects produced at the distances to which our ordinary observation extends as apparently to render hopeless any plan for experimentally determining the velocity. This circumstance rendered the efforts made by the celebrated Galileo and by the academicians of Florence to settle the question completely nugatory. The method of proceeding adopted by Galileo was to place himself upon an eminence opposite to an assistant observer something more than a mile distant, both being provided with lanterns which could be darkened by a slide. The lights being arranged, Galileo darkened his lantern, and the assistant, immediately on noticing its disappearance, darkened his also. Apparently both were extinguished at the same instant. The Florentine academicians repeated the experiment, increasing the distance between the stations, but the result was the same. The problem remained unsolved; but its solution came at last, when demanded by the exigencies of a higher branch of science. In 1675, Roemer, an astronomer of Copenhagen, in his observations upon the eclipses of the first satellite of Jupiter, became perplexed by irregularities for which he could conceive no means of accounting. It was suggested by Dominic Cassini that these difficulties might perhaps be removed by supposing that the time occupied by light in passing through the vast distance between Jupiter and our planet may be large enough to be appreciable, and therefore that, as our distance varies, this time must vary also. Assuming this hypothesis to be true, and that the epoch on which our computations of future eclipses are founded is the date of some eclipse actually observed when the two bodies were occupying their points of nearest approach, it will follow that if the accuracy of the determination is affected only by the motion of light, all subsequent eclipses, observed when the distance is the same as at the epoch, will agree with the prediction, and all others will be in retardation by an amount of time equal to that which light requires to pass over the space by which the distance has been increased. In like manner, if the epoch had been an eclipse observed in the position of greatest distance between the bodies, subsequent eclipses would be in advance of the prediction; and if the epoch had been an observation made from some position intermediate between the points of greatest and least distance, the eclipse afterwards occurring would be sometimes in advance and sometimes in retardation. The test of the correctness of the hypothesis would be a careful comparison of the observed irregularities of time with the variations of distance—a comparison involving no slight labor. Cassini, with whom the idea originated, seems to have abandoned it, but Roemer followed it up with such perseverance as at length conclusively to establish its truth. He demonstrated that the time occupied by light in passing over the entire diameter of the earth's orbit is 16 minutes and 26 seconds. But at that period the dimensions of the earth's orbit were not accurately known, and this determination was insufficient to fix the absolute value of the velocity of light. Assuming the sun's mean parallax to be 8.88″, the mean diameter of the orbit must be about 184,000,000 of miles, and this number, divided by 986, the number of seconds in 16 minutes and 26 seconds, gives for the velocity in miles 192,700. The velocity of light has, since the time of Roemer, been ascertained, with a probably near approximation to the truth, by other independent methods, and the results of all these are substantially in harmony, 187,000.

The next discovery of importance in the progress of optical science was made near the close of the last century by Dr. Wollaston in his observations upon the prismatic spectrum. He discovered that by employing a pencil of light very narrow in the direction of the plane of refraction, but broad parallel to the axis of the prism, five well-defined dark straight lines could be distinguished crossing the spectrum at right angles, and maintaining invariably the same positions relatively to the colors. This number he afterwards increased to seven. These lines may very easily be distinguished by holding a prism near the eye, parallel to any small fissure through which light makes its way into a dark room. By aiding the eye with a telescope the number discovered becomes surprisingly great. M. Fraunhofer of Munich enumerated 590, and Sir David Brewster afterward increased this number to 2000. The eight principal lines are distinguished by the letters A to H, of which the line A is at the beginning of the red and the line H about the middle of the violet. The positions of these lines being definitely fixed among the colors of the spectrum, they furnish valuable aid in comparing the refracting powers of different bodies, and have served to reveal the fact that bodies whose *mean* refractive powers are equal do not always equally refract the several elementary rays. The line A is not among the most easily discernible, but Sir David Brewster has discovered others in the almost imperceptible light below A, and Sir John Herschel, and especially Prof. Stokes, have discovered many others still beyond the violet. By his curious discovery of *fluorescence*, or the property possessed by some substances of rendering sensible to vision rays beyond the limit of the ordinary spectrum, Prof. Stokes has, in fact, quadrupled its length.

In the year 1808 the French Academy of Sciences proposed the problem of the double refraction of light as the subject of a prize to be awarded two years thereafter. The successful competitor for this prize was Malus. To him is due the polarization of light by reflection. He was led to this remarkable discovery by an accident. In observing, through a prism of Iceland spar, the light reflected to his windows from those of the palace of the Luxembourg, he was surprised to see that, as he turned the prism around the ray, one of the two images vanished at every quarter revolution. By following up the indication thus given, he arrived at the important law that when light is reflected from glass at an angle of 54° 35′, or from water at an angle of 52° 45′, it possesses all the properties which belong to the pencils into which a ray of ordinary light is divided by a double refracting crystal. This remarkable condition of light was distinguished by the name *polarization*. It was the conclusion of Malus that the angle of polarization of a given body is independent both of its refractive and of its dispersive power. Dr. Brewster, however, demonstrated that this angle depends on the refractive power, and is connected with it by the law that "the index of refraction of any body is the tangent of the angle of polarization."

A remarkable fact in regard to the condition of light emitted at great obliquity from luminous solids or liquids was discovered by M. Arago. Whenever the light of an incandescent body of either of these classes is examined as it proceeds directly from the body and with no great inclination to the luminous surface, it is found to be unpolarized. But when the rays whose obliquity to the surface is very considerable are the subject of examination, they are found to be partially polarized. The inference is that these rays have been polarized by refraction, and hence that they must have originated beneath the surface of the luminous body. The light of flames and incandescent gases exhibits no such polarization. The light of the sun is always unpolarized, whether it be examined at the limb or at the centre of the disk. From this observation Arago was led to consider the luminous envelope of the sun to be gaseous, and not liquid or solid, thus corroborating incidentally the ingenious suggestion of the elder Herschel in regard to the constitution of the solar photosphere.

In the year 1811, M. Arago communicated to the Academy of Sciences of Paris one of the most remarkable and beautiful discoveries which has ever been made in the history of optics. Upon examining thin plates of certain transparent crystals, such as mica, selenite, or quartz, by means of transmitted polarized light, he found that when the light was received upon the eye through a prism formed of Iceland spar, the richest conceivable colors made their appearance, which were complementary to each other in the two images, and which varied in intensity with the azimuth of the laminæ or of the prism. The colors thus seen in crystalline laminæ recur in several successive series as the thickness of the laminæ is increased. Another class of chromatic effects produced by crystalline plates viewed in polarized light was first observed by Dr. Wollaston in

Iceland spar, in which the display is perhaps the most brilliant. In these cases the crystal is cut perpendicularly across the axis. In examining plates of quartz cut across the axis as above described, M. Arago observed a peculiarity of a remarkable kind, which is scarcely found in any other natural crystal. The centre of the field was not dark in any position of the analyzer, but was deeply and uniformly colored with a tint which varied as the analyzer was turned. When a bi-refringent prism was employed as an analyzer, the two images seen were constantly complementary in color, and as the analyzer was turned they ascended in tint, in the order of Newton's scale, from red to violet. M. Biot in subsequent experiments discovered that in some crystals the ascent of the tints in the scale is produced by a right-hand rotation (the ordinary direction of a screw), and in others, by a left-hand rotation. These classes of crystals have been distinguished by the names right-handed and left-handed crystals, or *dextrogyre* and *lævogyre*. The peculiar kind of polarization produced by quartz has on this account been called *rotatory* polarization. The physical cause of rotatory polarization is unknown. M. Biot supposed it to belong to the ultimate molecules of the substance, but this hypothesis Sir David Brewster believed to be disproved by the fact that the property ceases to appear in quartz whose crystalline structure has been destroyed by fusion.

In the prosecution of his investigations, Sir David Brewster arrived at the discovery that the polarizing structure could be artificially produced in glass by heat or by rapid cooling; that this effect is transient when the heat is below the point of softening or fusing the substance; but that when it is carried beyond that point, and cooling rapidly follows, as in glass which is not annealed, the structure is permanent. He found that the same structure could be produced by pressure, by torsion, by tension, or by flexure, and traced the transient condition of the same kind produced by heat to the mechanical effects of unequal expansion. Any solid transparent substance, organic or mineral, was found by him to be capable of receiving this structure transiently or permanently. Among these may be named horn, indurated jellies, tortoise-shell, gums, resins, the crystalline lenses of fishes or animals, etc. etc.

In the year 1815, M. Biot made the remarkable discovery that many liquids possess the power of rotatory polarization—a discovery which was independently made by Mr. Seebeck; the effect was first observed in oil of turpentine, but has since been found in most essential oils, in solutions of sugar, dextrine, the vegetable alkaloids, camphoric and tartaric acids, and the tartrates. In some of these substances the plane of polarization is turned to the right and in others to the left. M. Arago early made the discovery that the light which comes to us from the atmosphere is polarized. Observations made in the vertical plane passing through the sun show sensible polarization in that plane up to about 150° from the luminary—a point which can only be observed, therefore, when the sun is low. The polarization at this point becomes zero, and it is hence known as Arago's neutral point. Below this point down to the horizon polarization is found in a horizontal plane. M. Babinet discovered a second neutral point 17° above the sun, and Dr. Brewster a third, 8° 30′ below. Neither of these is easy of observation, in consequence of the proximity of the sun himself and his great light.

Regarding atmospheric reflection of the sun's rays as the cause of atmospheric polarization, it will follow that every plane passing through the sun (in the superior portions of the atmosphere at least) must be a plane of polarization. This will, therefore, be true of the *hour-circle*, or meridian, in which the sun happens at any time to be; and as all hour-circles pass through the pole of the heavens, it results that a delicate polariscope, directed toward the pole, may follow the horary motion of this plane. Such a polariscope, furnished with a dial and index, becomes a chronometer. This is the principle of an elegant little instrument invented by Wheatstone, called the *polar clock*. When accurately adjusted, it will indicate, in the hands of a practised observer, the apparent solar time within a very few minutes. It will operate even when the sky is overcast with clouds, provided there be an unobscured spot at the pole through which the blue sky may be seen. In the foregoing very succinct outline of the history of optical discovery the object kept in view has been to present simply facts, without entering into any discussion of the physical causes to which they are to be attributed. These are considered elsewhere in this volume, especially under the titles LIGHT and UNDULATORY THEORY. F. A. P. BARNARD.

Optima'tes and **Popula'res** were the two party names under which the old opposition in the Roman commonwealth between patricians and plebeians took a new form and kindled into a deadly struggle in the time of the Gracchi. *Optimates* denoted the conservative party, consisting of the senatorial families with their dependents, the aristocracy proper. *Populares* denoted the progressive party, consisting of the mass of the people, the old *plebs*, the freedmen, persons often of wealth, but with small personal influence, and the proletariate. Caius Gracchus at the head of the *populares* was victorious, and introduced considerable changes in the oligarchic constitution of Rome, but with Sulla the *optimates* once more came into power. In the struggle between Pompey and Cæsar the latter succeeded in fully overthrowing the old constitution, and in the confusion after his death the old party constellation disappeared, and with it the old party names.

Op'timism [Lat. *optimum*, "best," in contrast with *pessimum*, "worst"], the doctrine that the world is the best possible, or that evil is only relative and contingent, being incident to the evolution of good—that good is substantial, evil only temporary. It is the philosophical counterpart to the religious doctrine of an overruling Providence that educes good out of evil. The divine purpose in creation is held to be the bringing of good into existence where nothing existed before, and the replacing of the imperfect by the more perfect; in general, it is to change chaos to a cosmos, and make it reflect the attributes of God. Creation, evolution, change of any sort, involve contra.t and the manifestation of two principles. Hence, the passive principle (chaos), which is eliminated by the activity of the good, is manifested or made apparent by the activity which annuls it. Without the activity of creation the passive or negative principle (chaos or mere potentiality) would remain a pure zero, and be neither good nor evil. In all the stages of the realization of good, from the lowest to the highest, there is contrast, and hence the phenomenon of evil; but evil or the relatively imperfect exists only as the battlefield upon which it receives defeat from the victorious higher good. This is the view *sub specie æternitatis*, as Spinoza called it. Of course, any partial view, taking its point of observation from some one imperfect being, would see in its destruction the triumph of evil rather than of good, and evil might seem predominant in the world. The optimistic theory is consistent only with theism, perhaps only with Christian theism. It finds place in the theory that God creates the world from nothing (chaos or pure space) as his manifestation or self-revelation. Opposed to this is the emanation-theory characteristic of Oriental thinking, in which the Absolute is an abstract unity devoid of attributes, impersonal, and above multiplicity. All creating is removal from unity toward multiplicity, and hence evil; it is a lapse from the Absolute, and finite existence is therefore altogether a mistake, or perhaps even a punishment for sin in a former state. The return of all finite to the infinite through absorption or annihilation is regarded as the desirable end. Nature is not a conflict of good and evil, but altogether evil. Still, the good only is, in the highest view. For all creation is *maya* or illusion of the senses and intellect. The religion of the emanation-theory lays chief stress on ascetic renunciation with a view to reabsorption into the Absolute. Even destruction of consciousness and individuality is regarded as blessedness. "The conclusive, incontrovertible, one only knowledge, is that neither I am, nor is aught mine, nor do I exist," says the *Sankhya Karika*. In contrast with this, European thought quite generally embraces optimism. From the doctrine of Plato, that God is the absolute good, and "the Good possesses not envy, and on this account has made the world most similar to itself," down to the doctrine of Hegel, that all nature and history are the celebration of God's personality, optimism accompanies the doctrine which makes man a free immortal spirit transcending nature, and nature to be the theatre best fitted for his development. The Christian philosophers have variously expanded this doctrine. St. Augustine explains that evil is only contingent or incident to finitude in its different degrees of imperfection, and that it exists only as an adjunct of the good; "as a painting with dark colors is beautiful when seen as a whole, so the sum of things when seen with one glance is good." St. Anselm adopted the same view, and asserted that the fall of man rendered him capable of attaining higher good. St. Thomas Aquinas likewise: "The infinite manifoldness in the objects of nature is requisite in order to display God's infinite perfection; evil is only the privation of perfect actuality incident to the mere participation in the divine." Malebranche says that God has used everywhere the simplest means to realize his purposes, and accordingly has admitted the fewest evils possible into the world. Leibnitz, who is the best-known defender of optimism, distinguished three kinds of evil: (*a*) metaphysical, owing to the finiteness of things: this is unavoidable; (*b*) physical evil or pain, which is conditional good, being a monitor to warn us against error; (*c*) moral evil or wick-

edness, for which man alone is responsible, being incident to freedom, which is his highest gift. "God, therefore, out of the infinite number of possible worlds which he saw, chose the one which is actually the best."

WILLIAM T. HARRIS.

Op′zoomer (KARL WILHELM), b. Sept. 20, 1821, at Rotterdam; studied jurisprudence at Leyden, and attracted, even while a young student, much attention by his *Letter to Da Costa* and *Examination of the Annals of Dutch Theology*, in which he attacked the so-called orthodox dogma; was appointed professor of philosophy at the University of Utrecht in 1846, and acted as a leader in all movements of reform and progress in politics, religion, and science. His principal works are—*Wetenschap en Wijsbegeerte* (1857), *Het Wezen der Kennis* (1863), *De Godsdienst* (1864), besides a number of minor essays.

Oquaw′ka, post-v., cap. of Henderson co., Ill., on the Mississippi River and the Mississippi division of the Rockford Rock Island and St. Louis R. R., has 2 newspapers and considerable trade in agricultural products. P. 1370.

Or′ache, the *Atriplex hortensis*, *A. patula*, and other species of the genus, chenopodiaceous herbs, the first mentioned a native of the Old World, the second (and others) of both hemispheres. They sometimes are cultivated, and make very good substitutes for spinach.

Or′acle [Lat. *oraculum*, from *orare*, to "entreat," derived from *os*, *oris*, "mouth," corresponding to the Sanskrit *osa*], a term applied to answers given by the ancient Egyptian and Greek deities when solemnly consulted by their votaries, and also to the places where they spoke. Oracles spoke in different ways—in some cases through a human being, who uttered words of inspiration; in others by signs, which the priests watched and interpreted. Greece and Egypt had oracles of both these kinds, while in Italy the latter only existed. The ancients consulted oracles on all important affairs, whether public or private. If, as often happened, an enterprise failed even though the gods had seemed to favor it, the oracles still lost no credit, for their answers were so ambiguous that it was no easy matter to interpret them clearly. Zeus (Jupiter), though the source of oracular inspiration, was immediately consulted less often than the minor gods, who, especially Apollo, acted as mediators between him and mankind. Nor did he reveal his will by direct inspiration, but by certain signs. His oracle at Dodona, the most ancient in Greece, spoke by sounds of the wind rustling through groves of oaks and beeches, in the branches of which were hung brazen vessels: these, striking against each other as the wind blew, rendered the god's language more intelligible. At first men were its interpreters, but in later times old women officiated. The oracle of Zeus at Olympia was chiefly consulted by persons about to take part in the Olympic games. Sacrifices were offered, from the appearance of which the priests deduced an answer. That of Zeus Ammon, situated in a Libyan oasis, was greatly venerated, and was much consulted by the Greeks: here men gave the answers. The chief oracle of Apollo was at Delphi or Pytho, on the southern slope of Mount Parnassus, and near the Castalian Spring. According to legend, it was discovered by some shepherds, whose sheep, having approached a chasm from which smoke issued, were seized with convulsions. Human beings, affected in like manner, uttered prophecies, so that the place came to be regarded as holy and under the influence of Apollo, to whom a temple was built over the chasm. Among other oracles of Apollo were—that of Abæ in Phocis, where a priest was the medium; of Ismenion in Bœotia, where the god spoke by the appearance of the victims; of Claros, in the territory of Colophon, where a man became inspired by drinking of a sacred well; of Delos, consulted only in summer; of Patara, in Lycia, consulted only in winter.

While the oracles of Zeus and Apollo pronounced on all important matters, the other gods and heroes were questioned on those subjects only over which they were supposed to preside. Thus, Æsculapius was consulted only by the sick: he had many oracles, the most renowned of which was at Epidaurus. The oracle of Ceres, in Achaia, was also consulted only by sick persons, who, after performing various ceremonies, were shown in a mirror either dead or restored to health. At Nysa, in Caria, was an oracle of Pluto, where priests cured the sick with remedies revealed to them in dreams by the god. Hermes (Mercury) had an oracle in the market-place of Pharæ, in Achaia: the question was whispered in the god's ear, and the applicant went out of the temple and took the first chance remark he heard as a divine reply. In Thrace there was an oracle of Bacchus, where the priests drank abundantly of wine, and, thus inspired, answered the inquirer. At Aphaca, in Cœle-Syria, stood a temple of Venus near a lake into which persons consulting the oracle threw presents: these sank if acceptable to the goddess, and floated if rejected by her. The oracle of Trophonius, at Lebadeia, was very famous. The votary, after purification and prayer, entered the hero's cave, where he saw visions, from which, he having described them to the priests, an answer was deduced. At Bura, in Achaia, the oracle of Herakles answered by painted dice which were thrown by the questioner. Somewhat after this manner Fortuna was interrogated by the Italians: slips of oak board, graven with sacred characters, were shaken together by a boy, and one was drawn by the consulter. Among lesser forms of oracle were those "of the dead," by which departed spirits were consulted. The "Urim and Thummim" of the Jews, and also the *Bath Kol*, or echo, were species of oracle. Eusebius and many subsequent Christian writers affirmed that with the birth of Christ all oracles ceased. In the later times of oracles little real respect was paid them by the more enlightened pagans.

JANET TUCKEY.

Oraga′wa, town of Japan, on the south-eastern side of the island of Niphon, and forms the port of Jeddo. It is said to have about 20,000 inhabitants.

Or′amel, post-v. of Caneadea tp., Allegany co., N. Y., on the Genesee Valley Canal. Pop. 289.

O′ran, province of Algeria, bounded N. by the Mediterranean, E. by the province of Algiers, S. by the desert, and W. by Morocco. Area, 111,831 square miles. Pop. 513,492, of whom 411,874 were natives, 51,729 French, and 47,433 foreigners. Large tracts of this province are uncultivated and unfit for cultivation; others are cultivated with the utmost care, and wheat, maize, cotton, and wine are grown with great success. The climate is very hot, but not unhealthy.

Oran, town of Algeria, capital of the province of Oran, on the Mediterranean. It is surrounded with walls and defended by several strong forts; the streets are generally broad and airy, the houses spacious and elegant, and the promenades beautiful. Its harbor is naturally poor, but has been greatly improved of late, and large quantities of French cotton goods, hardware, wine, and wheat are here exchanged for gold-dust, ivory, ostrich feathers, gums, etc. Pop. 40,674.

Oran, tp. of Logan co., Ill. Pop. 769.

Oran, post-v. and tp., Fayette co., Ia. Pop. 715.

Or′ange [Fr.], the well-known and delicious fruit of many varieties of the genus *Citrus*, which, although much confused, are probably all referable to *Citrus aurantium*. *Citrus* is a genus formerly placed in the order Aurantiaceæ, but now included in Rutaceæ. It embraces trees and shrubs, all exotic, and in our northern climate unable to cope with winter cold. In our extreme Southern States the orange is productive. The foliage is fragrant, and the pure white flowers are odorous and beautiful. Wherever known throughout the world they are regarded as the appropriate ornaments of a bride. These flowers have from twenty to sixty or more stamens, sometimes in sets, and have one style. There are from four to eight, usually five, petals. The filaments of the stamens are more or less united, and the ovary many-celled, with a prominent disk at the base. The fruit is a juicy and luscious berry with a leathery rind, usually of that color known as orange. This rind contains little cysts or cells filled with a fragrant and volatile oil which is easily inflammable. The branches of the tree are spiny and the leaves in reality compound; that is, they consist of a single leaflet, as is shown by the articulation between the blade and the petiole. The latter is generally winged.

It is supposed, although the fact is not decided, that the original of the orange came from the East Indies or from China. Species of *Citrus*, indicating the origin of *Citrus aurantium*, have been found in the foot-hills of the Himalaya. Of whatever country it is native, it has now spread over all the warmer regions of the earth. It has an astonishing productiveness, one tree sometimes yielding in favorable localities as many as 20,000 marketable oranges. No cultivated fruit is more liable to degeneration, and for this reason it is seldom grown from seed. The trees we meet with in conservatories usually bear a bitter, unpalatable fruit, and are chiefly grown for ornament. They are not only evergreen, but bear simultaneously the golden fruit and the perfumed blossoms. The leaves are fragrant also, and have a limited use in medicine in cases of hysteria, when they are employed instead of tea. Oil of neroli is prepared from orange-flowers, and is the basis of the popular perfume known as eau de cologne. The fruit contains citric acid, but not in so large proportion as the lemon. The numerous seeds often contain more than one embryo. Sicily, Malta, Spain, the Azores, Portugal, and Cuba furnish most of the oranges of commerce. Of late years, Florida has begun to export fine fruit, and

the cultivation is profitably conducted in California. The orange is of very great importance, as the fruit of some varieties is easily transported from one climate to another without damage. The rind enters into various articles of confectionery, and is used for flavoring. An orange tree will live to a very great age. W. W. BAILEY.

Orange, town of France, department of Vaucluse. It is old, ill built, and dirty, but it has several well-preserved and interesting remains from the Roman time (a triumphal arch and a theatre), some manufactures of linen and cotton fabrics, and a large trade in honey, wine, spirits, essences, oil, truffles, saffron, and madder. The old province of Orange fell in 1531 by marriage to the princes of Nassau, but was recovered by France at the Peace of Utrecht in 1713. Pop. 10,622.

Orange, or **Gariep,** a river of South Africa, rises in the mountains which separate Natal from the Orange River Free State, flows in a nearly western direction and with a tortuous course, and falls into the South Atlantic Ocean in lat. 28° 38′ S. Its shores are covered with extensive forests yielding excellent timber and many different sorts of valuable wood, and rich copper ores have been found in its vicinity; the country between its basin and the Cape Colony is a naked desert.

Orange, county of E. Florida, bounded on the E. by St. John's River and the Atlantic Ocean. Area, 2450 square miles. It abounds in lakes, which are surrounded by fertile hummock-lands. The county has large forests of pine, cedar, and cypress. The land is in great part elevated and rolling. It is adapted to the culture of oranges, cotton, sugar-cane, rice, etc. Cap. Orlando. Pop. 2195.

Orange, county of S. Indiana. It is uneven, has dense forests and a fertile soil. Area, 400 square miles. Live-stock, wool, tobacco, and grain are leading products. The N. part is traversed by the Louisville New Albany and Chicago R. R. Cap. Paoli. Pop. 13,497.

Orange, county of S. New York, bounded E. by the Hudson River. Area, 838 square miles. It extends S. W. to New Jersey and Pennsylvania. A considerable part of the county is broken and even mountainous, but as a whole it is remarkably fertile. Iron ore, flagging and building stones are extensively obtained. The county is famous for its milk, butter, cheese, etc. Live-stock, grain, hay, and market-garden products are largely raised. The county is traversed by the Delaware and Hudson Canal and by various railroads, mostly operated as branches of the Erie R. R. There are important manufactures of flour, hats, iron, machinery, woollen goods, spirits, leather, carriages, metallic wares, harnesses, clothing, furniture, etc. Caps. Newburg and Goshen. Pop. 80,902.

Orange, county of N. North Carolina. Area, 630 square miles. It is somewhat uneven, very fertile, and abounds in good iron ore. It is traversed by the North Carolina R. R. Live-stock, corn, and tobacco are leading products. Cap. Hillsborough. Pop. 17,507.

Orange, county of S. E. Texas, bounded E. by the Sabine River (which separates it from Louisiana), on the S. by Sabine Lake, and on the W. by the Neches River, all navigable the year round. It is also traversed by the Texas and New Orleans R. R. The county is level, very fertile, and well timbered. Cotton, corn, tobacco, rice, and live-stock are produced. Area, 350 square miles. Cap. Orange. Pop. 1255.

Orange, county of E. Vermont, bounded E. by the Connecticut River, which separates it from New Hampshire. Area, 640 square miles. It is hilly and in part mountainous, but generally well adapted to farming. Grain, hay, and wool are leading products. Lumber, farming implements, harnesses, carriages, etc. are manufactured. The county is traversed by the Connecticut and Passumpsic Rivers R. R. Cap. Chelsea. Pop. 23,090.

Orange, county of Central Virginia. Area, 300 square miles. It is bounded N. by the Rapidan River. It is in part mountainous, but has a productive soil, especially in the valleys. Grain and tobacco are leading products. Flour is the principal article of manufacture. The county is traversed by the Washington City Virginia Midland and Great Southern R. R. Cap. Orange Court-house. Pop. 10,396.

Orange, post-v. and tp., New Haven co., Conn. Pop. of v. 782; of tp. 2634.

Orange, post-v. and tp., Clark co., Ill. Pop. 924.

Orange, tp. of Knox co., Ill. Pop. 1167.

Orange, post-v. and tp., Fayette co., Ind. Pop. 881.

Orange, tp. of Noble co., Ind. Pop. 2066.

Orange, tp. of Rush co., Ind. Pop. 1273.

Orange, tp. of Black Hawk co., Ia. Pop. 864.

Orange, post-v. and tp., Clinton co., Ia. Pop. 1018.

Orange, tp. of Guthrie co., Ia. Pop. 212.

Orange, post-v. and tp., Franklin co., Mass., on the Vermont and Massachusetts R. R. Pop. of tp. 2091.

Orange, post-v. and tp., Ionia co., Mich. Pop. 1382.

Orange, tp. of Douglas co., Minn. Pop. 178.

Orange, tp. of Grafton co., N. H. Pop. 340.

Orange, city, Essex co., N. J., on the Morris and Essex division of the Delaware Lackawanna and Western R. R., 13 miles W. of New York. The city stands on rolling ground 190 feet above tidewater, and is very picturesquely located. Its streets are laid out at right angles, and the more important ones are paved with "Telford." The chief industry of Orange is hatting, which is carried on to a large extent. Llewellyn Park, its most attractive feature, extends from the base to the brow of Orange Mountain, comprising 750 acres, studded with elegant residences and laid out in handsome grounds kept in common. Orange contains an orphan asylum, a hospital and dispensary, 28 school organizations, 1 national and 2 savings banks, 4 weekly newspapers, a well-organized city government, including a police and paid fire department. Horse-cars connect it with Newark, 3½ miles distant. Pop. 9348.
J. M. REUCK, ED. "JOURNAL."

Orange, post-v. and tp., Schuyler co., N. Y. Pop. 1960.

Orange, a v. (NANKIN P. O.) and tp., Ashland co., O. Pop. of v. 271; of tp. 1485.

Orange, tp. of Carroll co., O. Pop. 1207.

Orange, tp. of Cuyahoga co., O. Pop. 812.

Orange, tp. of Delaware co., O. Pop. 1266.

Orange, tp. of Hancock co., O. Pop. 1167.

Orange, tp. of Meigs co., O. Pop. 828.

Orange, tp. of Shelby co., O. Pop. 951.

Orange, tp. of Columbia co., Pa. Pop. 905.

Orange, tp. of Orangeburg co., S. C. Pop. 1243.

Orange, post-v., cap. of Orange co., Tex., on the Sabine River, 103 miles E. of Houston.

Orange, post-v. and tp., Orange co., Vt. Pop. 733.

Orange, post-v. and tp., Juneau co., Wis., on the Chicago Madison and St. Paul R. R. Pop. 235.

Or′angeburg, county of Central South Carolina. Area, 900 square miles. It is bounded N. E. by the Congaree and Santee rivers, and S. W. by the South Edisto. It is uneven and productive. Cotton, rice, corn, and live-stock are leading products. The county is traversed by the South Carolina R. R. Cap. Orangeburg Court-house. Pop. 16,865.

Orangeburg Court-house, post-v., cap. of Orangeburg co., S. C., on the South Carolina R. R., 80 miles from Charleston, contains the South Carolina Agricultural College, Claflin University, several academies and schools, 6 churches, a fire department, 2 carriage manufactories, a shingle-factory, a brickyard, and stores. It is a large market for cotton, rice, turpentine, and lumber. Pop. 246.
THAD. C. ANDREWS, ED. "ORANGEBURG NEWS."

Orange City, post-v., cap. of Sioux co., Ia., near the Sioux City and St. Paul R. R., 42 miles N. of Sioux City, founded in 1870 by a colony from Pella, has 1 church, 1 grist-mill, 1 newspaper, and the usual stores. Pop. about 300. C. W. HARMON, ED. "SIOUX COUNTY HERALD."

Orange Court-house, post-v., cap. of Orange co., Va. Pop. 731.

Orangemen, a political association, whose official name is **The Loyal Orange Institution,** formed in 1795 in Northern Ireland in honor of King William III., prince of Orange, in opposition to the Roman Catholic association of the Ribbonmen, and for the purpose of defending the Protestant religion in Ireland, the legislative union between Great Britain and Ireland, etc. The association spread rapidly, and it soon came to bloody conflicts between its members and those of the Roman Catholic association, which it required considerable military force to suppress. At last, in 1836, the association was dissolved, but in 1845 it was again revived, though not acknowledged by the government; its processions are still forbidden in Ireland. In 1829 the institution was transferred to British America with great success, but there too, as well as in New York, its processions have sometimes occasioned riots.

Orange Oil, an essential oil, consisting chiefly of hesperidene, $C_{10}H_{16}$, is extracted by pressure or distillation with water from orange-peel. It begins to boil at 175° C., and 97.8 per cent. goes over below 180° C.; the remainder consists of a soft yellow inodorous resin. (See *Chem. Soc. J.* [2] ix. 1186.) The flowers of the orange yield, on dis-

tillation with water, a fragrant oil, called *oil of neroli.* It consists of two oils, one readily soluble in water, the other sparingly soluble. Alcohol of 90 per cent. separates a solid neroli-camphor. (See Watts's *Dict.*, article *Citrus*, 2*d suppl.*, article *Orange-peel Oil*, and *U. S. Disp.*)

C. F. Chandler.

Orange, Prince of. See William of Nassau.

Orange, Prince of, son of William of Nassau. See Maurice, Count, of Nassau.

Orange River Free State, territory of Eastern South Africa, bounded E. by Natal, from which it is separated by the Quatlamba, Maluti, and Drachenberg mountains, S. by the Cape Colony, and N. by the Transvaal Republic. It comprises an area of about 50,000 square miles, and consists of elevated flats around the Orange and the Vaal, eminently well suited for the breeding of cattle and sheep. It is inhabited by about 37,000 Dutch settlers, who left Natal on its being declared an English colony, and formed an independent state on this territory.

Orange Springs, a v. of Putnam co., Fla. Pop. 177.

Or′angetown, tp. of Rockland co., N. Y., on the Hudson River, traversed by New York and Erie R. R. P. 6810.

Orange Valley, post-v. of Essex co., N. J.

Or′angeville, post-v. of Wellington co., Ont., Canada, on the Toronto Grey and Bruce Railway, 43 miles from Toronto, has 2 weekly newspapers and numerous manufactories of lumber, furniture, woollens, castings, bricks, pottery, etc. Pop. of sub-district, 1458.

Orangeville, post-v. of Oneco tp., Stephenson co., Ill. Pop. 255.

Orangeville, post-v. and tp., Orange co., Ind. P. 904.

Orangeville, post-v. and tp., Branch co., Mich. Pop. 1145.

Orangeville, post-v. and tp., Wyoming co., N. Y. Pop. 1217.

Orangeville, post-v. of Hartford tp., Trumbull co., O., on the Atlantic and Great Western R. R. Pop. 260.

Orang′ Outang′ [properly *orang-utan*, Malayan for "man of the woods"], the *Simia satyrus* of Borneo and the neighboring islands, one of the most highly developed of the anthropoid apes. It is about five feet in height, and usually is covered with reddish hair, but several varieties are reported varying in size and color. It is always strictly arboreal, being seldom seen on the ground. It does not assume an erect posture except when taught to do so in confinement. It is a fierce and dangerous animal when wild, and especially when wounded or at bay. Even when tamed it is dangerous if irritated. The male is rendered hideous by great cheek-callosities, and has large tracheal pouches, whose use is not known. This creature is omnivorous, and builds a rude shelter of branches in the tree which serves as its home.

Orato′rio [Lat. *oratorium*], an elevated form of musical composition in which voices and instruments combine to represent scenes, passages, or themes from biblical or sacred history, the text consisting of verses from the Scriptures arranged with a view to moral and spiritual effect; the music comprising chorus, recitative, aria, quartette, trio, solo—in short, all the recognized combinations of harmony and melody, with organ and orchestral accompaniment, as in opera. It differs from opera principally in being sacred instead of secular, and in being unsuited to stage or scenic representation. Oratorio is sometimes described as sacred opera. This is not, strictly speaking, correct. Oratorio, when it becomes operatic in the sense of scenic and passionate, as in the case of Rossini's *Moses in Egypt*, ceases to be oratorio. The oratorio may be classed with dramatic compositions, on condition that the element of action is omitted. The movement is subjective, the development ideal, the characterization intellectual, the spirit epical. The oratorio was never intended to do service in the offices of worship, was never written in the direct interest of Sabbath or cathedral observances. Though its name was derived from *oratorium*, a "little chapel," its modern beginnings having been laid there, it has sought unconsecrated halls for its display. It was, in fact, an effort to associate the charm of musical composition with the solemnity of sacred themes. Hence, in large measure, its popularity in England with the "evangelical" Protestants, who are forbidden by their religious feeling to attend operatic and theatrical entertainments, and with the orthodox public of the U. S. In Paris it has, in fact, no abiding-place, nor is it held in favor in Italy, where it originated. The germs of oratorio existed in the Middle Ages in the shape of *mysteries* and *moralities*—scenes from Scripture rudely dramatized, with some primitive sort of music, the design being to entertain the coarse and vacant-minded peasantry, and entice them from idleness and vicious pleasure. The steps of development in conception and form cannot be traced. In the middle of the sixteenth century, St. Philip Neri, a man of deep humor and genuine sympathy with the people, attempted to mingle instruction and entertainment by engaging the music director of St. Peter's church to aid him in his popular interpretations of sacred story. The musician introduced songs in passages of dialogue and soliloquy. That the attempt was successful appears from the fact that it was made in other places and with more art. In the year 1600 one of these musical dramas was exhibited on a stage erected in the church Sta. Maria in Valicella. It was called *Soul and Body*, was composed by Emilio del Cavalieri, and may be regarded as the first systematic production of oratorio, with chorus, recitative, and song. To these the dance was added. From this point to the time of Handel the history of oratorio is uncertain. In the seventeenth century Giacomo Carissimi composed *Jephthah* and the *Judgment of Solomon*; in the latter part of the same century Francis Federici composed two pieces, *Santa Christina* and *Santa Catharina di Siena*, which were called oratorios. Among composers of oratorio may be mentioned Alessandro Scarlatti, Alessandro Stradella (*John the Baptist*), Giacomo Perti (*Abraham*), Benedetto Marcello (*Judith*), Heinrich Schütz (*Resurrection* and *Seven Words*), all of about the same period (1645–1710). The great master in this style of composition—the creator he may justly be called of the oratorio—was Handel (1740–51). His best-known works were *Saul* (1740), *Messiah* (1741), *Samson, Judas Maccabeus* (1747), *Jephthah* (1751). All have English words. The greatest, *Messiah*, is considered the masterpiece of its kind. *The Creation*, by Haydn (1798), ranks next to it in popular repute. They have but one peer, Mendelssohn, whose *St. Paul* (1836) and *Elijah* (1846) are brilliant and beautiful examples of the capacity of this species of composition. With lovers of music *Elijah* is greeted with more enthusiasm than even the *Messiah*, its spirit being more modern, its musical form more flexible, its conceptions more intellectual. While the tone is purely and throughout religious, the ideas, less confined to dogma, are addressed to the imagination rather than to the heart—to the æsthetic rather than to the "spiritual" sense. The oratorios of Mendelssohn bear to those of Handel much the same relation that the new sentiment of piety bears to the old. They are an adaptation of an ancient form to modern taste and feeling.

O. B. Frothingham.

Or′atory [Lat. *oratorium*], a private chapel attached for the most part to a domestic establishment, and used sometimes for private and family devotions, and sometimes fitted up for the hearing of mass. This latter use has led to serious controversies between the bishops and parish clergy on the one hand and nobles and their chaplains on the other.

Oratory. See Eloquence and Rhetoric.

Oratory, Congregation of the, a monastic order in the Roman Catholic Church, was founded in 1560 by St. Philip de Neri; established in France in 1611. Its first rule was oral, but was afterwards written out, and received papal approval in 1612. The fathers are mostly devoted to the spread of learning; they assume no vows. One of the most eminent of their number in modern times is Dr. J. H. Newman. Baronius, Bosio, Bérulle, Malebranche, Gallandi, and Massillon are among those who belonged to the order in times past. The French Oratory, called "the Oratory of Jesus," was always a distinct though kindred organization. It is now nearly extinct.

Orbetel′lo, town of Italy, province of Grosseto, on a tongue of land that rises out of the saline marsh of the same name, and is not exempted from the general unhealthiness of the region. It is about 28 miles S. W. of Grosseto, and is surrounded by a fortified wall. The town contains a church, and a penitentiary in which are 1000 prisoners. Interesting Roman and Etruscan antiquities are sometimes found in the neighborhood. Pop. 6461.

Orbigny′, d′ (Alcide Dessalines), b. Sept. 6, 1802, at Coneron, Loire-Inférieure, France; was educated at La Rochelle; explored, from 1826 to 1833, South America from Brazil and Peru to Patagonia; was appointed professor in palæontology at the Museum of Natural History at Paris in 1852, and d. at Pierrefottes, near Paris, June 30, 1857. His principal works are—*Voyage dans l'Amérique du Sud* (9 vols., 1834–52), *Paléontologie française* (14 vols., 1840–54); he also wrote for the *Dictionnaire Universel d'Histoire naturelle*, published in 24 vols. (Paris, 1839–49) by his brother, Charles Dessalines d'Orbigny, b. Dec. 2, 1806, at Coneron, conservator at the Museum of Natural History of Paris.

Orbiso′nia, post-v. of Cromwell tp., Huntingdon co., Pa., has 1 weekly newspaper. Pop. 177.

Orb'it [Lat. *orbitus*], in astronomy, the relative path of one body with respect to another body around which it revolves. The actual paths followed by the satellites in revolving about the planets, and by the planets in revolving about the sun, are exceedingly complicated curves, but the relative path of any body with respect to its primary is comparatively simple. Kepler showed that the orbits of the planets are ellipses having the sun in one of their foci. This principle, known as Kepler's second law, was shown by Newton to be a logical consequence of the law of gravitation; it was further shown that the law is not rigorously exact, the orbit being subject to slight irregularities in consequence of the mutual attractions of the planets on each other. These irregularities or perturbations are so small that we may neglect them in taking a general view of the motions of the bodies of the planetary system. Taking this view of the case, it may be shown that the orbit of a body projected into space with a certain velocity, and then acted upon by a central body in accordance with the Newtonian law, will be some one of the conic sections. The nature of the conic section is dependent upon the velocity of the body at some particular point of its path. The orbits of the planets, as we have seen, are ellipses; the orbits of the satellites are also ellipses; but the orbits of the comets and of the meteoric streams of meteors with which they are so closely connected may be ellipses, parabolas, or even hyperbolas. The character of the orbit of a planet or of a comet may be determined by three observations of its right ascension and declination separated by a suitable interval of time, say two or three days. The position of the orbit of a planet with respect to the ecliptic is known when we know its inclination and the longitude of its ascending node; its shape and size are known when we know its eccentricity, the mean distance of the planet, and the longitude of its perihelion. These elements being known, we may locate the planet in its orbit at any time if we have given the *epoch* (that is, the time when the planet is in perihelion) and the periodic time (that is, the time required for the planet to make a sidereal revolution about the sun). W. G. PECK.

Orca'gna (ANDREA), (ANDREA ARCAGNUOLO DI CIONE, Orcagna being a contraction of Arcagnuolo), an Italian painter, sculptor, designer, architect, goldsmith, and worker in mosaic, one of the great names in the history of art, b. at Florence 1329; d. probably in 1376; a pupil of Andrea Pisano. The frescoes of *Hell* and *Paradise* in the Strozzi palace are his work; the frescoes of the *Last Judgment* and the *Triumph of Death* in the Campo Santo at Pisa have been attributed to him, wrongly, as some think. The splendid tabernacle of the main altar of Or San Michele in Florence, described by Dr. Lübke as "perhaps the most magnificent decorative work in the world," was executed by him; also the "Loggia de' Lanzi." Rich remains of his work are preserved in the Strozzi chapel of S. Maria Novella. O. B. FROTHINGHAM.

Orcein (*Lichen-red, Flichtenroth*), $C_7H_7NO_3$, the chief ingredient of the red and purple dye-stuffs known under the name ARCHIL (which see). It is found by the action of ammonia and oxygen on orcin, $C_7H_8O_2$:

$$\underset{\text{Orcin.}}{C_7H_8O_2} + NH_3 + O_3 = \underset{\text{Orcein.}}{C_7H_7NO_3} + 2H_2O.$$

When ammonia is added to a solution of orcin, and the whole is exposed to the air, the liquid assumes a dark-red or purple tint by the absorption of oxygen. On acidulating with acetic acid a dark red precipitate of orcein is obtained. Orcein is slightly soluble in water and freely soluble in ammonia and fixed alkalies, with a purple or violet color; it is very soluble in alcohol. C. F. CHANDLER.

Orchard. See FRUIT-CULTURE.

Orch'ard-house, a green house without artificial heat, used for growing dwarfed and carefully-pruned fruit trees in pots, resting upon a rich border. In winter the plants are stored in cellars. In this way, by skilful management, a small space is made to yield a very large amount of fruit.

Orchella Weeds, certain lichens which are made to furnish, by a species of fermentation, very valuable dyes. (See ORCIN, ORCEIN, and ARCHIL.)

Or'chestra [Gr. ὀρχήστρα; Lat. *orchestra*], the place or structure occupied by performers on instruments in a theatre, music-hall, or other building fitted for concerts, oratorios, etc. In oratorios, cantatas, and other pieces with vocal parts a portion of the orchestra is also allotted to the choir. The term "orchestra," in modern use, often means the body of instrumental performers themselves, especially as distinguished from the choir or vocal department, in the execution of such works as are for voices and instruments.

Or'chestral, in music, that which relates to an orchestra, as the "orchestral parts" of an oratorio, mass, or solo with full accompaniment.

Or'chids, or **Orchidaceæ** [from *Orchis*, the typical genus], an interesting natural order of perennial endogenous herbs, found all over the world except in very cold and very dry climates. In the cooler regions they are terrestrial, while in hot countries they are oftener air-plants, growing upon stones and trees, but epiphytic rather than parasitic. They have irregular and often extremely beautiful, but sometimes very grotesque, flowers, always perfect, with a hexamerous adnate perianth, a one-celled ovary, numerous ovules, and three parietal placentæ. The stamens are one, two, or three; the pollen generally coheres in masses. Fertilization is almost always effected by the aid of insects. Many of the species have flowers singularly resembling insects in form. Not a few have very fragrant blossoms. This vast order affords but few useful plants. Among these are vanilla, faham, salep, and several medicinal products. Of late years florists have very successfully attempted the culture in green-houses of many superb tropical epiphytes of this order. The U. S. have comparatively few species of this vast order.

Orchil. See ARCHIL.

Orchom'enus, an old city of Greece, situated in Bœotia, at the entrance of the river Cephissus into the Lake Copais, was the capital of the pre-historic empire of the Minyæ, and is reported by Homer to have sent thirty ships to the siege of Troy and to have contained riches which might be compared to those of Thebes in Egypt. In the Persian wars it abandoned the national cause, and in the wars between the various Greek races it always sided with the aristocratic party. But in 367 B. C. it was taken and destroyed by the Thebans. The buildings were burnt, the men put to the sword, the women and children sold as slaves. Rebuilt by the Phocians, it was again destroyed by the Thebans in 346, and although Philip of Macedon once more rebuilt it, it never again acquired any importance. Remains have been discovered of the treasury of Minyas, probably a royal tomb, and of the wall around the acropolis; also some inscriptions referring to the celebrated festival of the Graces which was held here.

Or'cine, $C_7H_8O_2$, a diatonic phenol or oxyphenol. It appears to exist ready formed in all the lichens which are used for the preparation of ARCHIL, LITMUS, and CUDBEAR (which see), and is the product of the decomposition of certain acids present in the lichens: orsellinic ($C_8H_8O_4$), erythric ($C_{20}H_{22}O_{10}$), lecanoric ($C_{16}H_{14}O_7$), and evernic acids ($C_{17}H_{16}O_7$). Ammonia converts it into the beautiful red coloring-matter orceine. C. F. CHANDLER.

Ord (EDWARD O. C.), b. in Cumberland, Allegheny co., Md., Oct. 19, 1818; graduated from the U. S. Military Academy, and appointed second lieutenant of artillery July, 1839; served in Florida against the Seminole Indians until 1842, from which date he was mainly engaged on frontier duty, participating in various expeditions against the Indians; and at the outbreak of war in 1861 was stationed in California; appointed brigadier-general of volunteers in Sept., 1861, and assigned in November to command a brigade of Pennsylvania Reserves, he fought (Dec. 20) the battle of Dranesville. Promoted to be major-general of volunteers in May, 1862, he was in June transferred to the West, and commanded the left wing of Gen. Grant's army in Mississippi Aug.–Sept., participating in the battle of Iuka, Sept. 19–20, and while in command at the action on the Hatchie, Oct. 5, 1862, was severely wounded. Commanded the 13th army corps during the siege and capture of Vicksburg and capture of Jackson, when transferred with his corps to the department of the Gulf; commanded 8th Corps and middle department July 9–21, 1864; the 18th Corps before Richmond, July 21–Sept. 29, when again wounded in the assault and capture of Fort Harrison. On the 9th of Jan., 1865, he relieved Gen. Butler in command of the department of Virginia and North Carolina and of the Army of the James, with which army he remained throughout the siege of Petersburg and subsequent pursuit of the Confederate army of Northern Virginia, ending in the surrender at Appomattox Court-house. At the close of the war he had attained the rank of lieutenant-colonel of artillery, but continued to hold his volunteer rank of major-general, and commanded various districts and departments until Sept., 1866, when mustered out of the volunteer service, having, however, been appointed a brigadier-general (July, 1866) in the regular army; and has since commanded the departments of California, the Platte, and at present (1876) commands that of Texas.

Ord (GEORGE), b. at Philadelphia, Pa., in 1781; was an intimate friend of Alexander Wilson, the ornithologist, whom he accompanied in some of his expeditions; wrote the *Supplement* to Wilson's *American Ornithology* (Philadelphia, 1825), prefixing an excellent biography; published *Memoirs* of C. A. Le Sueur and of Thomas Say, and was

president of the American Academy of Natural Science from 1851 to his death at Philadelphia Jan. 24, 1866.

Or′deal, a word of Anglo-Saxon origin, and allied to the German *Urtheil,* denotes an appeal to the immediate judgment of God, and forms one of the most peculiar features of the jurisprudence of the Dark Ages. In difficult cases, in which the common means of evidence, such as witnesses and oath, were lacking or insufficient, and in which the judge considered himself unable to discover what was right, it was believed that God himself would reveal the truth in order to protect the innocent and punish the guilty; and accordingly trials were instituted for this purpose. There are traces of such institutions with the Jews (Num. v.) and the Greeks (Sophocles' *Antigone*). With the Germanic nations they were very common, and consisted principally in trials by battle and by lot. A place was enclosed by stones, and here the challenger and the challenged met and fought in presence of judges. He who was driven outside the pale lost; that is to say, he was considered guilty. Often the battle ended only with the death of one of the combatants. With a wild and warlike people like the Germanic race, to whom battle and the god of battle presented the highest moral ideas, such a form of the ordeal was quite natural, but by the Christian clergy it was utterly abhorred, and the trial by battle was one of the very first of the old pagan institutions which they attacked and endeavored to suppress. Nevertheless, it continued into the seventeenth century, though as an institution of chivalry it assumed a somewhat different character. The trial by lot, which Tacitus mentions as a Germanic custom, was less frequently used, and employed only as a means of discovering a thief or murderer. Its practical insufficiency for this purpose was soon understood, however, but it continued in use up to our days as a means of decision under doubtful circumstances, though in course of time it lost its character of an ordeal and became a mere expedient. Of the different ordeals introduced, or at least sanctioned, by the Christian clergy, and always administered under their superintendence, the trial by fire or iron was considered the most decisive, and used only on very solemn occasions. The accused carried a piece of red-hot iron in his hand for some distance, or put on a red-hot iron glove, or walked barefoot and blindfolded over bars of red-hot iron, or passed through a blazing fire with nothing but a thin shirt covering his body. If unhurt, he was declared innocent; if hurt, guilty. But cases in which a person was injured or killed by this ordeal were very rare, for the clergy were merciful; when they could not give the accused a victory they refused him the trial. It was often granted to noble ladies as a means of proving their chastity; in Norway, Inga carried the red-hot iron on the lawn before the cathedral of Trondhjem to prove that her son was the child of the king and the heir of the crown. The miracle with the red-hot iron glove was several times performed by Bishop Popo of Hamburg, and made a great impression on the pagan Danes. In 1498, Savonarola appealed to the trial by fire, but in the last moment he recoiled from the ordeal, and lost thereby all his influence. Much more common was the trial by water, hot or cold. The accused thrust his hand and arm into a vessel filled with boiling water to take up some small object placed at the bottom. The arm was then bound up, sealed, and examined after the lapse of three days. This ordeal was in use even in the middle of the fifteenth century, but already in the sixth century Gregory of Tours tells how a deacon who went through the ordeal had his arm prepared previously with balm. The cold-water ordeal, which consisted in throwing the accused, with the arms and legs tied together, into a pond or river, was generally used in cases of witchcraft, and applied to women; she that floated on the water was a witch and was burnt; she that sank and was drowned was innocent and became a saint. These witches' ordeals did not disappear till the middle of the eighteenth century. The ordeal of the Eucharist was mostly used among the clergy, and consisted in taking the holy sacrament under solemn imprecations of the vengeance of God if it were taken to cover a lie. This kind of trial is first mentioned in the ninth century, and Thomas Aquinas says that it fell out of use in the thirteenth. It was more common and subsisted longer under another form, as the ordeal of the *corsned,* or trial of the hallowed bread and cheese. It was believed that the guilty could not swallow the morsel without being choked; and it is told how Godwin, earl of Kent, who was accused of having killed the brother of Edward the Confessor, actually was suffocated by the trial. The ordeal of the cross was forbidden by Louis le Débonnaire in 816. The accuser and the accused were placed face to face with outstretched arms, and a cross planted between; he who first let fall his arms was guilty of falsehood. The ordeal of the bier subsisted much longer, though it soon lost its authority as an ordeal, and became simply a superstition. He who was suspected of a murder was led to the bier of the murdered and compelled to touch the corpse; if it bled or moved, he was guilty. These ordeals formed parts of the laws, and are found in the Salic, Saxon, Frisian, Anglo-Saxon, Longobardian, Visigothic, and old Scandinavian lawbooks. They were administered with great solemnity. The family and friends of the accuser and the accused were present, and in some cases, especially in the ordeal of battle or fire, the accused might undergo the trial in company with his son or friends—in some cases through a representative. But, although the ordeals became social institutions chiefly by the aid of the clergy, the Church never ceased to work against them, and their abolition is due to the Church no less than their establishment. They seem to have a natural connection with certain stages of religious development, and are found almost invariably at a certain point in the history of a civilization, often in the most curious forms. With the Hindoos the accused or suspected was carefully weighed after fasting a whole day. The accusation was then written down on a paper, which was bound on his head, and he was weighed a second time; if he weighed more, he was guilty. In Siam the accuser and the accused were both together thrown in the way of a tiger; he who was eaten was guilty. In Malabar the suspected could prove his innocence by swimming across a stream which abounded in crocodiles. But such fantastic forms of the ordeal may be found in Europe too; in Hungary witches were still weighed in the beginning of the eighteenth century; and, on the other hand, both among the Hindoos and Chinese forms of the ordeal were used very similar to the European trial by fire and water. In Africa all the negro nations to the N. of the Zambesi are described as strong believers in ordeals. A decoction from a poisonous plant is administered to the suspected, and his guilt or innocence is inferred from the effect of the potion. CLEMENS PETERSEN.

Or′der [Lat. *ordo*], in architecture, refers to the column, and comprises such differences in construction and ornamentation as constitute an individual character. As in ancient architecture the column forms the most characteristic element of the construction, its order is decisive for the style of the whole building; but in modern architecture, in which it is only of subordinate importance, the order of the columns has no influence on the style of the building. The Greeks distinguished between three different orders—the Doric, Ionic, and Corinthian—to which the Romans added two, the Tuscan and the Composite. The finest buildings in the Doric style were the Parthenon and the temple of Theseus in Athens; in the Ionic, the temple of Pallas Athene in Athens, of Bacchus at Teios, and of Fortuna Virilis in Rome; and in the Corinthian style, the Pantheon, the temple of Mars Ultor, and that of Jupiter Stator in Rome. The Tuscan and the Composite orders are hardly anything more than modifications of the Greek models, the Tuscan being a simplification of the Doric, without fluting and almost without tapering, and the Composite a combination of the Ionic and Corinthian, connecting in its capitals the volutes of the one with the foliage of the other. (See CORINTHIAN ORDER, DORIC ORDER, and IONIC ORDER.)

Order [Lat. *ordo*], a name used by zoologists and botanists for combinations of animals and plants. In zoology, it is now always used for a group more comprehensive than the family which intervenes between it and the class, but in botany usage varies. In the *Systema Naturæ* of Linnæus (who only recognized in the organic kingdoms the categories of class, order, genus, and species) the order was the only group intermediate between the class and genus, and was applied to combinations which are still recognized as natural orders, although otherwise defined. Such are the orders Glires, Cete, Coleoptera, Hemiptera, Neuroptera, Lepidoptera, Hymenoptera, Diptera, Filices, Musci, Algæ, and Fungi. Subsequent naturalists introduced other categories and modified the terms of the order. Early French naturalists had employed the name *famille* as a vernacular substitute for the *ordo* of Linnæus, and later French naturalists use both in different senses, reserving the word *ordre* for the groups recognized by Linnæus, or of the approximately equal value and restricting *famille* to subordinate ones. This custom has received the universal sanction of modern zoologists, who accept, as nearly as the present advanced condition of science permits, the Linnæan idea of orders as exhibited in the combinations of animals which he best understood, and employ the word *family* (generally with the termination -idæ) for groups of about the value of the Linnæan genus. The custom is not quite uniform in botany, and our most esteemed botanists (*e. g.* Prof. Asa Gray) use the two terms as interchangeable, adopting the word *order* in connection

with the Latin name of the group and *family* in combination with the English one, thus: "Order Magnoliaceæ, magnolia family." No definition can be given which will enable any one from such definition alone to understand orders, only acquired experience and native tact sufficing for the appreciation of the facts in the case. They have, however, been defined by Prof. Agassiz as distinguishable "by the degrees of complication of that structure" by which the including class is indicated. Prof. Agassiz's understanding of the limits of orders was quite different from Linnæus's and the great majority of modern naturalists, his groups being more comprehensive and to some extent equivalent to the sub-classes of recent zoologists.

THEODORE GILL.

Orderi'cus Vita'lis, b. at Atcham, Shropshire, England, Feb. 17, 1075; educated in Normandy, where he became a monk; spent his whole life in his monastery, and d. about 1143, leaving a Latin chronicle of ecclesiastical history, from the birth of Christ to the year 1142, of which an English translation in 4 volumes is included in Bohn's *Antiquarian Library.*

Orders in Council. This is a phrase used in England to embrace certain orders made by the sovereign in conjunction with his privy council. (See PRIVY COUNCIL.) This council, consisting of a considerable number of persons nominated by the king, transacts most of its business through committees, known as the board of council for trade, the committee for education, and the judicial committee; the proceedings of the committees are designated as "acts of the lords of the council." On the other hand, "orders in council" are made by the king, being personally present, by advice of the council. Such acts, strictly speaking, should be executive and not legislative in their nature. Still, there are extraordinary emergencies in which orders in council legislative in their nature are issued, and the parties concerned trust to an indemnity from Parliament on its meeting. A recess of Parliament might render it impossible to obtain immediate legislative sanction for an act which the interests of the state required should be at once performed. Some orders of this kind have assumed great importance in the domain of international law. These are the well-known orders of 1807 and 1809, by way of retaliation for the Berlin and Milan decrees issued by Napoleon Bonaparte. The Berlin decree (Nov. 21, 1806) made it lawful for French armed vessels to seize every neutral vessel departing from English ports with cargoes of English merchandise. The retaliatory orders of the English council (Jan. 7, 1807, and Nov. 11 and 21, 1807) declared, in the first instance, that all neutral vessels trading from one hostile port in Europe to another with property belonging to the enemy were liable to seizure, and ultimately that France and all subject states were in a state of blockade, and that all vessels might be seized which had "certificates of origin" on board, or which should attempt to trade with the blockaded ports. The "certificates of origin" referred to in this order were certificates from the enemy to the effect that particular cargoes were not of British manufacture. The Milan decree of Napoleon was issued Dec. 27, 1807, and proclaimed that the entire British dominions were in a state of blockade, and all countries were prohibited from trading in any articles of British produce or manufacture. These oppressive orders were very obnoxious to the people of this country, and in Dec., 1807, an embargo was laid on commercial vessels in our ports. In Mar., 1809, an act was passed by Congress prohibiting intercourse with France and England until their restrictions on neutral commerce were relaxed. The privy council in Apr., 1809, modified its previous orders so as only to place the ports of Holland, France, and Northern Italy under blockade. The order was rescinded June 23, 1812, after the French had rescinded their decrees. The policy of these orders in council has been strongly impugned. They had much influence in bringing about the last war of this country with England. They have been justified as a lawful exercise of the royal prerogative in time of war.

It is quite common at the present time in England for the Parliament to cause a statute to go into effect at the time that an order is issued by the privy council. Thus in chap. 53, 38 and 39 Vict., § 3 (Aug. 2, 1875), it is provided that the act of Parliament of the Dominion of Canada concerning copyright attached as a schedule to chapter 53, just referred to, shall, if assented to by the crown, come into operation at such time and in such manner as Her Majesty may by order in council direct. So, in the act of 7 and 8 Vict. c. 12 (international copyright act), there is a clause authorizing the crown by order in council to extend the privileges of British copyright to works first published in any foreign country which gives similar privileges to works of British authors. Some writers have regarded these statutes as a delegation of legislative authority to the council. The more correct view would seem to be that, while the Parliament originates the legislation, it prescribes special terms on which it shall go into effect. The order of the council is in the nature of a contingent event, so that what is done is to pass a contingent or conditional statute instead of the ordinary, absolute, and unconditional one.

T. W. DWIGHT.

Orders, Religious. See MONACHISM.

Or'dinance of 1787. The confederation of the U. S. was delayed and put in jeopardy more by a dispute as to what should be the fate of the unoccupied lands at the West than by anything else. The large States, which by their charters extended to the "South Sea," claimed to have the entire disposal of and jurisdiction over the territory within their boundaries as described in charters proceeding from the Crown of England. Some of the States not thus richly provided with unsettled lands, as Maryland and New Jersey, claimed that the States which were proprietors of them ought to yield them up as common property for the benefit of all, since the efforts of all the States had secured the acknowledgment of independence from Great Britain. In 1780, New York gave authority to its delegates in Congress to fix a limit for its western boundaries, and to cede a part of its lands for such States as should become members of the Confederation. It was not until the next year that Maryland, last of all the States, joined the new league. Soon afterward, the State of Virginia gave up her lands N. W. of the Ohio for the general benefit; but it was not until 1784 that an ordinance for the temporary government of the North-west Territory, which emanated from a committee of which Mr. Jefferson was chairman, was passed by the Congress of the Confederation. Mr. Jefferson's act provided for the formation on this soil, of States, which might be organized whenever there should be 20,000 inhabitants on the territory to be formed into a State, and which might be admitted into the Confederation on certain terms whenever their inhabitants should be equal in number to those of the smallest of the original thirteen States. It also contained this provision in its original form as presented to Congress: "that after the year 1800 there should be neither slavery nor involuntary servitude in any of the said States, otherwise than for the punishment of crimes, etc." This anti-slavery clause was lost, and the ordinance without it was passed Apr. 23, 1784, but no settlements were made within the territory in question for some years.

Two other attempts at legislating for the North-western territory were made in 1785 and 1786, and the committee raised in the latter year to consider this subject made a report which was ordered to a third reading in 1787. Very fortunately, the bill reported was laid aside, and a new committee, appointed July 9 of the same year, reported two days later the ordinance of 1787, which became a law in two days after it was submitted to Congress. This ordinance, besides defining the rights of the citizen, contained two provisions of great importance. The fourth article prohibited slavery and involuntary servitude except in punishment of crimes. Another article provided that the navigable waters leading into the Mississippi and St. Lawrence, and the carrying-places between the same, should be common highways, free to the citizens of the U. S. The importance of this ordinance in shaping the destinies of the U. S. is beyond calculation. It can scarcely be doubted that if slavery, even a small percentage of it, had been able to creep into the territory where the great free States of the West, E. of the Mississippi and N. of the Ohio, now lie, this country would now have been a slave republic. It has been generally supposed that Mr. Nathan Dane of Massachusetts, then in the congress of the Confederation and a member of the committee which reported the ordinance, was its principal author. But an article in the *North American Review* for Apr., 1876, written by W. F. Poole, conclusively shows, from documents which have not been used before, that the authorship of it must belong mainly to a Massachusetts clergyman, Rev. Manasseh Cutler, who appeared in New York, where the last Congress of the Confederation was then sitting, and who purchased 1,500,000 acres in Ohio for a company composed of officers in the then recent war living in Eastern Massachusetts, and 4,000,000 acres for other parties. For the particulars of the evidence that he principally caused this bill to be carried through Congress we must refer to the article in question. T. D. WOOLSEY.

Or'dinary, in ecclesiastical law. The meaning of the Latin word *ordinarius*, from which this term is derived, is one who has authority to decide causes of his own right and not as a deputy. In ecclesiastical law in England it means in general the bishop who is the ordinary of his own diocese. An important part of the ordinary's jurisdiction concerned the cognizance of testaments of personal prop-

erty, the administration of estates of persons dying intestate, and marriages. In the case of persons dying intestate, the rule of the early law was that the ordinary or bishop became the owner of the personal property in trust, and his duty was to apply the money to pious or charitable uses. As incidental to this jurisdiction, he had the probate of wills of personal estate, for the purpose of determining whether they were so far valid as to withdraw from him his usual power of administering upon such property. By an early statute (13 Edward I. ch. 9) these rules were so far modified that the ordinary was required to pay an intestate's debts before making the appropriation to "pious uses." By a later act (31 Edward III. ch. 11) it was required that the ordinary shall depute the nearest and most lawful friends of the deceased to administer upon his estate, by which was meant his nearest blood-relatives. By a law passed in the reign of Henry VIII. he might select either the widow or next of kin, or both, at his discretion; and where two or more persons are in the same degree of relationship, he may select between them. In this way it has happened that a peculiar system of jurisprudence has grown up in England, as applicable to wills and administration, as well as the law of contracting marriage, which were all deemed to be matters of ecclesiastical cognizance under the control of the ordinary or bishop. This law is to be collected from reports of decisions known as ecclesiastical and consistory reports. The body of this law, so far as it is applicable to wills and administration, is in use in the States of this country, except so far as it may be modified by statute. The surrogate's court, orphans', and probate courts, answer to that of the ordinary's. The term "ordinary" or "judge ordinary" is still in use in some of the States. The title "surrogate" is derived from the name of the deputy of the ordinary, who was allowed to attend to ecclesiastical matters in the ordinary's place. The ecclesiastical jurisdiction over the matters referred to was transferred in England in 1867 to a new tribunal called the "court of probate." The judge having regular jurisdiction over these subjects is known as the "judge ordinary." He is assisted in the performance of his duties by district registrars (see COURTS), who have powers to grant letters testamentary and of administration. The same officer is made judge ordinary of the court of divorce. By the recent act for the reorganization of the courts (supreme court of judicature act) the court of probate becomes a division of "the high court of justice," and the judge ordinary becomes a judge of that court. In this country, the probate courts have in general only a local jurisdiction. Thus, in New York there is a surrogate in each county. In Connecticut there are probate districts, and in a number of instances a single town constitutes a probate district. It would seem to be a desirable improvement in probate law if the business could be classified into the litigated and non-litigated, as in the case of bankruptcy proceedings. Litigated business should be referred to a judge of learning and ability, while the formal business could be transacted by probate clerks, resembling the registers in bankruptcy. Judicial force would thus be economized, the important questions being solved by competent judges and routine matters transacted by men of no high grade as lawyers, but yet skilful as clerks. The work of the courts would also be much better done than at present, as is abundantly proved by the experience of the high court of probate in England, which, since its organization under a single judge ordinary, has been conducted in the most satisfactory manner. T. W. DWIGHT.

Or′dinate [Lat. *ordinatus*], in co-ordinate geometry, one of the elements of reference used to determine the position of a point with respect to the co-ordinate axis. It is the distance of the point from the axis of abscissas, measured on a line parallel to the axis of ordinates. Every function of a single variable may be regarded as the ordinate of a point of a curve of which the variable is the corresponding abscissa. This curve is called the curve of the function. W. G. PECK.

Ordina′tion [Lat. *ordinatio*], the ceremony by which ministers of the Christian Church are dedicated to their office, is performed in a somewhat different manner, and somewhat different ideas are attached to it, in the different Christian churches; but the ceremony itself and its principal feature, the imposition of hands, are as old as the Church, and are mentioned in the New Testament (Acts vi. 1–7; xiii. 1–4; xiv. 23; 1 Tim. iv. 14; 2 Tim. i. 6). In the Greek and Roman churches ordination is considered a sacrament; that is, a special divine gift, a new spirit, a fitness for the office, is believed to be conferred by the ceremony upon the candidate, and he is thus, at once and for ever, set apart from the laity and entered among the clergy, *ordo*. In order to be valid ordination must be performed by a bishop of the Church; a priest or deacon has no power of conferring holy orders, and the ordination by a bishop of the Evangelical Church is not acknowledged as having any validity. But if once duly performed, the ordination can never be forfeited or made invalid by any act of the ordained in his after life; and it is not repeated when the candidate ascends from one rank in the Church to another. An ordination is not lawful, however, because it is valid. On the contrary, the Roman Catholic Church has enacted very strict and very minute laws concerning this point. A candidate can be lawfully ordained only by his own bishop—that is, the bishop to whom he belongs by birth, by domicile, by benefice, or by connection of personal service—and any irregularities render both the ordaining bishop and the ordained candidate liable to heavy ecclesiastical penalties. In the Protestant or Evangelical churches ordination is not considered as sacramental or indelible, though it has been questioned in the Church of England whether a bishop could be lawfully deprived of his orders as bishop. The Church of England has generally retained the regulations of the ancient canon law, according to which no one could be ordained who was not provided with some appointment in the Church capable of maintaining him, or who was disqualified by bodily infirmity, immorality, etc.; nor could the ordination take place until after an examination of the fitness of the candidate. The ordinal, as drawn up under Edward VI., then modified in the reign of Elizabeth, and finally fixed by the convocation of 1661, also resembles the ancient service, though it is simpler, and lays a particular stress on the examination. A clergyman may be suspended or deprived of his ecclesiastical benefices by his bishop without forfeiting his ordination. He is deprived of his status of priest or deacon only when he is deposed or degraded on account of his being convicted of treason, murder, or felony. In the Presbyterian Church a minister is deposed—that is, he forfeits not only his office but his clerical status—by being convicted of heresy. In the German Reformation, with its ideas of a universal priesthood and its views of the ministry as a calling rather than an office, ordination was considered simply as a solemn ceremony, conferring no special gift and establishing no special status, but beautiful by itself on account of its pious remembrance of the times of the apostles. Thus it was defined by the first Protestant theologians, Chemnitz and Gerhard, and thus it was generally considered by the Protestant churches in Germany and Scandinavia, until of late the old view of the ministry as a divine office has seemed to revive, at the same time that a desire has arisen of placing the whole liturgy on a more objective basis. Kliefoth of Schwerin became the spokesman of this tendency, and in his memorial to the conference of Dresden in 1854 he endeavored, though not with any marked success, to define ordination (like marriage and absolution) as occupying a place intermediate between a ceremony and a sacrament. Connected herewith is the question whether an ordination received within a certain state Church should be considered valid and legal in other state Churches of the same denomination—a question which has been very differently answered. CLEMENS PETERSEN.

Ord′nance. We do not propose to treat this subject historically, but to present as briefly as practicable the present state of the manufacture of heavy guns, with occasional observations upon the theory of their construction and use.

Preliminary.—Cannon were originally made of bars or staves of wrought iron, secured by hoops of the same material *shrunk on*. In some cases the staves were welded together. Cast iron came subsequently very largely into use, and, with the exception of field and siege artillery, constituted the sole material for cannon, which in general were bored from solid castings.

With reference to the projectiles to be used, we divide cannon as follows: (1) "Smooth-bore guns," for round shot or shells; (2) "rifle guns," mostly superseding the former and throwing elongated projectiles.

Smooth-bore Cannon.—The smooth-bore system has probably reached its highest standard of efficiency in the U. S. The 15 and 20 inch guns of Rodman and the IX. and XI. inch of Dahlgren have, in their respective spheres of service, fully sustained the reputation of the distinguished officers by whom they were designed and whose names they bear. The Rodman guns are cast hollow, upon the plan of interior cooling; and this is so arranged that from the time the metal is run into the mould the heat shall be wholly taken off from the interior, so that the cooling of any one portion of the gun shall precede that of the metal outside of it. To effect this a hollow cylinder, termed the core-barrel, closed at the bottom and coated on the outside with refractory material, is placed in the mould of the gun, the melted metal being run into the space between the mould and the core-barrel. At the time of casting water is conducted into the core-barrel through a pipe placed

centrally, and opening near the bottom of the core-barrel; and this water, rising between the pipe and the interior of the core-barrel, flows off from the top of the latter, thus establishing a continuous circulation of water, and cooling the gun *from the interior*. At the same time the iron flasks containing the mould are kept hot by fire applied externally, so that internal cooling is effectually secured. This mode of casting was introduced by Gen. Rodman, and the guns are said to be cast hollow with "water-core."

The Dahlgren IX.-inch and XI.-inch guns were cast solid, and in exterior form cylindrical, being made as near the finished size at the reinforce as practicable, the chase being formed by turning off the large excess of metal. This mode of casting was adopted in order to give great solidity to the lower part of the gun, where strength is required. The mould, placed before casting in a pit, was surrounded with sand—a precaution to obtain very slow cooling of the gun, which after casting was left several days in the pit. The boring was effected by cutting out a cylinder from the centre of the gun, and from this cylinder, at different points, test specimens of the metal were taken. As a general rule, the iron and treatment which had given good results at any one foundry were required to be strictly adhered to, and very great success certainly attended these guns. It can, however, hardly be doubted that for cast-iron guns of very great weight the water-core system is to be preferred.

Rifle Cannon.—The introduction of rifle cannon is of very recent date, as they were not practically successful until after the Crimean war. Rifle guns for field service were used by the French in the Italian campaign of 1859.

Advantages of Rifle Cannon.—Round projectiles thrown from smooth-bore guns are irregular in their flight from two principal causes: (1) The friction of the ball against the surface of the bore; (2) the fact that the resultant of the pressure of the atmosphere against the surface does not pass through the centre of gravity of the ball, the latter not generally coinciding with the centre of figure. The effect of these disturbing causes is to produce a rotation of the ball about an axis varying according to the amount and action of these forces, and a consequent uncertainty in the course of the projectile. It was found that by impressing upon the round projectile a rotation about an axis corresponding with that of the bore of the gun much greater accuracy of fire was obtained. This rotation was given by inclined grooves cut in the interior surface of the bore, and thus, like a screw, imparting the desired rotation to the ball, which, being a little larger than the bore, was, when of lead, forced down mechanically. The rotary movement of the ball thus obtained prevents the uncertain friction on the sides of the bore; and as to the resistance of the air, the rotation continually changing the point of application of the disturbing force, it balances itself, and the shot continues its direction subject only to the rotation due to the rifling.

This principle was soon found to apply to elongated projectiles, which were introduced in small-arms, with various devices for compelling the projectile to "take" the grooves. The introduction of the elongated projectile in small-arms was attended not only with the greater accuracy exhibited by the round ball projected from a rifled bore, but with an extraordinary increase of range. The elongated projectile, issuing from the gun without rotation about its axis, would almost immediately revolve about its shortest diameter, this being the only stable condition of its motion. To prevent this tumbling of the shot, forced rotation is given to it by rifling the gun. While the rifle projectile preserves its rotation about its axis, it moves point forward, is far less resisted by the air than the sphere of equal weight, and, by preserving its velocity, is effective at much greater ranges. The initial velocity of the shot, its rate of rotation, and its figure and weight will determine its course.

Smooth-bore small-arms are now entirely superseded by the rifle; and although the same is not true in regard to smooth-bore and rifle cannon, the latter are almost the sole subject of study and experiment, and they must of necessity be a main portion of every well-appointed armament. It may be presumed that difficulties of little consequence in the rifle musket, with a projectile of yielding material, may become very serious when we undertake rifle cannon, with their heavy charges and rigid projectiles, usually of cast iron. As the elongated shot greatly exceeds in weight the round projectile of like calibre, and is subjected both to a sliding and rotary movement, it becomes peculiarly necessary to keep the bore of rifle cannon free from foulness or accidental impediments.

Work required from Rifle Guns.—The increased weight of the rifle projectile, as well as the other considerations alluded to, make it necessary to provide for increased strength in the construction of rifle cannon. Thus, the rifle of 6.4 inches calibre, or 32-pounder smooth-bore, throws a projectile, as a rifle, of from 80 to 100 pounds; a 10-inch smooth-bore gun has a shell of 100, a solid shot of 125 pounds; the 10-inch rifle, a projectile of 250 pounds or heavier, according to its length and other dimensions. As in the steam-engine the pressure in the cylinder depends on the resistance opposed to the piston, so in the rifle cannon the charge being resisted by the greater mass in proportion to the surface on which the pressure is applied, the elastic fluid will necessarily assume a higher tension than with the spherical projectile.

Strain upon Guns considered.—In investigating the resistance of a cylinder to a pressure applied equally over its interior surface, we must distinguish two cases: *First*, when the strain is caused by a slowly-increasing force, such as that upon the cylinder of the hydraulic press produced by the repeated strokes of the pump, and when the pressure attains a maximum and is equal to the resistance of the cylinder; *second*, when the strain is more suddenly and rapidly applied, as with a charge of fired gunpowder, and time for the full development of the resistance of the cylinder is not given.

(1) *Resistance to a Slowly-increasing Force.*—We suppose the cylinder to be composed of thin concentric rings or circular layers of metal. We may premise that the strain in such cases is first felt by the inner layer, and that, if increased to the rupturing point, the interior layer will be the first to yield; but with forces not beyond the regular working resistance of the cylinder the strain will extend freely from layer to layer, and all these layers will together make up the resistance of the whole cylinder. Now, supposing the pressure to have gradually increased to its maximum, and become stationary, causing a strain in equilibrium with the resistance, how will this strain be distributed among the several layers of the cylinder? In transmitting the strain from the inner ring to the others, each will be extended in succession, and whatever of the strain is not supported by the elasticity of the first layer is transferred to the next, and so on, each layer supporting its part of the strain, and transferring the excess to those exterior to it. Thus, the outer ring is extended by its part of the whole strain; and if it were possible for the next within it to remain more strained than the outer, the latter would not be at rest, but would receive the strain and be further extended; thus we see that the extension of the several layers would be by equal forces, and the strength of the whole proportional to the number of layers or the thickness of the cylinder; and each one of the layers sustaining an equal part of the resistance, every layer will be extended, but by the same force as the others, and the extension of the several layers will be in proportion to their respective lengths or to their diameters or radii. The case is similar to that of rods of unequal length, which are extended by equal forces proportionally to their respective lengths. And if we represent by R and r the radii of the outer and inner circumferences of the cross-section of the cylinder before the pressure is applied, and by e the extension of the interior layer, that of the exterior will be $e\frac{R}{r}$. Before extension the area of the cross-section of the cylinder will be $\pi(R^2 - r^2)$. After extension the area will become—

$$\pi\left(\overline{R + \frac{Re}{r}}^2 - \overline{r + e}^2\right), \text{ or}$$

$$\pi\left(R^2 + 2R^2 + \frac{R^2e^2}{r^2}\right), \text{ or}$$

$$\pi\overline{\left(R^2 - r^2) + 2e\left(\frac{R^2}{r} - r\right) + e^2\left(\frac{R^2}{r^2} - 1\right)};$$

which last expression, as $\frac{R^2}{r}$ is greater than r, and $\frac{R}{r^2}$ is greater than unity, must be greater than $\pi(R^2 - r^2)$, the area of sections of cylinder before pressure.

The rule of Barlow, that the resistance of the layers varies inversely with the squares of their distances from the centre, is based on the supposition that the area of the cross-section of the cylinder remains constant during the application of internal pressure. This does not appear to be the case. Although we have not considered the force as carried to the bursting-point, our views are illustrated experimentally by the trials of cylinders of cast iron described by Gen. Rodman. (*Experiments on Metal for Cannon, and Cannon Powder*, p. 156.) These cylinders were carefully prepared and burst by a slowly-increasing pressure produced by forcing beeswax into them; and the pressure under which each set was broken, and the thickness of metal, are given in the following table; also the ratio of the thickness of the metal to the bursting force:

No. of set.	Thickness of metal.	Bursting pressure per sq. in.	Ratio of thickness.	Ratio of bursting force.
1	.2 in.	9,768	1.	1.
2	.3	14,854	1.5	1.52
3	.4	20,286	2.0	2.07
4	.5	23,610	2.5	2.41
5	.6	27,404	3.0	2.80
6	.7	31,979	3.5	3.27
7	.8	36,890	4.0	3.77
8	.9	38,887	4.5	3.98
9	1.0	45,566	5.0	4.66
10	1.1	49,760	5.5	5.09
11	1.2	49,813	6.0	5.10

Although Gen. Rodman does not regard this experiment as entirely reliable, he remarks that these results are anomalous, and do not confirm the theory on this kind of resistance. Up to the ninth set, inclusive, they show the resistance to increase almost directly as the thickness of metal. They certainly are not to be reconciled with the theory of the resistance varying inversely as the squares of the distances from the centre.

It would seem that whenever there is *time* for the transmission of the force, its action will be in accordance with our views; and a remarkable example has very recently been made public. (See *Engineering*, May 7, 1875, p. 385.) A cylinder of Whitworth steel of 2.56 inches bore and 7.83 inches external diameter was closed at the ends and subjected to repeated discharges of gunpowder, the gas escaping by a small orifice 0.1 inch diameter. After forty-eight discharges the bore was found to be enlarged .0485 inch, and the exterior .1919 inch. Here even a great work of resistance appears to have been done by the external portion.

Resistance of a Cylinder to a rapidly-increasing force like that of Fired Gunpowder.—Still supposing the cylinder to be made up of successive rings or layers, we see that the first action of the powder will be upon the bore or interior layer; that the assistance which the bore will receive from the layers which follow it outwardly in succession will be greater as the force of the powder is more gradually developed; and that in general the inner layer will be most severely strained, and with forces increased to the bursting-point the fracture will begin at the bore. From observation of the effects of severe and continued firing upon cast-iron guns, it appears that injury is first shown by minute fissures produced at the surface of the bore, as if the strain was too quickly increased to admit of the support of the more distant metal. These fissures are gradually extended by repeated firing until the destruction of the gun is complete. It is well known that the part of the bore of guns exposed to severe strain by tension is small, and exceeds but little the space occupied by the powder; and we conclude that the extreme force of the powder is developed before the projectile has moved its own length from its place. A rapid accumulation of the force of the powder to its maximum, and very great reduction beyond this limit, are characteristic of all kinds of powder, but they differ widely in the mode in which they pass from first combustion to the highest tension, as well as in their continued pressure on the projectile.

If the metal of the cylinder does not act in resisting the strain of gunpowder in the same manner as with a slowly-increasing force, it is for the reason that there is not *time* to bring into action the exterior metal of the gun before the strain has passed its maximum. In this way powder may no doubt be so quick that rupture commences at the surface of the bore while it is actually unsupported by the outer metal of the gun. Not only does it require *time* to bring into action the strength of the layers of metal relatively to their distances from the bore, but the mode in which we conceive them to resist will increase that time. As in all other cases of strain, the work done by any layer will be proportional to the force multiplied by the extension produced in that layer, and the greater extension which must be given to the more distant layers will add to the time of bringing the greatest resistance to act in any given case.

Modes of obtaining Increased Strength in Cannon.—The strength evidently required in rifle cannon has not yet been obtained in cast-iron guns by increase of thickness. Probably, the laws governing the resistance to the strains of firing, as well as the nature of the material itself, will prevent the use of guns of cast iron made in a single piece, as rifle cannon. With the exception of the large smooth-bore guns before described, and some varieties of field artillery, all modern ordnance consists of cannon made of two or more separate parts, united to form the complete gun, which we denominate a "*built-up gun*." Built-up guns are as follows: (1) banded guns, (2) tubed guns, (3) guns of bands and tubes combined.

Theory of Banded Guns.—Banded guns are composed of a body, usually of cast iron, strengthened by bands or hoops, either shrunk on or forced into their places. Thus, the Parrott gun of 1860–61 consisted of a cast-iron body and a wrought-iron band or reinforce. In France and Sweden heavy cast-iron guns, hooped with steel bands, have also been used, and, as represented, with favorable results. The principle on which the banded gun depends is that of producing a tension upon the hoop or band, generally by the well-known operation of "shrinking," and thus calling forth the strength of the exterior part of the gun to meet in advance, as it were, the strain produced by firing the gun. The shrinking on of the band will necessarily produce a compression at the bore of the gun, and thus a part of the strength of the external band is made available at the first effort of the charge and at the very moment of firing. The band therefore takes a part—and it may be said the first part—in the work of resistance, and until it has yielded the metal of the bore is not in danger. This operation of the band cannot be questioned, but doubts have been suggested as to its regular and sustained action when put on "under a strain."

But we may mention, in support of the efficacy of the band, the following considerations: It cannot be doubted that bands applied with the proper *degree of tension* are a very effective mode of strengthening guns. That the bands are under a strain, and may become less effective in time, has been advanced as an objection to banded guns; but both fact and sound reasoning will show that, as in all other constructions, when proper proportions are followed, guns so made will work continuously with safety. Thus, in a large steam-engine the top and bottom of the cylinder are secured by bolts, and these are placed under strain by screwing up to make a tight joint and to meet the shock produced by the sudden admission of the steam to the cylinder; yet these bolts, if properly proportioned, go on for many millions of shocks without failure.

All constructions must consist of parts, some of which are subjected to strain; and it depends wholly on the due proportion of the parts in reference to the strains to which they are subjected whether the work can be performed safely and constantly or not. Guns, like other mechanical constructions, should be viewed in reference to the regular work they may safely perform, although guns are from the nature of the force employed more subject to be accidentally overstrained.

The theory we have advanced is the same upon which the Armstrong, Woolwich, and the Krupp guns are constructed. In all of them the external parts are placed upon the internal portion or barrel by being forced or shrunk on. The Parrott guns, altogether lighter than the more modern rifles, have presented too many cases of endurance to permit any doubt of the efficacy of bands in strengthening guns.

Tubed Guns.—Tubed guns are those in which additional strength is obtained by the insertion of a tube of wrought iron or steel, the body of the gun being usually of cast iron. Our limits do not permit us to enter into a detail of the various plans proposed, but we may say that one writer, Pallisser, advocates wrought iron, the tube being inserted from the muzzle; and Parsons prefers steel, inserted from the breech. The wrought-iron tube can be made of just sufficient exterior diameter to admit of its being pushed into the gun. By a few rounds the tube is expanded against the cast iron, by which something like the action of a band is obtained from it. The stronger material forming the actual bore is better suited than cast iron to resist the first strain, which falls upon that part. It is, moreover, a metal much less subject to fissures than cast iron or steel, and it is probable that tubed guns of this kind will be found the least costly description of the heavy rifled cannon now demanded.

Guns of Tubes and Bands Combined. (See also ARTILLERY.)—Such are the English "Woolwich guns," composed of a steel tube and large bands of wrought iron, called coils from the mode of their manufacture; also the Krupp gun, made wholly of steel, and consisting of a large barrel or centre piece and built up with heavy bands.

Rifle cannon are either muzzle-loading or breech-loading. The latter have been extensively adopted in Germany and Russia, and various devices for closing the breech have been introduced. To the success of any of these the effectual cutting off the escape of the gas is essential, and this is best accomplished by the ring of Mr. Broadwell. The protection of the gunners and the facility of loading, particularly on shipboard or in casemates, are important points in favor of breech-loading cannon.

Mortars.—These are very short pieces of ordnance, designed for throwing heavy projectiles at a high elevation, their effect being produced by the weight and velocity acquired by the projectile in its descent from a great height. Mortars in general have smooth bores and spherical projectiles. If, however, by rifling the mortar it can be made

capable of projecting masses two to three times the weight of the spherical projectile, the advantage of such a change is not to be doubted. Some experiments made in this direction indicate that favorable results can be obtained by rifling the ordinary mortar.

Projectiles.—Of these we shall only mention such as belong to rifle cannon, which may be divided into two classes —"expanding" and "non-expanding." Expanding projectiles are such as are provided with a portion of metal sufficiently yielding to the force of the powder to "take" the grooves of the gun, and thus effect the rotation of the projectile. Non-expanding projectiles are of two kinds—first, those which are fitted with projections, usually called "studs," which move in the grooves, thus giving rotation to the shot; and, secondly, projectiles for breech-loading guns, which are furnished, on their cylindrical part, with a coating of soft metal or with rings of suitable exterior diameter to fit a portion of the bore of the gun at the rear, from which the grooves have been removed. On firing the soft metal is forced through the grooves and rotation obtained. The system of *studs* is adopted in the Woolwich guns in England, the *coated projectile* of course with breech-loading guns, and the expanding system has been extensively used in the U. S.

With the projectile the rifling of the gun is closely connected, but we cannot properly consider the question of twist, number of grooves, and other points of much interest. With regard to the twist, it may be said that the increasing twist is favorable to the taking of the grooves by the expanding projectile at the first effort of the powder, and that the effect will be to relieve the gun at the moment of greatest strain. The English, as we understand, have adopted the increasing twist in the Woolwich guns, which are served with studded projectiles. If we are correctly informed, these projectiles are so arranged that they rest, when in the gun, upon the studs, which thus carry the weight of the projectile, while they must of course do the whole work of rotation. We think many of the complaints of damage to the bore of these guns are erroneously attributed to the increasing twist, and that the weight of the projectile should be supported by the bore, and the studs, entering but not reaching to the bottom of the grooves, should be confined to their proper office of giving rotation to the projectile.

Closely connected with our subject are the mounting of heavy guns and penetration of armor-plates, but to consider them would carry us beyond the proper limits of this article.

For our own country the subject of heavy ordnance has a peculiar interest. Since the peace in 1865 we have been unwilling to persevere in keeping pace with other governments in the production of the very heavy rifle cannon which during the last ten years have been so largely made in Europe. To a certain extent we have derived advantage from their experience, but at the same time we are losing the skill and the appliances for executing such work. The cost of such ordnance is undoubtedly great, but nothing to that of being found unprepared in the emergency of a foreign war. R. P. PARROTT.

Ordnance Survey, British. The Ordnance Survey, so called from having been originally under the control of the board of ordnance, may be said to have had its commencement in the operations conducted by Gen. Roy in 1784 for the determination of the difference of longitude of the observatories of Greenwich and Paris, though it was only in 1791 that the systematic survey of the country with the view of producing a military map of the whole kingdom on the scale of one inch to a mile ($\frac{1}{63360}$) was commenced. The first sheet of this map was published Jan. 1, 1801, and in 1824 the work was so far advanced as to include the whole of the S. of England, with part of Wales and a small part of Scotland, when it was in a great measure suspended in order that the survey of Ireland on the scale of 6 inches to a mile might be proceeded with. In 1840, this survey of Ireland being completed, and the military map of England finished up to the southern boundaries of Lancashire and Yorkshire, the government decided on adopting the scale of 6 inches to a mile for the survey of the remaining counties of England and the whole of Scotland. In 1855 the scale was again changed, and that of $\frac{1}{2500}$ (25.344 inches to a mile) ordered for the cultivated districts of the four northern counties of England and of the whole of Scotland. The uncultivated districts were at the same time to be drawn on the scale of 6 inches to a mile ($\frac{1}{10560}$), and the $\frac{1}{2500}$th plans to be reduced to the 6-inch scale, so as to make the plans of every county perfect on that scale. In 1862 the four northern counties were finished, and in the following year the extension of the large scale to those portions of the country which had been previously surveyed on the scale of 1 inch only was ordered.

At the present moment the 1-inch map of England, with hills engraved, is complete; that of Scotland is about half completed, with hills; that of Ireland is completed and published in outline, and about one-half is engraved with hills. The south-eastern counties of England are partly finished and partly in progress on the large scale, and the survey is now being prosecuted principally in the mineral districts of the country. The survey of Scotland is completed on the large scale, with the exception of the Shetland Islands, which are in progress, and some of the southern counties, which are only on the 6-inch scale. Towns are published generally on the scale of $\frac{1}{500}$.

The sheets of the 6-inch and 1-inch map are engraved on copper. It is unnecessary here to explain the process of electrotyping by which the engraved plates are multiplied, as it is now generally known. The sheets of the $\frac{1}{2500}$-scale are zincographed. The reduction from this to the 6-inch scale is effected by photography, the relation of those two systems being that a 6-inch sheet when divided into $4 \times 4 = 16$ similar rectangles; each of these rectangles corresponds to a sheet of the large scale. The sheets of the $\frac{1}{500}$-scale used for towns are formed by dividing a $\frac{1}{2500}$-sheet into $5 \times 5 = 25$ rectangles. In some cases the town maps have been engraved, but they are generally zincographed.

The principal triangulation of Great Britain and Ireland consists of some 250 stations, the triangle sides being in some cases upward of 100 miles in length. The angles were measured with theodolites of 36, 24, and 18 inches diameter. The latitudes of 32 stations were determined by observation, and the direction of the meridian observed at 60 stations. It is a feature peculiar to the Ordnance Survey that these observations were mostly made by non-commissioned officers of Royal Engineers; and any one who examines the *Account of the Principal Triangulation* (1858) will be at least satisfied with the precision and completeness of the work. The triangulation was reduced by the method of least squares—a most laborious operation. Six base-lines were measured in the course of the work, but the final results are made to depend on the two lines —one in the N. of Ireland (8 miles long), and the other in the S. of England (7 miles long)—which were measured with Colby's "compensation bars." The latitudes of the stations were determined with the zenith sector, but the superiority of the zenith telescope for such observations has since been proved.

The British triangulation contributes an arc of more than 10° to the data for the determination of the figure of the earth, which, combined with the most recent measurements in Russia and India, gives an ellipsoid whose semi-axes are 20,926,350, 20,919,972, and 20,853,429 feet of the standard yard; the greater equatorial axis being in lon. 15° 34′ E. If, however, a solid of revolution be insisted on, the semi-axes are 20,926,062 and 20,855,121 feet.

In 1862 the English triangulation was connected through France with that of Belgium, with the view of so far completing the grand arc of parallel (which will shortly be published) between the western point of Ireland and Orsk on the river Ural. At the head-quarters office at Southampton a series of comparisons has lately been made, with the utmost attainable precision, between the standard yard of England and the geodetic standards of France, Belgium, Prussia, Austria, Russia, Italy, Spain, the Cape of Good Hope, India, Australia, and the U. S. of America. The American standards were—the mètre "No. 6" of the six mètres which were compared (*U. S. C. Survey Rep.*, 1862, App. 26) with the "committee mètre," and two standard yards for the lake surveys. The account of these comparisons will be found in the *Philosophical Transactions of the Royal Society* for 1866 and 1873, and in the volume entitled *Comparisons of Standards of Length of England, France, etc.* (London, 1866).

The principal triangulation is reduced to a secondary triangulation having sides about 6 miles long, by means of theodolites of 12 inches diameter; this triangulation is again reduced by 7-inch theodolites to sides of 1 or 2 miles in length, according to the nature of the country. The trigonometrically computed lengths of these sides form a check on the chain measurements and prevent effectually any errors. The nature of the projection used for the 6-inch county maps will be sufficiently explained by saying that the edges of the sheets are parallel and perpendicular to the central meridian of the county. The sheets measure 36 inches by 24, each showing a rectangle of 6 miles by 4. The projection for the 1-inch map of Scotland is a modification of Flamstead's.

With regard to levels. A system of initial levels executed with the greatest accuracy, covering the country and reduced by the laborious method of least squares, forms a basis on which all district levelling is founded. The

maps show elevations above the mean level of the sea, and the 6-inch maps show contour-lines drawn at 50, 100, 200 . . . . , and at intervals of 100 feet up to 1000. These contours are also inserted on outline impressions of the more recent sheets of the 1-inch map.

Besides the ordinary steady work of surveying the country, special surveys have been and are made from time to time for the war department and other services, not only in this country, but, for instance, in Canada and in Gibraltar, and trained parties from the Ordnance Survey have been employed at the Cape of Good Hope and in British Columbia and elsewhere. The surveys of Jerusalem and its vicinity and of portions of the desert of Sinai, though semi-official and paid from private subscriptions, owe much of the value that attaches to them to their connection with the Ordnance Survey.

In 1860 the process of photo-zincography, by which photographs are transferred to the surface of a zinc plate, thence to be printed from as in ordinary zincography, was introduced by Maj.-Gen. Sir Henry James, and has proved invaluable in the production of inexpensive and perfect copies of maps or other documents. At Southampton an extensive series of fac-similes of the most valuable of our ancient national manuscripts of England, Scotland, and Ireland, including the great survey of England made in 1086 by order of William the Conqueror, and known by the name of the *Domesday Book*, has been made and published, and further copies are making, including some of the very ancient Anglo-Saxon charters.

The organization of the Ordnance Survey has been steadily preserved, having been found to produce results certainly of the highest quality at moderate cost. Its essential feature is the combination of military and civil elements. There are 20 officers of the Royal Engineers, including 1 director, 4 field-officers, 7 captains, 6 lieutenants, and a quartermaster. There are four companies of Royal Engineers, which, including non-commissioned officers, amount to 372 men. The number of civil assistants and laborers is about 1450. At Southampton there are 6 officers and about 70 non-commissioned officers and men of Royal Engineers, and some 420 civil assistants and laborers. In this staff are included 100 engravers, 132 zincographic tracers and printers, 60 colorists, 50 draughtsmen and examiners of plans, 20 trigonometrical computers, 32 artificers, including 3 opticians, besides photographers, clerks, accountants, and others. The sum voted annually by Parliament for the prosecution of the survey varies from time to time; it is at present about £130,000. It would be impossible here to do more than name the several directors of the Ordnance Survey—Gen. Roy, Col. Williams, Gen. Mudge, Gen. Colby, Col. Hall, and Gen. Sir Henry James, to whose able and energetic directorship the survey owes much of its efficiency, and the present director, Maj.-Gen. Cameron, C. B., F. R. S. A. R. Clarke.

Ordogno, the name of several kings of Asturias and Leon, of whom the first two became celebrated for their wars with the Moors. Ordogno I. succeeded his father as king of Asturias in 850, fortified Leon and Astorga, and conquered Salamanca in 862. D. at Oviedo in 866.—Ordogno II., a son of Alfonso III., succeeded Garcias I. in 913 as king of Leon and Asturias, and removed the royal residence from Oviedo to Leon. He defeated the Moors in 916 at St. Étienne de Gormaz, and took from them Talaveyra de la Reyna. D. in 923.—Ordogno IV., a son of Alfonso IV., fought about the crown of Leon with Sancho I., who was supported by Abd-er-Rahman, caliph of Cordova. In 960, Ordogno, who had received the surname of the Bad, was defeated and compelled to flee. D. shortly after in a village of Andalusia.

Ore, a metal chemically combined, or in a native state, mechanically mixed with other substances, which render treatment necessary to separate it. In a strictly technical sense, only those substances are ores which contain the metal in sufficient quantity and of sufficient purity to make the treatment profitable. Arsenopyrite, a combination of arsenic, sulphur, and iron, contains 34.4 per cent. of iron, but is not an ore of iron, because the metal made from it is not of sufficient commercial value to pay the expenses of treating it. Thomas Egleston.

O'Rea'gan (Anthony), D. D., a native of Ireland; became a Roman Catholic priest of the U. S.; was in 1854 consecrated bishop of Chicago; translated in 1858 to the see of Dora *in partibus infidelium*, and d. in 1865.

Örebro. See Oerebro.

Ore Deposits. An ore deposit is any natural occurrence of metalliferous minerals from which one or more of the heavy metals can be profitably extracted. The ore may be a single native metal, or a chemical or mechanical mixture of metals, or a single mineral consisting of a metallic oxide or a metallic salt, or it may be a mechanical mixture of several of these minerals. Generally, the ore is associated more or less intimately with other minerals, which are called the gangue. The ore and the gangue together form the deposit.

Texture.—Metalliferous deposits sometimes consist solely of one ore, as in some occurrences of magnetite, hæmatite, spathic iron ore, galena, more often of two or more ores, with one or more minerals forming the gangue. The different ores may be intimately associated with each other and with the minerals forming the gangue, or they may exist separately and with a greater or less regularity of distribution. The more common varieties of texture, chiefly as given by Von Cotta, are—

Compact, when the texture is so fine that the separate particles are not visible to the naked eye: compact hæmatite.

Granular, when the particles are visibly in the form of grains: fine-grained, medium-grained, coarse-grained, are terms used to indicate the size of the individual particles: granular magnetite, granular pyrites, etc.

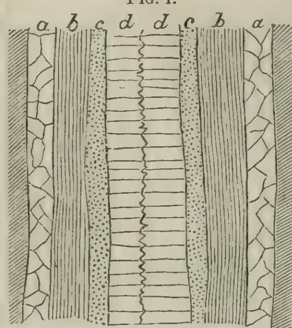
Micaceous or finely laminated, when the particles are in thin laminæ or scales: micaceous specular iron ore.

Disseminated, when the ore is distributed through the gangue in grains or laminæ.

Porphyritic, when the ore is distributed as integral crystals through the gangue.

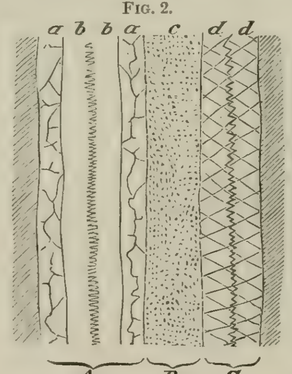
Banded or combed, when the constituents—ores or gangue or both—are arranged in parallel layers. This variety, which is very common in certain kinds of deposits, is of signal interest from both scientific and economic standpoints.

Fig. 1.



Deposits having this structure were formed in cavities, fissures, caves, chimneys, and the layers indicate gradual growth under more or less varying conditions. The oldest members or layers (*a*, *a*) formed on the opposite walls (Fig. 1), then *b*, *b*, *c*, *c*, till finally the two youngest members, *d*, *d*, filled the narrowed space. Frequently two contemporaneous layers, which may alone fill the vein or may form the two youngest members, consist of crystals set perpendicularly to the walls of the vein, and with their terminal faces bristling toward each other from opposite sides or interlacing (*d d* in the sketch). This symmetrical repetition is sometimes interfered with by the interposition of other layers when the vein has reopened and formed a new vein between the walls of an older one. Fig. 2 represents three distinct veins, A, B, C, between the same walls.

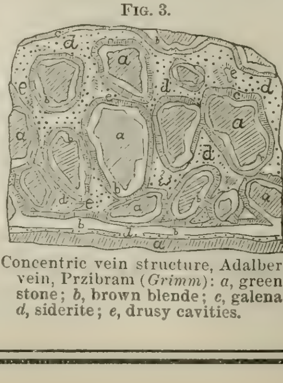
Fig. 2.



Concentric-banded, *Cocardenerze*, or *Ringerze*, when the bands are arranged symmetrically around a nucleus, which is often a fragment, as in Fig. 3.

Brecciated.—The deposits very often contain fragments of the enclosing rock or "country," or, also, pieces of still older ore-formations. When these are very numerous the texture is brecciated. Sometimes these fragments form nuclei, around which the minerals of the ore and gangue have crystallized, forming a massive or banded or drusy cement. Very often, especially in veins, the highly altered fragments of the wall-rock form nearly the entire filling, in which the minerals of the ore and gangue are distributed

Fig. 3.



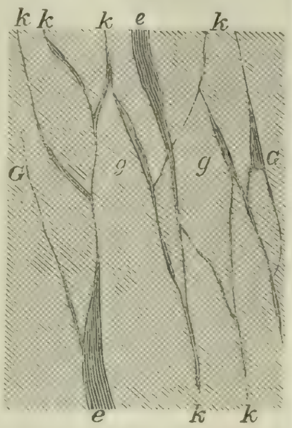
Concentric vein structure, Adalbert vein, Przibram (*Grimm*): *a*, greenstone; *b*, brown blende; *c*, galena; *d*, siderite; *e*, drusy cavities.

in thin threads and seams. (See Fig. 4.) The texture is then generally earthy-granular or flaky and lenticular.

Drusy, when the deposit contains many cavities lined with crystals.

The boundaries of a deposit are called walls; when these are well defined, the plane between the deposit and the wall-rock is called the selvage (*Salband*); this is sometimes very smooth and highly polished (*Slickenside*).

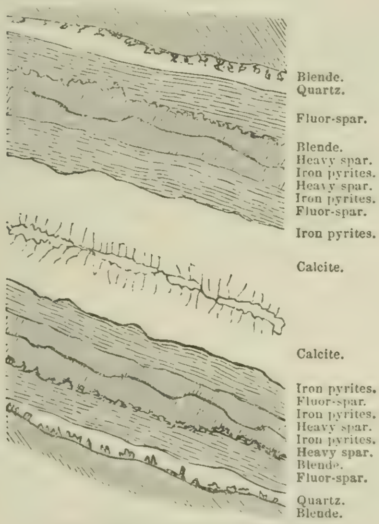
Fig. 4.



G, wall-rock; *k*, clefts; *g*, wall-rock in the lode; *e*, ore.

Succession of Minerals.—The formation of any deposit was due to slowly acting causes working during long periods of time, and often under more or less varying conditions. The progress of growth is often marked by the banded structure when present, the varying conditions by the alternating constitution of the bands, and the relative ages of the constituents by their relative positions in the separate bands or by the superposition of one upon another, forming what is called a paragenetic series, as in Fig. 5. Not unfrequently the constituents of one of the minerals have been removed in part or wholly, and other substances have taken their place, forming a new mineral, which, however, retains the external crystalline form of its predecessor; this process, called pseudomorphism, has sometimes gone so far that a new series of minerals has taken the place of the older deposit. Limonite, pseudomorphous after spathic iron ore, is one of the more frequent instances of deposits changed as regards mineral composition.

Fig. 5.



Paragenetic series (*Von Weissenbach*).

Grouping of Minerals.—Certain metalliferous substances have a tendency to occur together, either chemically combined or associated as separate minerals; for instance, ores of lead and zinc, of copper and iron, of cobalt and nickel, of iron and manganese, of tin and wolfram. A similar tendency to association exists with regard to certain gangue minerals, both among themselves and with certain ore groups. The preceding table, from Von Cotta's *Treatise on Ore Deposits* (translated by F. Prime, Jr.), illustrates some very common instances of association where the deposit consists of two, of three, or of four or more members.

Two Members.	*Three Members.*	*Four or more Members.*
Galena, blende.	Galena, blende, iron pyrites (silver ores).	Galena, blende, iron pyrites, quartz, *and* spathic iron, dialagite, brown spar, calcite, *or* heavy spar.
Iron pyrites, chalcopyrite.	Iron pyrites, chalcopyrite, quartz (copper ores).	Iron pyrites, chalcopyrite, galena, blende, *and* spathic iron, dialagite, brown spar, calcite, *or* heavy spar.
Tin, wolfram.	Tin, wolfram, quartz.	Tin, wolfram, quartz, mica, tourmaline, topaz, etc.

Oxidation Zone.—That part of a deposit which is nearest the earth's surface is subject to changes produced by the oxidizing influence of the descending waters. This influence is especially active where portions of the deposit are subjected to constant drainage, so that water freshly charged with oxygen and carbonic acid is more or less constantly filtering through the mass. The result of this process is the oxidizing of the sulphuretted ores, and, if continued long enough, the removal of nearly all the metallic contents except the iron, which remains, chiefly as ferric oxide, and part of the precious metals, which remain in a native state. This oxidized portion is called the "gossan," "Eiserne Hut." In many regions which have been subjected to the long-continued destruction of the surface by glacial action, this oxidized zone has been wholly removed.

Classification.—The modes of occurrence of ores are so varied that it has been found necessary, both for technical and scientific purposes, to classify them. The present state of our knowledge warrants the assumption that the greater number of the varieties of deposits were not formed either previously to, or contemporaneously with, the enclosing rock, but that their forms are due to the action upon the enclosing rock of processes in some instances mechanical, in others chemical, which made room for the formation of the ore and gangue. We know, also, that all metalliferous aggregations are the result of a process, or of a series of processes, of concentration—that their constituents, existing previously in a diffused state, were moved in a fluid or gaseous condition. In circulating in the crust of the earth, whether descending or ascending, they moved along lines of least resistance, passing slowly through the capillary cracks and pores of hard rocks, and more freely in more permeable beds like sandstone, but tending always, as in all drainage, to converge from the countless minute and restricted channels to the larger and more open fissures or cavities. Wherever, in the path of this circulation, there existed a cause competent to arrest and render stable a metallic substance thus moving, there was effected a further concentration, which, if carried far enough, resulted in an ore deposit. The following classification is in harmony with the above-mentioned conditions and with our present knowledge regarding the origin of ore deposits:

- I. Disseminated Concentration.
  - 1. Impregnations, Fallbands.
- II. Aggregated Concentration.
  - 1. Lenticular aggregations and beds.
  - 2. Irregular masses.
  - 3. Reticulated veins.
  - 4. Contact deposits.

} Forms due to the texture of the enclosing rock or to its mineral constitution, or to both causes.

- III. Cave Deposits.
- IV. Gash-Veins.
- V. Fissure-Veins.

} Forms due chiefly to pre-existing open cavities or fissures.

- VI. Surface Deposits.
  - 1. Residuary deposits.
  - 2. Stream deposits.
  - 3. Lake and bog deposits.

Deposits whose forms are dependent on the texture of the rock or on its mineral constitution, or on both conditions.

I. Disseminated Concentration.—*Impregnations.*—The determining characteristic of this form is the dissemination of one or more metallic substances, in particles from an invisible size up to that of a pea or larger, through the rock-mass. The particles may be in flakes or grains or crystals. They may occur in any kind of rock, sedimentary, metamorphic, or eruptive. The most common illustration of this form is seen in the frequent occurrence of iron pyrites in shales and schists and in hornblendic rocks, granites, etc. When this disseminated pyrites contains gold, as is frequently the case, especially in the metamorphic schists, it sometimes becomes of economic value. The Permian sandstone and shales along the western edge of the Ural Mountains are impregnated with copper ores, as malachite, azurite, volborthite, with some cuprite, chalcopyrite, and tetrahedrite. They occur especially in the sandstone as a cement and forming films in the cracks, and they also replace the remains of plants contained in the rock. Similar occurrences in sandstone are known in different parts of Bohemia, Tyrol, Chili, and in the U. S. At Mansfeld in the Hartz, and at many points in Thuringia, the Permian limestone is associated with dark, bituminous, marly clay-slates, which are impregnated with ores of copper and of other metals, and have long been worked. The ores occurring here are pyrite, chalcopyrite, bornite, chalcocite, tetrahedrite, cuprite, melaconite, malachite, azurite, native copper, native silver (very rare), galena, brown and

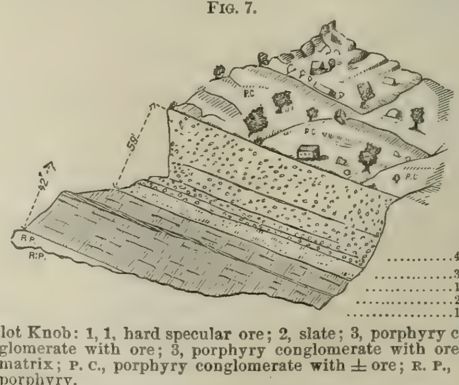
black zincblende, copper-nickel, earthy cobalt, cobaltine, bismuth, antimony, arsenic, and molybdenite, the last five very rare. The other minerals are calcite, gypsum, barytes, mica, asphaltum, and coal. Very generally the organic remains, especially of plants and fishes, are changed to copper and iron pyrites. The copper ores predominate very greatly over all the others. The famous deposits of native copper on Lake Superior are in part impregnations in the amygdaloids of the melaphyr. The copper occurs as a secondary product, filling or lining amygdaloidal cavities, and as threads and films, and associated in these with quartz, calcite, iron-chlorite, green-earth, epidote, and prehnite, analcite, adularia, and laumontite, and often with native silver. It also occurs in the conglomerates and sandstones formed from the detritus of quartz-porphyry, which are interbedded with the melaphyr. In these conglomerates and sandstones the copper occurs in the interstices between the grains, often to such an extent as to form a continuous cement. In the great Calumet and Hecla mine the conglomerate is from 6 to 8 feet thick, and in the extensive areas worked in the mine the copper averages about 4 per cent. of the rock. Its associated cementing minerals are calcite, quartz, and epidote. In most instances, both in the amygdaloids and in the conglomerate, the copper has replaced older minerals. Copper ores occur also as impregnations in the extensive Lower Silurian sandstone, younger than the melaphyr, but, so far as is known, not to a workable extent. Ores of lead and of zinc also occur as impregnations. The ores of the two metals are generally associated to a greater or less extent. One of the most noted instances is that at Commern in Rhenish Prussia. The rock is the *Bunter Sandstein* (Triassic), here immediately overlying the Devonian. At the bottom it is a conglomerate of coarse Devonian fragments cemented by quartz. Above this is a fine white or yellow loose sandstone in thick beds, with numerous lenticular layers of conglomerate. The sandstone and enclosed conglomerate are very uniformly impregnated with galena, often associated with a little zincblende. The ore is in grains from the size of a pin-head to an inch or more in diameter, and these almost invariably contain sand in the interior, cemented by the ore. The galena is sometimes changed to cerusite, and the presence of a little copper is shown by stains of green and blue carbonates. The ores contain $\frac{1}{23000}$th to $\frac{1}{3200}$th of silver. Ores of lead and zinc frequently occur as impregnations to a small extent in many argillaceous rocks of different ages, as in the Chemung beds of New York and in the shales of the Carboniferous and in coal. They also occur extensively in the various lead-bearing limestones and dolomites, but, owing to the texture of these rocks, the impregnations are very subordinate to the other forms of deposits. Auriferous pyrites and native gold form typical impregnations in some metamorphic schists. Many of the occurrences of ores of cobalt and tin in quartz and mica schists and of tin in granitic rocks are other instances. This form of deposit is one of the most common in Scandinavia, where it is known under the name of *fallbands*. These are beds, or portions of beds, of metamorphic schists impregnated with sulphurets. At Kongsberg the impregnations consist especially of iron pyrites, and, with this, lesser amounts of copper pyrites, pyrrhotite and blende, and traces of silver-glance and native silver; at this point their chief importance lies in the fact that they enrich the veins which traverse them. At Skutterud and Snarum the rock containing the fallbands is a fine-grained mica-schist, forming transitions into quartzless mica-schist, quartzite, and gneiss. The ores and associated minerals are cobaltine, skutterudite, arsenopyrite containing cobalt, leucopyrite, chalcopyrite, molybdenite, pyrrhotite, pyrite, galena, chalcocite, malachite, native copper, chrysocolla, magnetite, titanite, ittrotitanite, rutile, graphite, amphibole, tremolite, anthophyllite, sahlite, actinalite, amianth, epidote, garnet, scapolite, smoky quartz, tourmaline, talc, and serpentine. The ores contain a small percentage of nickel, but they are worked especially for the cobalt.

II. Aggregated Concentrations.—1. *Lenticular Aggregations and Beds.*—It frequently happens that the ores, instead of being in grains disseminated with more or less regularity throughout the rock, are aggregated into numerous masses. If the rock is stratified, these aggregations are generally lenticular and parallel to the stratification. These may consist wholly of ore, or of ore associated with the minerals forming the rock, or with minerals which are not essential constituents of the rock. When these lenticular masses lie so close together that they predominate over the enclosing rock, or when the ore and its gangue form a continuous interstratified sheet, the deposit is a bed. Between all the already mentioned forms, impregnations, lenticular aggregations, and beds, there are intermediate forms; they all sometimes occur in the same deposit, passing gradually one into the other, or the same ores occurring in the same kind of rock may in the same district be represented in each of these forms. As instances we may mention some of the occurrences of auriferous pyrites in metamorphic schists, and especially of magnetite in chloritic schists, where the three forms are rarely absent. Excepting, perhaps, tin, there is hardly any ore that does not occur in this form of deposit. The ores of the more common metals, as iron, lead, zinc, and copper, often occur each as the sole constituent of the bed; while ores of the other metals, when present, are generally subordinately associated with the more common ores or with gangue minerals. As iron is the most universally distributed metal, so it forms also the most extensive beds. As a carbonate it forms extensive and very important beds associated with the shales and limestones of the coal-measures, as well as in other formations. At Eisenerz in Styria a bed of spathic iron, in places 600 feet thick, occurs in the Devonian limestone, covered in part with Werfener strata (Triassic sandstone). The junction with the limestone is not sharply marked, but is effected by a transition, in which the limestone is seen to be mixed with spathic iron ore. The beds of hæmatite in the Archæan schists often attain to enormous dimensions. In the upper peninsula of Michigan, bordering Lake Superior, specular iron ores, with not more than from 2 to 5 per cent. of foreign substance, chiefly quartz, form beds of great persistence, and often 30 to 50 feet thick, in chloritic and talcose slates (Fig. 6). Besides these, there are beds of leaner silicious ore which aggregate many hundred feet in thickness,

Fig. 6.

Iron-ore beds, Superior Mine, Lake Superior: c. s., chloritic schist; s. and c. s., silicious and chloritic schist; u. h., upper hæmatite; l. h., lower hæmatite; p. o., pure ore; m. o., mixed ore; d., diorite.

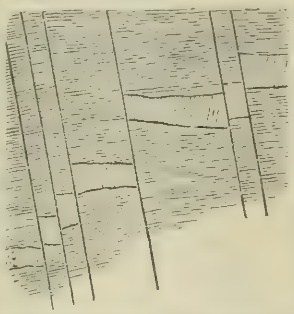
Fig. 7.



Pilot Knob: 1, 1, hard specular ore; 2, slate; 3, porphyry conglomerate with ore; 3, porphyry conglomerate with ore in matrix; p. c., porphyry conglomerate with ± ore; r. p., red porphyry.

and can often be traced continuously for many miles. At Pilot Knob in Missouri a bed of hæmatite more than 40 feet thick occurs interstratified with bedded quartziferous porphyry and porphyry conglomerate (Fig. 7). Magnetic iron also forms very large beds in gneiss in North-eastern and South-eastern New York and in New Jersey. In the upper peninsula of Michigan, magnetite also forms in chloritic slates beds of exceptional purity and richness, which in places have a thickness of 60 to 80 feet. The annexed Fig. 8 shows a much-faulted bed of magnetite 8 feet thick at the Byram mine in New Jersey. In many lead-bearing limestones and dolomites, the ore deposit assumes in places the bed form, though, owing to the tendency of these rocks to form open cavities, other forms of deposits are much more common. The great lead and nickel mines of Mine La Motte in Missouri are worked in a bed in dolomite, which belongs to the Calciferous or to an older epoch. The ores, in some places only galena, in others galena with copper, nickel, and cobalt ores, appear to be confined chiefly to one horizon in the dolomite. In this they are sometimes concentrated into a continuous layer 6 inches to 2 or 3 feet thick; sometimes they form numerous minor sheets or lenticular masses distributed through several yards' thickness of the dolomite, and accompanied in this by galena in impregnations and threads and small seams in the clefts. In part of the field, the ores of nickel and cobalt are confined to a seam of argillaceous shale rarely one foot thick accompanying the lead-bearing bed and abounding in *Lingulæ*. To give an instance of a bed of ore other than iron in metamorphic strata, we may mention the copper ores of Vermont. In Orange county a copper-bearing zone has been traced for several miles in mica slate, and has given rise to mining at several points. The ore, consisting of chalcopyrite, pyrite, and quartz, varies from 2 or 3 feet to more than 20 feet in thickness. It has often the stratified and granular structure of the schist, and consists in places of a solid bed, in others of isolated lenticular masses interstratified and overlapping each other in the mica schist.

FIG. 8.



Faulted magnetite bed, Byram Mine, N. J. (*Geol. of New Jersey, 1868*).

2. *Irregular Masses* (Stœcke in part).—These are all deposits of irregular outline which have not been formed in open cavities. Such are some of the great iron ore deposits of the world, as the magnetite stock at Tagilsk in the Ural Mountains, and the hæmatite (altered from magnetite) of Iron Mountain in Missouri. At the latter place immense masses of ore of undefinable shape occur in porphyry, and this porphyry, which is partly decomposed (D. P. in Fig. 9), is besides traversed throughout by ore in veins of all sizes, forming a perfect reticulation in all directions. Some deposits of this kind are formed by the union of large lenticular masses. Such seems to be the great mass of copper and iron pyrites at Rammelsberg in the Hartz, which forks in descending.

FIG. 9.

Iron Mountain: D. P., decomposed porphyry.

3. *Reticulated Veins.*—In this form the rock is traversed by a network of seams or veins parallel to different planes, surrounding polygonal masses of the rock; they are sometimes so close together that the entire mass has to be mined; when they are separated to such an extent that the intervening rock is not mined, they are called floors. To this class belongs the great tin Stockwerk of Zinnwald in Saxony. Here a dome-shaped mass of greissen (quartz and lithian mica) is traversed by two sets of veins, one parallel to the dome-shaped surface, dividing the rock into concentric shells, the other vertical and intersecting the first. The first set, often one foot thick, consists of symmetrically crystallized quartz and lithian mica, intimately mixed with cassiterite and wolfram. They often contain in the middle galena, tin pyrites, chalcocite, chalcopyrite, tetrahedrite, blende, fluorite, scheelite, cerusite, pyromorphite, uranite, spathic iron, heavy spar, feldspar, apatite, tourmaline, topaz, and pycnite. Sixteen of these flat veins or beds are known to exist one over the other. The vertical set are generally mere cracks or thin quartz veins with little ore, but having the wall-rocks much impregnated with tin ore and wolfram.

4. *Contact Deposits* are such as are formed along or near the plane of contact between two non-conformable rock-formations in such a manner that the determining cause of their mode of occurrence can be referred to the contact phenomena. They occur more frequently at or near the contact of limestone or metamorphic rocks (Fig. 10) with granitic rocks, and crystalline schists. Though sometimes quite extensive, they are generally very uncertain in this respect. Their outlines are necessarily very variable; when they exist in the plane of contact they are subject to all the irregularities of the plane separating two rocks of dissimilar age, and are contact masses; where the deposit is due to the mineralization of one or more beds in a series of strata near the contact (Fig. 11), the form may be that of an impregnation, or of lenticular bodies, or of a bed. Such occurrences are then contact impregnations, contact beds, etc.

FIG. 10.

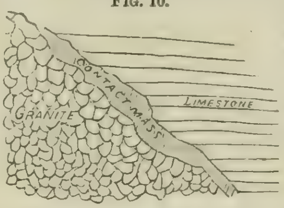
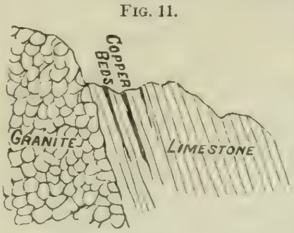


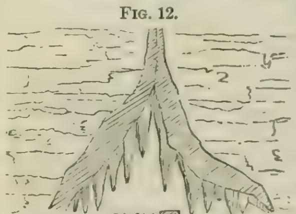
FIG. 11.



Deposits whose forms are due chiefly to preexisting cavities or fissures.

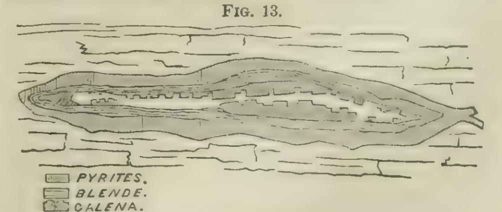
III. CAVE DEPOSITS.—Cave deposits are all occurrences in which a cavity formed by a dissolving and removal of the rock has been subsequently, partially or wholly, occupied by an ore. By the nature of the determining cause they are necessarily almost exclusively confined to limestones and dolomites. The outlines of these deposits are of the most varied and irregular shapes. Chambers isolated or connected by small passages, enlarged and contracted clefts, either vertical, inclined, or horizontal, transverse to the bedding or parallel with it, cylindrical chimneys or well-shaped cavities,—all these are frequently observed forms. In this class of deposits the ore and gangue minerals are crystallized on the walls of the cavity, often in symmetrical layers. The diagrams (Figs. 12, 13, and 14) will show some of the forms observed.

FIG. 12.



Cave deposits—chimney (*Whitney*).

FIG. 13.

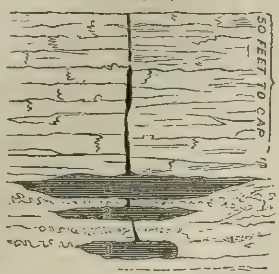


Cave deposit (*Whitney*).

IV. GASH-VEINS.—Gash-veins (Fig. 15) are fissures formed by the shrinkage of the rock, caused by the process of solidifying or by molecular changes during metamorphism. They are generally of limited extent, and are always confined to one rock, often to one bed. As bearers of ore

they are most common in limestones and dolomites. They are often undistinguishable from cave deposits, for they have frequently been the starting-points in the formation of caves. They often occur filled with lead and zinc ores in the lead-bearing limestones or dolomites of Missouri and Wisconsin.

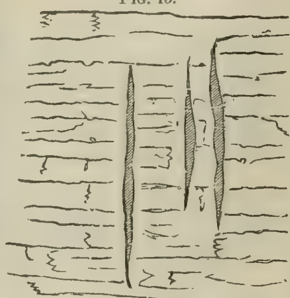
Fig. 14.



Connected caves: 1, first opening; 2, second opening; 3, third opening (*Whitney*).

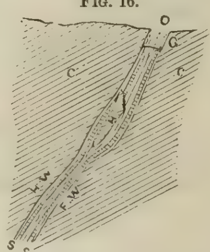
V. Fissure-Veins.—Fissure-veins (true veins, lodes) are deposits formed in fissures, the determining cause of which was the exertion of a force acting over a large area and producing one or more fissures traversing all rocks in its path. Veins generally send out minor cracks, usually at an acute angle, into the wall-rock, which are called feeders or branches. Very often the vein encloses large masses of the wall-rock or "country," which are called "horses." (Fig. 16.) The extension of a vein horizontally is called its strike, direction, course, or bearing, and is expressed in points of the compass as N. E. by N., or in degrees of the quadrant, as N. 33° 45′ E. The vertical angle which it makes with the horizon is called the dip; thus, the dip varies from 0° in a horizontal vein to 90° in a vertical one. The thickness of veins varies from a mere crack to hundreds of feet. Veins often divide into several smaller ones, which keep proximately the original strike; they are then said to split up. (Fig. 17.) In districts which contain ore-bearing veins there are almost always a number of them, and they are then often grouped in a zone of nearly parallel veins, which sometimes run together or are united by leaders. Some districts have several zones, each roughly parallel to a different direction, and the different zones are then generally of different ages and more or less different in character. It is a common occurrence to find that a vein has been subjected to an upward or downward movement of the country on one of its sides, leaving the opposite walls in different relative positions to those existing before the movement. This motion has had more or less crushing, especially of the projecting portions of the wall, for a result, and has often left highly-polished wall-surfaces. Where the fissure lay in a warped plane, the tendency of a movement was to produce a vein of irregular thickness by bringing the alternating convex portions of the two walls into opposition. An important result of this is the permanent enlargement of the fissure as a whole. (Fig. 18.) The evidence of movement having taken place in a given vein is found in the relative displacement of the opposite sides. This is marked by interruption of the continuation of individual strata if the country rock is stratified (Fig. 18), or, if the vein intersects dykes or other veins which are older, by the displacement of these.

Fig. 15.



Gash vein—Lead ore (*Whitney*).

Fig. 16.



C, country rock; O, outcrop; G, gossan; H, horse; H. W., hanging wall; F. W., foot-wall; S. S., selvage.

Fig 17.

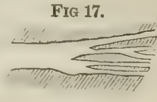
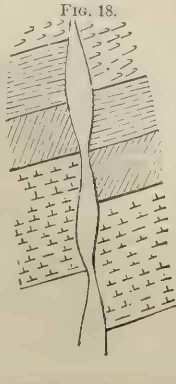


Fig. 18.



Faults.—This dislocation of strata or of dykes or veins is called faulting, and the occurrence is called a fault or throw. The appearance of a fault may, however, be produced without any sliding movement, but simply by the separation of the walls of the fissure when the vein intersects the strata or other vein under an angle of less than 90°; the apparent throw is then proportional to the width of the vein. (Fig. 19.) A vein (Fig. 20, B) may throw one vein (A), and be itself faulted by a still younger one (C). And the younger vein may intersect and throw all the older ones (Fig. 21), producing very complicated results. A throw may be only a few inches; it may also be thousands of feet. When it is found that a vein is thrown, it becomes very important to know in which direction to look for the lost continuation and the amount of the throw. It has been observed that as a rule the throw is such as would be produced by the slipping *down* of the *hanging* wall or the pushing *up* of the foot wall of the lode which produces the fault (Fig. 22). Therefore, when in the underground workings the vein is found to be cut off by a fissure, if this dips downward, away from the miner, the continuation lies below; if, on the other hand, the intersector rises away from him, the continuation lies above. In the case first supposed the continuation of the intersected vein lies in the opposite direction from that toward which it dips; in the other case it lies in the same direction. This is more clearly illustrated in the annexed diagrams (Figs. 23 and 24), where the arrow-points indicate the direction of the dip. The sections are horizontal. There are not unfrequent exceptions to the rule above given. Where two veins dipping towards each other are thrown by a third, they appear in a horizontal plan to be thrown in opposite directions (Fig. 25). This appearance is due to the fact that a horizontal plane must necessarily be nearer to the line of intersection of the two veins on one side of the faulting vein than on the other. A case has sometimes been observed in which a younger vein has apparently been thrown by an older one, as in Fig. 26. Really, the vein B intersected the vein A after this was filled, and the faulting of B was due to a subsequent movement along the wall (C C). If the vein B had thrown the older vein (A), there would be the *appearance* of two veins having thrown each other, as in Fig. 27. Next to the direction, the question of importance is the *amount* of the throw. This is generally easily determined when it is known how much the faulting vein has thrown any other vein, dyke, or bed. The elements of the calculation are then the amount of the vertical movement of the faulting vein and the angles and direction of strike and dip of all the veins, etc. in question. (For this part of the subject the reader is referred to Schmidt's *Theorie der Verschiebungen älterer Gänge* (Frankfort, 1810); Zimmerman, *Wiederausrichtung verworfener Gänge, Lager und Flötze* (Leipsic, 1828); Von Carnall in Karsten's *Archiv*, vol. ix. (1832); Combe's *Traité de l'Exploitation des Mines* (vol. i.).)

Fig. 19.

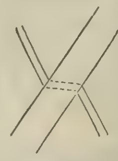


Fig. 20.

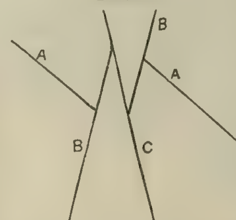


Fig. 21.

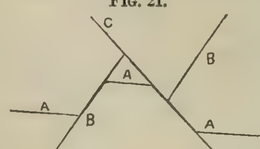


Fig. 22.

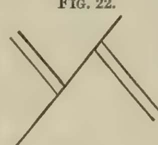
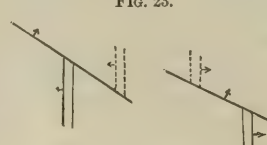
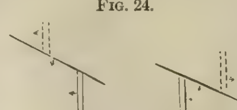


Fig. 23.



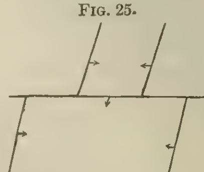
I Case.

Fig. 24.



II Case

Fig. 25.



The contents of a vein are the ore and the gangue. Some veins have a very simple character as regards the filling, containing one ore, or this and one kind of gangue. Others, again, are exceedingly complex, containing in the same part of the vein or in different

parts a great variety of metallic compounds, associated with numerous gangue minerals. Indeed, as there is probably no known element that is not contained in some veins, it is not surprising that a very large portion of the known minerals should have been formed in these laboratories. Compounds which are unstable or easily soluble in the presence of water can, as a rule, exist only in that part of the vein which lies above the drainage, and are then secondary products, formed by the alteration of the original ores of the vein. Veins are generally filled compactly with their contents, though druses sometimes exist. As has been already mentioned, the constituents—ore and gangue minerals—are often distributed in symmetrical layers parallel to the walls; they are often also heterogeneously mixed. The distribution of ore and gangue minerals is generally more or less irregular within the same vein. Sometimes the ore is concentrated at different points into bodies called bonanzas, nests chimneys, pockets, masses, etc while the rest of the vein is barren or contains only disseminated ores of the same kind or of different kinds to that of the bonanzas. This inequality of distribution is sometimes traceable to a cause. Thus, in some veins changes in the character of the wall-rock are accompanied by change in the character of the vein-filling—changes which may in one place be due to certain portions of the country rock contributing metallic solutions, in another place to parts of the country contributing a reagent capable of precipitating metals from solutions in the vein. Again, in veins of varying thickness, if the ore is one of the younger members, the older filling of the narrower parts by poor or barren material would leave room only in the wide parts for the richer member. The intersection of veins is often accompanied by enrichment. Besides changes due to local influences, there is observed in some districts a difference of character in depth. Thus, the veins of Oruro in Bolivia, which were rich in silver in their upper levels, contained ores barren of silver in depth. Veins containing both tin and copper have generally the tin ores above and copper ores below. Sometimes a dyke of eruptive rock has been altered to a considerable depth in such manner as to roughly simulate a fissure-vein. Fig. 28 represents a decomposed dyke of diabase near Przibram, in which the

FIG. 26.

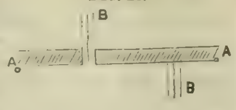


FIG. 27.

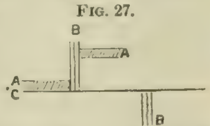


FIG. 28.

a, decomposed diabase, with lumps and threads of limonite; *b*, vein-like deposit of limonite; *c*, graywacke (*Grimm*).

iron from the augite has segregated into threads and nodules of limonite in the decomposed rock, and into vein-like bands 2 or 3 feet thick from the walls inward.

VI. SURFACE DEPOSITS.—1. *Residuary Deposits.*—When, by disintegration and erosion or by being dissolved, a rock-mass containing ore deposits of any form is removed, and the removing cause is not competent to carry away the ore, this remains in a more concentrated form and is a residuary deposit. The often important masses of magnetic iron sand which are concentrated by the wave-action on beaches from the disintegrated débris of rock-masses are of this form. On the Japanese coast workable beds of iron sand thus concentrated occur in elevated strata. Iron Mountain in Missouri was wholly mantled to a depth of from 2 to 20 feet with a loose mass consisting entirely of fragments of iron ore of all sizes. These representatives of the broken-up reticulated veins are all that remain of a large amount of porphyry, which has disappeared, leaving only the insoluble iron ore. In portions of the Western lead-regions, especially in Missouri, which have not been subjected to the destructive agencies of the Glacial epoch large quantities of galena are found in surface deposits of clay and chert, the whole representing solely the insoluble residuum of often hundreds of feet thickness of limestone and chert beds, the result of a process which has apparently been operating steadily ever since the Carboniferous period. Missouri also contains very numerous residuary deposits of limonite, derived from the pyrites left after removal of limestones.

2. *Stream Deposits.*—Stream deposits consist of loosely-aggregated material in modern or ancient water-courses, in which gold, platinum, etc. or tin ores are more or less concentrated. They are generally the lowest member of a river deposit, and owe their existence to the specific gravity and insolubility of these metals. The annexed sketch

FIG. 29.

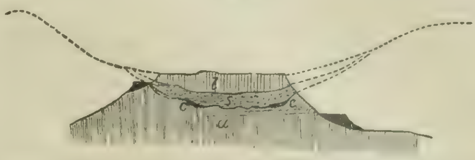
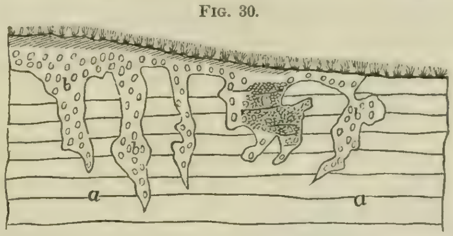


Table Mountain: *l*, lava; *s*, sandstone; *c*, *c*, auriferous channels; *a*, slate.

(Fig. 29) from Whitney (*Geol. Surv. of Cal.*) represents an auriferous stream deposit formed in a valley which, after being filled with a lava stream, became a mountain-crest by the erosion of the softer hills on either side.

3. *Lake and Bog Deposits.*—In many localities iron ore is deposited in marshes and on the bottoms of lakes. The ore is a variety of limonite called bog ore, and owes its origin to the action of decaying organic matter on ferric oxide, producing soluble ferrous carbonate, which, on entering the aërated waters of a lake, is oxidized and sinks. Under this heading come also the European deposits of

FIG. 30.



a, Jurassic or Cretaceous limestone; *b*, pisolithic iron ore; *c*, clay, earth, and sand (*Grimm*).

pisolithic iron ore, which were washed into open pit-caves in limestones. (Fig. 30.)

We have not space to describe the different views that have been held from the time of Pliny to the present day concerning the origin of ore deposits. They have been supposed to be formed in their present conditions simultaneously with the enclosing rocks; to have been injected through fissures as molten matter from below, and to have permeated the adjoining rocks; to have been sublimated from below; to have descended in solution from the surface; to have ascended in hot solutions from great depths; to have been dissolved out of the adjoining rock-masses and precipitated in their present positions. In discussing the origin of our present ore deposits we have nothing to do with the question of the final source of metals, nor with their original distribution at the time when our globe first received its solid crust—whether they were contained in the exterior or interior portions. Since that early period a considerable portion of the original crust, and also of the erupted interior, have been used up with any ores they contained in forming that part of the globe which is accessible to our observation. During this long period the constituents have undergone many cycles of chemical and mechanical transformations.

Our attempts at a theory of the mode of formation of deposits must be limited to the more immediate processes which have operated. In its most general aspect the formation of an ore deposit requires (1) sources from which the constituents are derived; (2) transportation from the source; (3) concentration; (4) arresting causes which are capable of giving fixed and solid forms to the substances that are to form the deposit. There are three possible sources—viz. the unknown original interior of the globe; the igneous rocks of the outer crust, especially granite; and the ocean. The ocean is a more immediate source for at least nearly all the important substances with which we are concerned, because it has been from early time the great reservoir into which the constituents of all rocks have found their way as detritus or in solution. And, in fact, with the exception of tin, mercury, antimony, tungsten, and bismuth, all of the most important metals with which we have to do in this discussion have already been proved to exist in the ocean. Forchhammer, Bischof, Von Bibra, and others have detected thirty of the elements

either in the water of the ocean or in marine plants or animals which must have derived them from the water. Among these there are, of the elements in ore deposits—(1) *Fluorine,* determined from the water direct, found more easily in the deposits in the boilers of ocean steamers, and by Dana in the calcareous corals. (2) *Sulphur* in organic tissues, and as sulphuric acid, free and combined with lime and magnesia. (3) *Phosphorus,* in the water and in organisms. (4) *Carbon,* as free carbonic acid, and partly in combinations with oxygen, hydrogen, and nitrogen in organisms. (5) *Silicium,* dissolved as silica, also in shells and somewhat in corals, and abundant in some sponges. (6) *Boron,* as boric acid. (7) *Silver.* Malaguti and Durocher found one centigramme to the cubic mètre of water. It is found in the ashes of marine plants and in the carbonate of lime from the lower marine animals. (8) *Gold.* Sonnstadt found one grain to a ton of sea-water off the British coast. (9) *Copper,* in the carbonate of lime of the lower marine animals and in ashes of marine plants. (10) *Lead,* in the same secretions as silver and copper, but in larger quantities. (11) *Zinc,* in marine plants. (12) *Cobalt,* in the ashes of marine plants with nickel, copper, lead, and zinc. (13) *Nickel,* in the ashes of marine plants. (14) *Iron,* in solution and in the ashes of plants and animals. (15) *Manganese,* especially in the ashes of plants. (16) *Arsenic.* (17) *Calcium.* Lime occurs only in very small quantity combined with carbonic acid, much more as a sulphate, and in organisms as phosphate and fluoride. (18) *Barium,* as sulphate in considerable quantities in the ashes of plants. (19) *Iodine,* detected by Sonnstadt in sea-water; extracted as an article of commerce, chiefly from the ashes of marine plants. Besides these, oxygen, hydrogen, chlorine, magnesium, sodium, bromine, nitrogen, strontium, potassium, aluminium, lithium. This list will undoubtedly be extended to cover many other elements when more attention is given to the subject, and when more delicate methods are applied, as, for instance, spectroscopic analysis.

While some of the metals in this list have been detected only in the organisms of plants and animals, they must have been derived from the water. The plants assimilate the metals in small quantities, as they do potassium and calcium, sulphur, phosphorus, etc., all of which are essential constituents of their tissues or fibre. We have here a very marked concentration. The animals probably derive their share of the heavy metals, as they do that of the other elements, from plants or from plant-eating animals. Here, too, there is a marked concentration. Bischof was able to detect the presence of silver in treating only 1¼ pounds of *Pocillopora alcicornis,* one of the common reef-building corals. When these plants and animals die they are buried in sedimentary deposits, and the metals they contained are converted into sulphurets through the oxidation of the organic matter in presence of the sulphates in the sea-water. The metals thus concentrated by vital force are incorporated in the sedimentary deposits at the bottom or in coral reefs. In the case of plants there is a still greater concentration, for they are carried by the great oceanic currents into the sargassum eddies, where their remains rot and sink to the bottom. Enormous quantities are, however, deposited long before these oceanic cemeteries are reached. This process of concentration by means of life is as old as plant-life on the globe; and the plant and animal life in the ocean far exceeds that on land in amount. The sediments in which these metals are thus brought together form, when solidified, argillaceous shales, marls, limestones, and sandstones, and it is from these that the crystalline schists, clay-slates, and saccharoidal limestones and dolomites have been formed by metamorphism. The source, then, for at least the greater number of the more important ores is in the sulphurets diffused through strata of marine origin, especially such as abounded in remains of plant or animal life.

The formation of ore deposits becomes, from this point on, a question of dissolving the metals, bringing them together from a very extended space into a very small one, and fixing them there in a solid form. The character of the solution varies with the different metals and the different circumstances; carbonic acid, sulphuric acid, chlorine, and water containing alkaline carbonates and sulphates are the most common solvents. Many substances which appear highly insoluble in their ordinary condition are easily soluble, as shown by Hunt, before they have assumed a more stable molecular condition; and the same chemist says that there is little doubt that every substance has a transitional state in which it is soluble with comparative ease by some reagent contained in the fluids permeating the rock-masses. Once dissolved, the metals enter the restless circulation of the waters that permeate the pores, capillary cracks, and fissures of the outer crust of the globe. These circulating waters seek the channels of freest drainage; they work their way from the minute pores and capillary cracks into the larger cracks, and from these into larger, and finally converge into the great fissures. Throughout this journey the circulating solution often passes through rocks of very varying mineral character, which react upon its dissolved salts. Where these reactions precipitate metallic compounds there takes place a concentration of the metallic substances. If, for instance, a sandstone or a shale contains organic matter, it will continuously precipitate the metals from the waters passing through it, and the result will be an impregnation of the sandstone or shale with ores. If in the course of the circulation the metalliferous solutions pass through rocks in which the channels are chiefly the cracks which intersect compact rock-masses in all directions, a precipitiation of the metals there would form reticulated segregations. If the rock traversed is a limestone or dolomite containing open crevices, gash-veins, or caves, a precipitation would form the various kinds of cave deposits in which lead and zinc ores are so commonly found. If the metals continue in solution until in their circulation they reach the true fissures, and are there precipitated, they form true fissure-veins. In the great majority of all these deposits the ores are sulphurets, a form under which they would necessarily be precipitated in the presence of organic matter, and sulphates in some instances, or in others on coming in contact with sulphuretted hydrogen gas. Both of these conditions exist in all sedimentary deposits containing remains of plants or animals, until the organic remains have been consumed, a consummation generally reached only after the lapse of geological periods. The sulphuretted hydrogen contained in the waters permeating the rocks under the Mississippi Valley would still be able to fix lead and zinc ores in the form of cave deposits in the limestones, similar to those which abound in that region. The filling of a fissure-vein is the resultant of a great variety of chemical processes, for it was the converging point of countless drainage-systems, each bringing its chemical agents, and each more or less different in this respect from the others. It is therefore natural that in this class of deposits we find the greatest complexity in the character of the ores and gangue minerals. Those deposits which were not formed in pre-existing cavities were obliged to make for themselves, step by step, the spaces they occupy. They fall under two heads in this respect: 1st. The space was obtained by mechanical displacement of the enclosing material when this was in a semifluid or plastic condition. In eruptive rocks the primary impregnations of magnetite and titaniferous iron ore were formed before the rock had hardened; the same may perhaps be true of impregnations and lenticular segregations in some metamorphic rocks. But in the great majority of cases those deposits which do not fall under the next head were segregated together while the enclosing bed was in a condition resembling ooze, or like quicksand or the plasticity of clay. The frequent quicksand beds found in sinking deep shafts through alternating clays and shales, etc. shows that this condition is a very frequent one. 2d. The space was obtained by a chemical replacement similar to that to which pseudomorphs owe their origin, and here, as there, the product is often one of "exchange," in which part of the elements of the original rock remain, while the rest has been exchanged for a substance contained in the arriving waters, and has itself gone off in solution; as, for instance, the formation of some masses and beds of sparry iron in limestone through replacement of lime by ferrous oxide. And these may be further modified by the loss of a chemical constituent—formation of limonite, hæmatite, magnetite from the carbonate by loss of carbonic acid. Or the space may be obtained by the removal, in solution, of a more soluble mineral as a whole, and its replacement by a less soluble one. Most of the irregular masses, contact deposits, and bed deposits appear to have been formed by these processes. But many of these, and especially those which contain a considerable variety of ore and gangue minerals, are the result of a long series of molecular changes, which have altered wholly the character not only of the ore deposit, but also of the rock-masses in which they occur.

There are few ores or gangue minerals which are not found in deposits in comparatively unaltered sediments; lead, silver, zinc, copper, nickel, cobalt, barytes, fluor-spar, etc. in the horizontal limestones and dolomites of the Mississippi Valley as one out of many instances. In these instances it has been demonstrated by Whitney, and later by Schmidt, that the deposits were not filled from below. It is therefore evident that at least with regard to the formation of most ores very high temperatures and pressures and deep-seated sources are not *essential* conditions. But it is more than probable that there are instances where in forming the different minerals in a given vein, or even the

same minerals in different parts of the same vein, very different processes have operated, owing to the reverse reacting characteristics of certain reagents at different temperatures—silicic acid *versus* carbonic acid above and below 100° C.

Relative Values of Deposits.—Fissure-veins, *as a rule*, are more trustworthy, because of the continuity of the fissures, and the consequent facility offered the miner for underground prospecting. The same may be said of certain beds, while the other forms are of the most uncertain character; any given one may be an isolated occurrence or one of many, but from their nature they rarely offer clues by which the miner can work from one to another. The most productive mines of iron ore are beds and irregular masses. The most productive copper-mine is at present the Calumet and Hecla on Lake Superior, which is a bed of conglomerate impregnated with native copper. The largest production of lead has probably been from the quickly exhausted but innumerable cave-deposits and gash-veins in limestones and dolomites. The greater proportion of tin and native gold is derived from surface deposits. On the other hand, the greater part of the silver of the world is wrought from true fissure-veins; and, if we except deposits of iron and some isolated deposits of other metals, the instances of permanent ore-mining industries are found to be established on fissure-veins.

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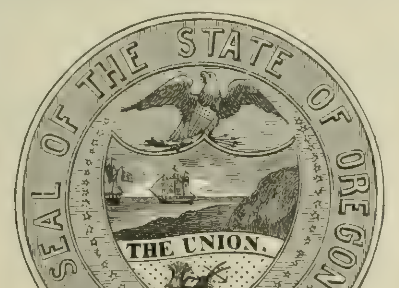
Or'egon, one of the Pacific States, between the parallels of 42° and 46° 18′ N. lat., and the meridians of 116° 33′ and 124° 25′ W. lon. from Greenwich, is bounded on the N. by Washington Territory, Columbia River forming the boundary to the point where it crosses the 46th parallel of N. lat., and that parallel eastward to Snake River; E.



Seal of Oregon.

by Idaho Territory, Snake River being the dividing-line to the mouth of Owyhee River, thence a line drawn due S. on the meridian of 116° 50′ W. lon. to the Nevada line; S. by Nevada and California along the 42d parallel; W. by Pacific Ocean. Its width from E. to W. is about 360 miles, from N. to S. about 275 miles, while the coast-line is about 300 miles. Its area is 95,274 sq. m.

Face of the Country.—The State is divided by the Cascade and Blue ranges into three sections, known as Western, Middle, and Eastern Oregon. The Coast Range passes through Western Oregon at from 40 to 70 miles from the coast, but its altitude nowhere exceeds 3000 to 4000 feet, and much of the fertile soil of its slope is covered with forests to the summit. The Cascade Mountains are a continuation of the Sierra Nevada range, and are about 110 miles E. of the coast. They have a mean elevation of 6000 to 7000 feet, while numerous peaks rise 4000 to 5000 feet higher. The most noted of these are—Mount Hood, altitude variously stated at 11,225 and 11,025 feet; Mount McLaughlin or Pitt, 11,000 feet; Mount Jefferson, 10,200 feet; the "Three Sisters," 9420 feet; Diamond Peak, about the same height; and Mount Thielsen, 8500 feet above the sea. The Coast Range is in some places precipitous on its western slopes, but the greater part of Western Oregon (lying between the Cascade Range and the coast), though hilly and broken at some points, is fertile and arable. Middle Oregon, between the Cascade and the Blue Mountains, is a rolling table-land, with occasional spurs from the Blue Mountains. It is not well watered, and its soil is represented as being barren. E. of the Blue Mountains lies Eastern Oregon, in the basin of Snake River—a region which, though traversed by some of the spurs of the Blue Mountains, has yet many fertile and beautiful valleys. The Willamette Valley, extending from Columbia River southward to the Callapoia Mountains, and lying between the Coast and Cascade ranges, is watered by Willamette River, is 150 miles in length and from 30 to 60 miles in width, with an area of 5,000,000 acres, nearly all of unusual productiveness. The surface of a part is gently undulating, but there is a very rich prairie in its centre, 40 miles by 30. In this valley are the principal towns of the State and almost two-thirds of its population. Umpqua Valley lies between the Callapoia and Grave Creek ranges, and extends from the Coast Range to the Cascade Mountains. It is much like the Willamette in productiveness, and has an area of 2,500,000 acres. The Rogue River Valley is in the southern part of the State, on both sides of Rogue River and between the Grave Creek and Siskiyou ranges. It is much like the preceding, and contains about 2,400,000 acres. Middle Oregon has no considerable valleys, but Eastern Oregon has several small ones, as the Grand Ronde Valley in the N. E., containing about 275,000 acres; the Powder River and Burnt River valleys; and in the S. E. the Malheur and Owyhee River valleys.

Rivers, Lakes, etc.—The largest rivers of Western Oregon are the Columbia, the Willamette, its largest tributary; Young, Clarke and Lewis or Snake rivers, also affluents of the Columbia; Umpqua, Rogue, Tillamook, Yaquina, Alseya, Siuslaw, and Coquille, discharging into the Pacific; and Tualatin, Clackamas, Yamhill, Santiam, Luckiamute, Mary, and Long Tom rivers, tributaries of the Willamette, together with the McKenzie's, Middle and Coast Forks. John Day, Des Chutes, and Umatilla rivers, all affluents of the Columbia, are the principal rivers of Middle Oregon; while Snake River and its branches, Grand Ronde, Powder, Burnt, Malheur, and Owyhee rivers, are the largest streams of Eastern Oregon. The Columbia is navigable with two interruptions (the Cascades and the Dalles) for 396 miles; the Willamette, a part of the year, for 138 miles, partly by slackwater navigation; the Yamhill and Tualatin for some distance during high water. There are numerous lakes (some of them salt) in Southern and South-eastern Oregon. The principal are the Upper and Lower Klamath, Goose, Warner's, Salt, Harney, Malheur, Albert, Summer, and Silver. *Bays, Harbors, Capes.*—The entrance to Columbia River, with its two channels 27 and 21 feet deep, is the best harbor on the Oregon coast. It is protected by Fort Stevens, built on Point Adams. Port Orford, Coos, and Tillamook bays have sufficient depth of water, but are somewhat exposed. For vessels of lighter draught the mouths of Umpqua, Yaquina, Rogue, and Coquille rivers furnish good harbors. The principal capes or headlands are—Point Orford or Cape Blanco, Cape Foulweather, Cape Lookout, Cape Perpetua, Umpqua and Tillamook heads.

Geology.—Much of Eastern Oregon has been the scene of comparatively recent stupendous volcanic disturbance. This has left deep fissures or cañons. Some of these cañons are 1500 feet in depth, the sides of which are a geologic record rarely accessible elsewhere. There are, first, the Cretaceous beds, abounding in marine shells preserved in form, though often filled with chalcedony or calcareous spar; next above, the Lower Tertiary rocks with leaf-impressions of great trees—of palms, yews, and giant ferns—as well as of the oak leaf and acorn; with these are associated the fossils of 2 species of the rhinoceros, 4 of the *Oredon*, a connecting link between the camel and tapir, and several genera of the tapir and peccary family; and with them the *Orohippus.* Upon this supervenes the period of volcanic action, with a vast overflow of lava, mud, and ashes. This region thus rent is heaved elsewhere into isolated cone-like hills or ridged with secondary rocks, piled up dike-fashion, their strata thrown into different angles or broken into chasms filled with earth or lava. Here are mountains of amygdaloid, heaps of volcanic conglomerate, and cliffs of columnar basalt lining the water-courses. In

the region of the upper Des Chutes and John Day rivers the Cretaceous formation is predominant. The Blue Mountains, however, and the Coast Range are alike Eozoic; the intermediate Cascade Mountains volcanic; while the Tertiary prevails on the narrow sea-margins W. of the Coast Range. The bed of lower Willamette River is partially basaltic, with perpendicular walls; S. of Oregon City it traverses a district of volcanic *débris;* black trap is frequently exposed. Southward of this also occur thin strata of limestone with fossil bivalvular shells, granite *in situ*, and again basalt. But the prevalent rock is trap, while at the head of the valley a light-colored clayey sandstone is found. The fossil teeth and tusks of elephants have been found at great depths in the same valley. At the Dalles, on the hillsides, are boulders of gray and of a red granite.

Mineralogy.—The mineral wealth of the State is great, but imperfectly developed. In Jackson and Josephine cos. gold-placer deposits, worked since 1851, have yielded not less than $20,000,000. Since 1862 extensive placers and quartz lodes have been developed in Grant and Baker cos., and the present annual production in that quarter is about $1,500,000. Grant co. has furnished since 1862 more than $10,000,000. The annual production of gold and silver for the past eleven years has been about $2,350,000. Placers have been worked on the ocean-beach at Coos Bay. The argentiferous formation of Nevada extends into Oregon. Argentiferous lead has also been found in Jackson, Josephine, and Douglas cos. in S. W. Oregon — copper at several points in the same quarter, not only as an ore, but in ledges. Iron ore of a superior quality exists in almost every part of the State; a large deposit at Oswego, about 6 miles S. of Portland, yields 54 per cent. of pure iron. There are similar deposits at St. Helen on the Columbia, and in Tillamook, Marion, Columbia, Clackamas, Jackson, and Coos cos. Coal also is met in beds of great thickness on Coos Bay, on Umpqua River, on the Yaquina, at St. Helen, on the line of the Oregon and California R. R., and in Douglas, Clackamas, Clatsop, and Tillamook cos. The beds on Coos Bay are extensively mined. Among the so-called precious stones, chalcedony, agates, carnelians, and jaspers of uncommon beauty are abundant on the banks of the Columbia. Salt is largely extracted for domestic consumption in Jackson and Douglas cos.

Zoology.—The largest of the fauna of the mountains of Oregon is the grizzly bear; the black and cinnamon bear are also common, with the large wolf and coyote, the panther, catamount, wild-cat, polecat, several species of deer, including the beautiful black-tailed species, antelopes, elks, and mountain sheep or bighorn of Eastern Oregon. Of the smaller animals there are species of large and small squirrels, the raccoon and porcupine, with beaver, otter, and muskrat in the streams. The mountains are the resort of some silver foxes, martens, and other small fur-bearing animals, hares, and rabbits. In the Columbia, seals are abundant, especially near the Cascades. The lower Columbia is prolific with salmon and salmon-trout. All the rivers emptying into the Pacific swarm with these fish; great sturgeons are also caught in the Columbia; halibut, herrings, smelts, and many other fish exist in these rivers in countless numbers. Above tide-water the streams and lakes teem with trout. Oysters, shrimps, and crabs of several species are found in Coos Bay, Umpqua, and other places on the coast. Among the larger birds are golden and bald-headed eagles, fish and several other hawks, and cormorants; several species of pelicans, gulls, and the albatross, with the great vulture and buzzard. Pigeons, quails of two species, robins, jays, yellowbirds, and humming-birds, the trumpeter and American swan, Canada and snow-goose, brant, many species of wild-duck, including one like the canvas-back of Chesapeake Bay.

Vegetation.—That of the coast and W. of the Cascade Mountains is dense and luxuriant, abounding in evergreens, with giant trees in girth and height, the largest of which is the redwood. The lofty Oregon cedar, often from ten to fifteen feet in diameter, is confined to the Coast Range, as are also the hemlock spruce (a graceful tree frequently 150 feet high), the red fir, white spruce, the Oregon yew. Among the deciduous trees of the same quarter are white maple, frequently six feet thick, the Oregon alder, sometimes 60 feet high, several species of pollard and balsam oaks, and on the lower Columbia and Willamette large white oaks. The willow and cottonwood occur both in W. and E. Oregon. The Oregon ash, a beautiful tree, is found on the banks of streams, and the Oregon dogwood, a much larger tree than on the Atlantic coast. The Oregon crab-apple and wild-cherry trees are both valuable to graft on. The oak occurs in rich alluvial soil. There are several species peculiar to Oregon. The broad-leafed evergreen laurel is found in the middle region of Oregon. Above the elevation of 5000 feet pines, larches, dwarf junipers, and cedars flourish to the snow-line. Arbutus, cornus, and hazels (some of these very large) form a thick undergrowth to pines and spruces, as at the head of the Willamette. The snowberry of Eastern gardens is indigenous to Oregon. The mock-orange, wild roses, woodbines, several species of honeysuckle, and other flowering plants abound. There are also lupines, columbines, a small and peculiar sunflower, wallflowers, scilla, ambrosia, asters, myrica, sweet-flowering pea, and a peculiar red clover in the small, rich moist valleys. Of roots in Western Oregon, the camas, not unlike a small onion in appearance, but in taste like the chestnut, abounds in the prairies and supplies the Indians with their bread. The bunch-grass is found in its greatest perfection in this State, and is said to cover 20,000,000 acres of its area. All the wild berries are found, and the climate, of Western Oregon especially, is admirably adapted to apples, pears, etc.

Climate.—In Western Oregon both summer and winter are materially tempered by the Pacific winds. That from the N. W. in summer carries sea-vapor inland, where it is changed to gentle rains or mist, modifying the heat. Thunderstorms are rare, and hailstorms unknown. Though the winter is a season of rains, the amount of rainfall is not excessive, and the average does not appear to be greater than 44 inches. Observations by the signal-service bureau and previously have established a mean temperature at Astoria and Corvallis in Western Oregon—at the first, for the spring, of 51.16°; summer, 61.36°; autumn, 53.55°; winter, 42.43°, and a yearly mean of 52.13° F.; at the second, of 52.19° for spring, 67.13° for summer, 53.41° for autumn, 39.27° for winter, and for the year of 53° F. Flowers and fruit trees bloom early in April, which is about the end of the rainy season, that sets in with November. In the ten years ending with 1868, at Portland 2379 days were pleasant, 637 rainy, 543 showery, with sunshine, and only 92 of snowfall. In 1874 the annual rainfall was 43.69 inches. E. of the Cascade Range, with severe, protracted winters and heavy snows, there is greater heat and dryness in summer, but cool, pleasant nights. At the Dalles (45° 40′ N. lat.) the mean temperature for the spring is 53°; summer, 70.36°; autumn, 52.21°; winter, 35.59°, and for the year 52.79° F.; and rarely does the temperature fall lower than 8° below zero. The rainfall E. of the Cascade Range does not exceed an average of 20 inches, whereas at Astoria and the mouth of the Columbia it reaches 60 inches. E. of the Blue Mountains there is the least rain, the summers are dryer, and the winters colder, with deep snow. Middle Oregon is more mild and equable. At the upper sources of the Klamath there is said to be frost almost every night of the year. Ice is rarely thicker than an inch in West Oregon, and of short duration.

Productions.—Wheat is the leading cereal crop. It is noted for its weight, frequently 65 pounds per bushel, and for the superiority of the flour made from it. Oats also weigh above the legal standard. Barley, hops, and flax are entering into the production of the State. Subjoined is a table of products for the years 1860, 1870, and 1874:

Year.	Wheat, bushels.	Oats, bushels.	Barley, bushels.	Indian corn, bushels.	Potatoes, bushels.	Flaxseed, bushels.	Apples, bushels.	Wool, pounds.	Butter, pounds.	Cheese, pounds.	Bacon and ham, pounds.	Value of live-stock.	Value of farm products.
1860	826,776	885,673	76	76,122	303,319	24,198	....	219,012	1,000,157	105,380	....	$5,946,255	$1,248,827
1870	2,346,746	2,029,909	210,736	72,736	481,710	10,988	....	1,080,638	1,418,373	79,383	....	6,828,675	7,122,790
1874	4,875,000	2,391,000	371,000	94,000	751,000	25,000	500,000	2,000,000	1,800,000	250,000	1,500,000	9,558,199	8,161,240

In 1870 the number of improved acres was reported at 1,116,290, with an estimated cash value of $22,359, and of farming implements, $1,293,713, with $719,875 expended in wages. At the same time there were owned in the State 51,702 horses, 258 asses and mules, 2441 draught oxen, 48,325 milch cows, 69,431 other cattle, 318,123 sheep, and 119,455 swine. In Jan., 1875, the number of horses was 85,500; of mules, etc., 3700; of milch cows, 76,400; of oxen and other cattle, 128,600; of sheep, 634,600; of swine, 174,600.

Manufactures.—In 1870 there were returned from Oregon 969 manufacturing establishments, employing 2884 hands, using $4,376,849 capital, paying $1,120,173 wages, consuming $3,419,756 of raw material, and producing manufactured goods to the value of $6,877,387. Flouring-mill products produced $1,530,229; lumber, $922,576; and woollen goods, $492,857. At the close of 1874 the value of flouring-mill products exported was about $4,000,000, gold, besides all that was consumed in the State; the lumber and timber trade, and the industries connected with it, exceeded

$3,000,000; and the value of the woollen goods exceeded $1,000,000. There are also several extensive foundries, rolling-mills, and machine-shops, producing iron and iron manufactures of excellent quality, as well as paper-mills, oil-mills, linen-factories, extensive tanneries, factories for agricultural implements and wooden-ware. *Fisheries.*—30 fishing and 13 canning establishments are in operation near the mouth of Columbia River, and in 1874 the exports of canned salmon alone amounted to over $1,500,000, besides what was consumed at home. *Mining.*—Coal, iron, and gold and silver are largely mined for export. The value of these products exported in 1874 was reckoned by Gov. Grover at $2,500,000.

Railroads.—There were in Sept., 1875, 265 miles of railway in operation, and 131 miles near completion. The whole cost of roads and equipment to that time was about $19,000,000. The roads were (1) the Oregon and California, beginning opposite Portland on the Willamette, and extending southward 200 miles through the Willamette and Umpqua valleys to Roseburg in the Umpqua Valley. Thence stages connect with Shasta or Redding on the Sacramento River, the present terminus of the California Northern Railway. (2) The Oregon Central, starting from Portland and crossing the Willamette, running W. to Hillsboro', then one branch going northward to St. Helen's, with Astoria as its eventual terminus, and the other southward along the W. side of the Willamette Valley to Yamhill River, 50 miles in all; it is to be extended to Junction City, 50 miles farther S., where it will join the Oregon and California. (3) A railroad of 15 miles around the Dalles of the Columbia in Middle Oregon. There is a short canal around the Cascades of the Columbia.

Finances.—The State government is economically administered, and taxation is relatively easy. On Sept. 14, 1874, the whole public debt was $596,256, of which bonds to the amount of $46,027 were then due and payable out of funds in hand; $200,000 were for bonds issued in aid of the Willamette Canal and Lock Co., which principal, payable in 1890, with 7 per cent. interest, was to be met from the proceeds of 500,000 acres of land belonging to Oregon and set aside for purposes of like internal improvements; $61,550 were wagon-road warrants, payable from special funds provided for that purpose, and $287,459 were outstanding warrants, to meet which there was over $95,000 in the treasury. Most of these warrants were for old accounts not properly provided for when due. The assessed value of real and personal estate in 1870, according to the census, was $31,798,510, with an estimated true value of $51,558,932. The State assessment for the same year was $29,587,846.25. In 1873 the assessment was $40,700,159. The receipts into the State treasury for the two years ending Sept. 14, 1874, were $628,775.01; adding to this sum the balance on hand Sept. 6, 1872—$172,597.41—the whole amount received into the treasury was $801,372.42. The disbursements for the same period of two years were $663,193.45, leaving a balance in the treasury Sept. 14, 1874, of $138,178.97.

Commerce.—The State is divided into three customs districts—S. Oregon, with Coos Bay as the port of entry; Oregon, with Astoria as the port of entry; and Willamette, with Portland as port of entry. For the year ending June 30, 1874, the importations were valued at $490,480, with a foreign exportation of $2,659,510, for the most part wheat and flour, and almost exclusively from Portland, where the imports were also received. In the same year (Dec. 31) 71 ships and barks were despatched from the same port, and the aggregate foreign entrances represented 30,064.95 tons—American, 11,771.44; foreign clearances, 42,439.17 tons—American 17,576.75; total entrances, 41,836.36 tons; clearances, 66,015.92. The coastwise entrances represented 101,025.65 tons, and clearances 85,361.94 tons, exclusive of vessels in the coal-trade between Coos Bay and like small ports with San Francisco. The value of products sent out of the State, including foreign exportations, was $10,000,000 for 1874, of which wheat and flour made up $4,000,000 in gold; salmon, $1,500,000; gold, silver, coal, and iron, $1,500,000; lumber, $1,000,000; wool, hides, meat, cattle, and horses, $2,000,000.

Banks.—There was in 1875, 1 national bank at Portland, with $250,000 capital, $250,000 bonds on deposit, $225,000 circulation, and $50,000 surplus. The State constitution prohibits State banks. There are 7 or 8 private banking-houses. There are no savings banks, trust companies, or fire or life insurance companies, though there are numerous insurance agencies for the companies of other States.

Education.—Oregon has a school fund amounting, Sept., 1874, to $504,216.46, derived from the sale of the sixteenth and thirty-sixth sections of each township surveyed or their equivalent in other lands, from the sale of other lands granted by Congress for educational purposes, on the sale of swamp-lands belonging to the State, and a percentage on the receipts from other lands. The revenue from this fund is supplemented by other sources of revenue and taxation, by the State, county, and district taxes, ratebills and other sources, and for the year 1874 amounted to $204,760.13. The school system of the State was reorganized by the school law of 1872, which provided for the first time for a superintendent of public instruction, who should devote his whole time to the work. From his report for 1874 we learn that the total expenditure of that year for school purposes was $215,107.12; the number of children of school age (4 to 20) was 40,898—21,519 males and 19,379 females; the number enrolled in the public schools was 20,680—11,138 males, 9542 females; the average attendance was 15,169—7871 males, 6874 females; number attending private schools, 2926; number attending no school, 10,711; number of teachers in public schools during the year, 860; average monthly salaries of male teachers, $45.92; of female teachers, $34.46. Number of public schools, 530; school-houses, 555; districts having six months' school or more, 288; value of school-houses, $255,086.44; of school libraries and apparatus, $1336.11; total value of school property, $332,764.34. There were also 43 private schools of primary grade, 21 of academic grade, and 6 of collegiate grade. There were in 1874, 12 public schools of the high school grade, and at least 100 in which some advanced studies were taught. Normal departments are connected with Pacific University and McMinnville College, and there were five teachers' institutes held in the State in 1874. There are 7 academies, seminaries, or high schools not public in the State, and 1 school for the superior instruction of women, St. Helen's Hall, at Portland, which has 9 teachers and 130 pupils.

Higher and Professional Education.—The following table gives the particulars of the colleges, universities, and professional and scientific schools of the State in Jan., 1875:

College, University, or Professional School.	Location.	Date of organization.	Under what control.	Professors and instructors.	Students.		Male.	Female.	Value of buildings, grounds, apparatus, etc.	Amount of endowment.	Income from endowment.	Income from all sources.	Number of volumes in library.
					Preparatory.	Collegiate or professional.							
Colleges, etc.:									$	$	$	$	
Christian College	Monmouth	1866	Christians	9	155	165	205	115	30,000	20,000	1,600	4,500	200
Corvallis College	Corvallis	1868	Meth. E. Ch., South.	6	152	.....	.....	.....	7,000	....	......	6,500	
McMinnville College	McMinnville	1859	Baptists	5	210	14	216	8	5,000	25,000	......	3,100	75
Oregon State University *	Eugene City	1875	State	...	.....	.....	.....	.....	75,000	60,000			
Pacific University	Forest Grove	1854	Evangelical	7	97	26	100	23	14,800	65,000	6,500	8,900	5,000
Philomath College	Philomath	1865	United Brethren	5	72	39	57	54	15,550	16,000	1,600	2,527	130
Willamette University	Salem	1844	Meth. Episcopal	8	282	64	242	184	123,100	38,000	3,800	8,801	2,500
Schools of Science:													
Corvallis State Agricultural College	Corvallis	1868	State and Meth. E.Ch., S.	3	50	55	105	.....	6,000	....	......	5,000	
Scientific Department of Willamette University †	Salem	1853	Meth. Episcopal										
School of Medicine:													
Medical Department of Willamette University	Salem	1867	Trustees	7	.....	14	.....	.....	....	....	......	1,080	

Special Instruction.—There is an institution for the deaf and dumb, and one for the blind at Salem, the former organized in 1870, the latter in 1873. The former has 2 teachers and 30 pupils; the latter 4 instructors and 8 pupils. Both are supported by the State.

* Not fully organized. † Included in collegiate department.

Population.—Before 1843, including the families at Walla Walla, now included in Washington Territory, there were not more than 400 white colonists in all Oregon; at the time of the admission of the State the population was 52,465. The following table shows the population at the date of the several enumerations:

Census.	Whites.			Colored.			Indians taxable.	Chinese.	Aggregate.	Density.	Ratio of increase.	Natives.	Foreigners	Illiterate.	Of school age.	Males of military age.	Males of voting age.
	Males.	Females.	Total.	Males.	Females.	Total.											
1850	8,138	4,949	13,087	128	87	207	.....	......	13,294	0.14	....	12,081	1,213	162	4,525	4,923	5,617
1860	31,451	20,719	52,170	76	52	128	177	......	52,465	0.55	294.6	47,342	5,123	1,511	16,988	15,707	18,806
1870	49,558	37,371	86,929	219	127	346	318	3,330	90,923	0.95	73.3	79,323	11,600	4,427	29,400	23,959	28,616

In 1875 the total population was about 112,000. Besides the population given in the above table, in 1870 there were about 10,960 Indians in the State sustaining tribal relations.

Charitable and Penal Institutions.—The Oregon hospital for the insane at East Portland in 1874 had 167 patients—119 males and 58 females. Its expenses were about $61,000 per annum. The State penitentiary has been located near Salem, but a new one was built in 1873–74 at Portland. In 1874 it had 113 convicts, all males. The expenditures of the prison were for the two years ending Sept., 1874, $69,822, and the earnings, $76,026.

Newspapers and Periodicals.—According to the census returns of 1870 there were 35 periodicals and newspapers in the State, with an annual issue of 3,657,300 copies; 4 of the newspapers were dailies, 26 weeklies, and 5 monthlies. In 1874 the number had been increased to 41, of which 4 are daily, 33 weekly, 1 tri-weekly, 1 semi-weekly, and 2 monthly.

Churches.

Denominations.	Organizations.	Edifices.	Sittings.	Value of property.	Church organizations, 1874–75.	Church edifices, 1874–75.	Ministers, 1874–75.	Members, or communicants, 1874–75.	Adherent pop., 1874–75.	Church property, 1874–75.
Baptists	28	16	4,750	$29,200	59	54	47	2,052	8,000	$51,300
Christians	26	16	4,400	25,000	43	29	36	1,867	7,900	42,500
Congregationalists	8	7	2,300	49,500	11	9	11	672	3,000	61,400
Episcopalians	[illegible]	8	1,800	53,200	16	14	15	607	2,800	74,300
Evangelical Association	2	2	550	9,300	3	3	2	217	1,000	12,000
Lutherans	1	1	300	15,000	2	1	1	160	800	18,000
Methodists	97	49	15,100	113,400	121	63	140	5,871	20,170	139,500
Presbyterians (regular)	8	7	2,425	33,000	28	26	25	1,599	7,000	64,150
" (other)	12	9	3,250	11,200						
Roman Catholics	13	14	2,750	94,500	17	15	18	....	15,000	124,500
Spiritualists	2	2	800	25,000	2	2	...	....	700	27,000
Unitarians	2	1	250	10,000	2	1	2	125	700	12,000
United Brethren in Christ	10	2	500	1,200	39	20	17	811	3,200	10,000
Universalists	1	...	......	....	6	3	4	183	720	10,000
Union	1	1	250	1,600	2	2	2	160	640	6,500
Totals	224	135	39,425	$471,100	351	242	320	14,324	71,630	$652,950

Counties.—The following table gives the names and population (by sexes) of each county in 1870 and in 1860, with the assessed valuation in 1873–74, and true valuation in 1870:

Counties.	Pop., 1870.	Males, 1870.	Females, 1870.	Pop., 1860.	Assessed valuation, 1873–74.	True valuation, 1870.
Benton	4,584	2,548	2,036	3,074	$1,457,742	$2,268,000
Baker	2,804	2,152	652	......	639,038	1,093,695
Clackamas	5,993	3,345	2,648	3,466	1,958,550	3,000,000
Clatsop	1,255	774	481	498	574,594	900,000
Columbia	863	518	345	532	315,482	350,000
Coos	1,644	1,078	566	445	785.464	960,000
Curry	504	313	191	393	218,797	200,000
Douglas *	6,066	3,506	2,560	3,203	3,094,518	3,000,000
Grant	2,251	1,885	366	.....	779,676	578,440
Jackson	4,778	3,031	1,747	3,736	1,827,971	1,500,000
Josephine	1,204	827	377	1,623	268,494	300,000
Linn	8,717	4,709	4,008	6,772	3,861,253	5,500,000
Lane	6,426	3,514	2,912	4,780	2,566,414	2.100,000
Marion	9,965	5.384	4,581	7,088	3,013,381	6,325,000
Multnomah	11,510	6,800	4,710	4,150	10,804,662	11,500,000
Polk	4,701	2,597	2,104	3,625	1,632,625	2,500,000
Tillamook	408	228	180	95	86,576	118,000
Umatilla	2,916	1,763	1,153	......	867,532	1,668,507
Union	2,552	1,547	1,005	......	935,428	1,500,000
Wasco	2,509	1,480	1,029	1,689	1,297,501	1,500,000
Washington	4,261	2,391	1,870	2,801	1,617,885	2,197,290
Yamhill	5,012	2,741	2,271	3,245	1,887,633	2,500,000
Totals	90,923	53,131	37,792	52,465	$40,491,216	$51,558,932

Principal Towns.—Salem, the capital, had in 1870 about 1200 inhabitants. It was estimated to have 4000 in 1875. Portland is the largest city in Oregon. (See PORTLAND.) It had 8293 inhabitants in 1870, and about 13,000 in 1875. The other towns having a population between 2000 and 3000 are Oregon City, Albany, and Jacksonville; between 1000 and 2000, Eugene City, Harrisburg, Corvallis, Astoria, and Junction City. Roseburg, Dalles, East Portland, Powder River Valley, Walla Walla, Baker City, La Grande, Port Orford, Ellenburg, Empire City, and St. Helen's are growing towns.

Constitution, Courts, Representatives in Congress, etc.—The State constitution, adopted in 1857, provides that every male citizen of the U. S., 21 years old and upward, and six months a resident of the State, may be a voter; and foreigners (males) of the same age, who have declared their intention of becoming citizens a year previous to any election, and have resided in the State six months, are also legal voters. The executive officers of the State are a governor, secretary of state, who is also auditor, and State treasurer—all elected for four years, and eligible for only eight out of any period of twelve years. In case of a vacancy in the office of governor the secretary of state succeeds to the office, and if a second vacancy occurs the president of the senate succeeds. The legislature consists of a senate, not exceeding 30 members, elected for 4 years, and a house of representatives, of not more than 60 members, elected for two years. The legislature meets biennially. The judiciary consists of a supreme court of six judges or more, having appellate jurisdiction; of six circuit courts, each presided over by one of the supreme court judges, who also meet as the supreme court once a year at the capital; the circuit courts have civil and criminal jurisdiction and appellate jurisdiction from the county courts; these judges are elected for six years in classes, so that usually two go out of office every two years; the county court judges are elected for four years; they also exercise probate jurisdiction. There are also justices' courts. The constitution prohibits State debts exceeding in the aggregate $50,000, or county debts exceeding $5000; allows no State officer to subscribe for stock in any corporation or to subscribe for any such stock for the State; nor is any county, city, town, or municipal corporation allowed to subscribe for any such stock or bonds, or loan its credit in any way for them. The State is entitled to one Representative in Congress.

History.—So far as maritime discovery confers a title to a region of country, the first claim to Oregon and Washington Territory belonged to Spain, which, by the Greek pilot De Fuca in 1592, by Admiral Fonte in 1640, and by subsequent explorers, had visited and mapped the greater part of the coast as far as the 55th degree of N. lat. The Nootka treaty of 1790 between Spain and Great Britain only gave to the latter some fishing and trading rights in the vicinity of Puget Sound. The discovery and exploration of Columbia River by Capt. Robert Gray, an American captain, who gave the name of his ship to the river; the purchase of Louisiana and all that belonged to it to the Pacific from the French in 1803, their claim being the best, next to that of Spain; the exploration of Columbia River from its sources to its mouth by Lewis and Clarke by order of our government in 1804–05; and the treaty of limits concluded between Spain and the U. S. in 1819, by which all the territory N. of 42° N. lat. was expressly declared to belong to us,—were conclusive proofs of our title to this region. But the treaty, which the British government called a "treaty of joint occupation," concluded

* Umpqua, which had 1250 inhabitants in 1860, was consolidated with Douglas in 1862.

in 1818, gave a great deal of trouble. Without any just title Great Britain attempted to claim territory as far S. as Columbia River, and even below, and finally offered to compromise on the Columbia. Meantime, a house had been built on the Columbia in 1810 by Capt. Winship, a New Englander, but the house was carried away by a flood the same year, and the settlement given up. In 1811, John Jacob Astor established a fort and fur-trading house at Astoria, but by the treachery of the manager in charge both were given up to the English, who were then at war with the U. S., in 1813. The English named it Fort George. It passed into the hands of the Hudson's Bay Company soon after, and in 1824 some of the servants of that company set out a few fruit trees and made some efforts to cultivate the soil. In 1832 the first settlers from the U. S. arrrived. In 1834 the missionary colony led by Dr. Marcus Whitman and Rev. Mr. Spalding entered Oregon. Their wives were the first white women who had crossed the Plains, and their children the first American children born in Oregon. Others followed soon after, and in 1842 the emigration was large. In 1843 they formed a provisional government. In 1846 a treaty was concluded between the U. S. and Great Britain fixing the boundary on the 49th parallel, except at the Straits of Fuca. Oregon was formally added to the U. S., but had no Territorial government till 1849. In 1847 a considerable number of settlers were massacred by the Indians. In 1848, Oregon was created a Territory, including what is now Washington Territory. In 1849 its first Territorial governor, Joseph Lane, was appointed. He arrived in Mar., 1849, and organized the Territory, which then had 8785 inhabitants. Her population, after a little, increased so rapidly that in 1857 a convention was called, a constitution adopted, and application made for admission as a State. This was granted in 1859, and though for some years its progress was slow, yet since the opening of railroads in the Willamette Valley and the discovery of gold in Middle and Eastern Oregon its growth has been much more rapid. There have been occasional troubles with the Indians, the latest being the "Modoc war" in 1872, in the extreme southern part of the State, but most of the tribes are on reservations, and are peaceful and partially civilized.

Governors.

(1) *Provisional.*

James Shields..............1848–49

(2) *Territorial.*

Joseph Lane.................1849–51
John P. Gaines.............1851–53
Joseph Lane.................1853–53
John W. Davis.............1853–55
George L. Curry...........1855–59

(3) *State.*

John Whittaker...........1859–62
Addison C. Gibbs.........1862–66
George L. Woods..........1866–70
Lafayette S. Grover........1870–78

Electoral and Popular Vote for President and Vice-President.

Year of election.	Candidates for whom the electoral vote of State was cast.	Electoral vote.	Popular vote.	Minority candidates.	Vote cast.	Total vote.
1860	Abraham Lincoln P.; Hannibal Hamlin V.-P.	3	5,270	Stephen A. Douglas P.; Herschel V. Johnson V.-P.	3,951	12,460
				John C. Breckenridge P.; Joseph Lane V.-P.	3,056	
				John Bell P.; Edward Everett V.-P.	183	
1864	Abraham Lincoln P.; Andrew Johnson V.-P.	3	9,888	George B. McClellan P.; George H. Pendleton V.-P.	8,457	18,345
1868	Horatio Seymour P.; Francis P. Blair, Jr., V.-P.	3	11,125	Ulysses S. Grant P.; Schuyler Colfax V.-P.	10,961	22,086
1872	Ulysses S. Grant P.; Henry Wilson V.-P.	3	11,818	Horace Greeley P.; Benjamin Gratz Brown V.-P.	7,740	20,147
				Charles O'Conor P.	587	

(For valuable documentary and other information relative to the productions, industry, commerce, valuation, and history of Oregon we acknowledge our indebtedness to his Excellency Lafayette S. Grover, governor of Oregon.)

THOMAS JORDAN. REVISED BY L. P. BROCKETT.

Or'egon, county of Missouri, bounded S. by Arkansas. Area, 700 square miles. It is rugged, broken, and densely timbered, with fertile valleys and ores of copper, lead, etc. Corn is the leading product. Cap. Alton. Pop. 3287.

Oregon, tp. of Butte co., Cal. Pop. 1169.

Oregon, post-v., cap. of Ogle co., Ill., on the Chicago and Iowa R. R., 100 miles W. of Chicago, has 2 public-school buildings, 4 churches, 2 banks, 2 weekly newspapers, 2 hotels, several oatmeal-mills, and stores. Pop. 1325.

C. R. HAWS, ED. "OREGON COURIER."

Oregon, post-v. and tp., Clarke co., Ind. Pop. 1360.

Oregon, tp. of Starke co., Ind. Pop. 524.

Oregon, tp. of Washington co., Ia. Pop. 1318.

Oregon, tp. of Lapeer co., Mich. Pop. 877.

Oregon, post-v. of Lewis tp., cap. of Holt co., Mo., 30 miles N. W. of St. Joseph, has a public library, the North-west Missouri Normal School, a good graded school, 5 churches, 1 bank, a handsome court-house, park, 2 newspapers, several hotels, 1 woollen-factory, 1 flouring-mill, and stores. Principal employment, fruit-growing and agriculture. Pop. 824.

Oregon, tp. of Lucas co., O. Pop. 1863.

Oregon, tp. of Wayne co., Pa. Pop. 690.

Oregon, post-v. and tp., Dane co., Wis., on the Madison division of Chicago and North-western R. R. Pop. 1498.

Oregon City, post-v., cap. of Clackamas co., Or., on the Oregon and California R. R., 12 miles S. of Portland, has fine water-power, 2 excellent schools, 5 churches, a large woollen-factory, 2 flour-mills, 1 newspaper, and stores. Pop. about 1600.

A. NOLTNER, ED. "OREGON CITY ENTERPRISE."

Oregon River. See COLUMBIA.

Or'egonville, tp. of Rockingham co., N. C. Pop. 2561.

O'reide, an alloy of copper with tin, or more rarely zinc, composed of 100 parts of the first to 17 of the tin or zinc. These are fused together and then fluxed with lime, magnesia, argol, and sal-ammoniac. It is used for the cases of cheap watches and for ornamental castings. It resembles gold in color, and affords a good base for electro-plating with gold. It is malleable and takes a good polish.

O'Reil'ly (ALEXANDER), COUNT, b. in Ireland in 1725; entered the Spanish military service at an early age; fought in Italy during the war of the Austrian succession; served in the Austrian army against Prussia 1757–58, and was distinguished at Hochkirch; re-entered the Spanish army as lieutenant-colonel 1761; introduced German tactics into Spain; was sent to Havana as brigadier-general 1763; saved the life of Charles III. when threatened by a sedition at Madrid 1765; went to Louisiana June, 1768, to take possession of that colony, ceded to Spain by France; put to death by court-martial Lafrenière and other French leaders who had resisted the transfer of sovereignty; abolished the French laws; appointed inspector-general of all the forces in Spanish America 1770; governor of Madrid 1773; sent into exile in Galicia on an insignificant pension 1786. D. at Chinchilla, Murcia, Mar. 23, 1794.

O'Reilly (BERNARD), D. D., b. in Ireland in 1803; was consecrated (Nov. 10, 1850) Roman Catholic bishop of Hartford, Conn. D. at sea Jan., 1856.

Orel', government of Russia, between lat. 51° 50′ and 54° N., and between lon. 33° and 39° E. Area, 18,393 square miles. Pop. 1,578,013. The surface is mostly level. The soil is fertile and well watered by the Desna, the Oka, and the Sosna. The climate is mild. Agriculture is the chief industry. Large quantities of wheat are exported, in grain and in flour, to Riga and St. Petersburg. Hemp is extensively cultivated, and oil of hempseed, sailcloth, rope, and yarn are manufactured. Some iron-mines are worked and many horses and cattle are reared.

Orel, town of Russia, capital of the government of the same name, on the Oka, is mostly built of wood, and was almost destroyed by fire on June 7, 1848. It has many educational institutions, breweries, distilleries, ropewalks, tallow-houses, and other manufactories, and an important trade in corn with St. Petersburg and Riga. It formerly formed a stronghold against Tartar invasions; its fortifications are now of no consequence. Pop. 43,575.

Orella'na (FRANCISCO), b. at Truxillo, Spain, about 1505; was one of the companions of Francisco Pizarro in the conquest of Peru; was second in command under Gonzalo Pizarro in exploring the regions E. of the Andes; descended the Amazon; obtained a commission to colonize the region he had passed through; embarked with four ships and 400 men; lost his vessels and men, and d. on the banks of the Amazonas, near Montealegre, in 1549 or 1550.

Orel'li (JOHANN KASPAR), b. at Zurich, Switzerland, Feb. 13, 1787; studied theology, but especially ancient and modern languages and literature, and was appointed *pro-*

fessor eloquentiæ in 1819 in his native city, where he d. Jan. 6, 1849. His critical editions of Horace (2 vols., 1837–38; 3d ed. 1850–52), Tacitus (2 vols., 1846–47), and Cicero (8 vols. in 12 pts., 1826–38; 2d ed. 1845–61); including *Scholiastæ Ciceronis* (1833), *Onomasticon Tullianum* (3 vols., 1836–38), are very celebrated, also *Inscriptionum Latinarum Selectarum Collectio* (2 vols., 1828).

O'renburg, government of European Russia, bounded E. by the Ural and S. E. and S. by the Caspian Sea. Area, 144,924 square miles. Pop. 840,704. The central part of the government is mountainous, covered with branches of the Ural Mountains which are very rich in iron, copper, and gold; the Crown mines yield over 1000 pounds of gold annually, and the private double as much. On both sides of the mountains are extensive steppes, in many places barren and dotted with salt lakes, but in others presenting good pasture-grounds, where immense herds of cattle, sheep, horses, and camels are reared. Besides the breeding of cattle, in which the Ural Cossacks are engaged, and mining, fishing in the Ural and the Caspian Sea and preparation of caviare form an important branch of industry. An extensive trade is carried on with Europe by means of canals —with Asia by means of caravans of camels.

Orenburg, town of European Russia, capital of the government of Orenburg, on the Ural, was founded in 1742. It is fortified, and carries on an extensive trade. Tea from China, shawls and silks from Persia, skins, tallow, and cattle from the Khirgheez and Cossacks, and metals from the Ural Mountains are brought here and exchanged. Pop. 33,431.

Orenburg Gum, a gummy and somewhat saccharine exudation collected in Siberia and Russia from the trunks of larch trees after great forest-fires have partly destroyed the trees. It is collected in large quantity, and used as a substitute for gum-arabic and to some extent as food. It has a resinous flavor, and is entirely soluble in water.

Oren'se, town of Spain, in Galicia, on the left bank of the Minho, which here is crossed by a magnificent bridge, 1400 feet long, 145 feet high, built in 1230, and spanning the river with seven arches. At the foot of the hill on which the city is built are the famous hot sulphur springs, Las Burgas. The town is also celebrated for its chocolate, hams, and wine. Pop. about 11,000.

Orense (José Maria), marquis of Albaida, b. in Spain about 1802; became a prominent republican leader; participated in several insurrections; was as often exiled and recalled, and almost constantly a member of the Cortés. After the overthrow of Isabella II. (Sept., 1868), Orense figured as the leader of the manifestations at Madrid in favor of a federal republic and the abolition of slavery in Cuba; was an earnest partisan of the French in the war of 1870–71; proposed at Tours (Sept., 1870) a federation of the "Latin races;" protested against the election of Amadeus as king of Spain (Nov., 1870); was chosen president of the Cortés on the abdication of that monarch (Feb., 1873); was dissatisfied with the republican governments of Figueras and Castelar, and withdrew from the Cortés Aug., 1873.

Oreodont'idæ [from *Oreodon*—ὄρος, "mountain," and ὀδούς, "tooth"—one of the generic names], a family of extinct mammals belonging to the order Ungulates and sub-order Artiodactyles, intermediate between the typical ruminants and hogs. In form the animals could not have resembled any living species, but must have had some general resemblance to a cow or sheep. The skull was destitute of horns; the olfactory chamber completely enclosed above by the long nasals, and on the sides by the supramaxillaries. The teeth were in full number (M. $\frac{3}{3}$, P. M. $\frac{4}{4}$, C. $\frac{1}{1}$, I. $\frac{3}{3} \times 2 = 44$), in series interrupted by a diastema for the reception of the canines of the upper jaw and the enlarged first molars of the lower; the true molars had double crescentiform ridges, as in the typical ruminants, and the posterior one was provided with two on the posterior as well as anterior halves; the premolars were more or less conical; the first in the lower jaw like canines; the canines of the upper jaw enlarged, those of the lower modified like the incisors. The family thus distinguished had a number of representatives in America during the Miocene Tertiary epoch, which have been differentiated into two sub-families: (1) Oreodontinæ, in which the orbits were closed behind and the lachrymal bones impressed by well-marked fossæ, including the genera *Merycoidoden* (or *Oreoden*), *Eporeoden*, *Merycochœrus*, *Merychyus*, and *Leptanchenia*, and (2) Agriochœrinæ, distinguished especially by the incomplete orbits and lachrymal bones without fossæ, limited to the genus *Agriochœrus*. The nearest representatives yet discovered of this family in Europe belong to the Hyopotamidæ, which, however, were also represented in this country. Theodore Gill.

Oreop'olis, tp. of Cass co., Neb. Pop. 249.

Ores'tes, in Grecian mythology, a son of Agamemnon and Clytemnestra; avenged the murder of his father by killing his mother and her paramour, Ægisthus, but was immediately attacked by the Erinnyes, who drove him mad, pursuing him from place to place. He sought refuge with Apollo in Delphi, but the manner in which the Erinnyes were finally appeased is variously related by the Attic tragedians, who frequently treated this myth and developed it differently. According to one version, Orestes went to Athens, where the court of the Areopagus declared him innocent through the influence of Athene. According to another, Apollo sent him to Tauri, whence he succeeded, by the aid of his sister, Iphigenia, who was a priestess there, in carrying away the image of Artemis. Of the tragedies which treated the myth, the trilogy *Orestea* by Æschylus, *Electra* by Sophocles, and *Electra, Orestes,* and *Iphigenia in Tauris* by Euripides, are still extant.

Oreus. See Histiæa.

Or'fa, Orfah, or **Urfah** [Greek *Edessa;* Arabic *Roha*], capital of the pashalic of Urfah in Asiatic Turkey, lat. 37° 8′, about 40 miles E. of the Euphrates. That it was founded by Nimrod, as stated by Isodore of Charax (about 300 B. C.), is hardly credible. The tradition which identifies it with "Ur of the Chaldees," the birthplace of Abraham, is probably not older than the fourth century of our era. Appian says it was founded by Seleucus (about 300 B. C.). It is built partly on the side of a hill looking eastward over an extensive plain. The river Kara Kozoon, spanned by three bridges, flows through it. Its streets are narrow, but clean. Its gardens resemble those of Damascus. Its mosque and pool of Abraham are famous. It has a large trade, and a pop. of about 50,000, nearly half of whom are Christians. (See Edessa.) R. D. Hitchcock.

Or'fila (Matthieu Joseph Bonaventure), M. D., b. at Mahon, Minorca, Apr. 24, 1787; studied medicine with brilliant reputation at Valencia and Barcelona, and in 1807 was sent at public cost to Paris to fit himself for a professorship at Barcelona; became in 1811 a private lecturer on chemistry in Paris; was naturalized in 1818, and became physician to the king, and in 1819 professor of medical jurisprudence; in 1823 professor of medical chemistry, and in 1830 dean of the faculty. He attained immense popularity as a physician, lecturer, and scientist, and did much to elevate the standard of medical learning. In 1848 he lost most of his distinctions at the hands of the revolutionists, but in 1851 was made president of the Academy of Medicine. D. at Paris Mar. 12, 1853. Orfila was the father of modern toxicology. His leading works are—a noble *Traité de toxicologie générale* (1813–15), *Éléments de Chimie appliquée* (1817), *Traité de médecine légale* (1823–47, 3 vols.).

Or'ford, post-v. and tp., Grafton co., N. H., on the Connecticut River. Pop. 1119.

Orford, Earls of. See Walpole.

Or'fordville, post-v. of Rock co., Wis., on the Wisconsin division of the Milwaukee and St. Paul R. R.

Or'gan [Gr. ὄργανον]. *Structure.*—The organ is a wind instrument of peculiar range, force, and complexity. Its peculiar capabilities are due to three principal properties. First of all, it includes a large number of distinct pipes, each of which is, in a sense, an independent instrument. Secondly, it contains peculiar arrangements, of which the chief is the keyboard (clavier), by which numbers of these pipes very remote from one another may be simultaneously operated on. Lastly, it substitutes for the natural production of the moving force (namely, air-currents) by the human lungs an artificial production of the same by means of a bellows; which substitution not only relieves the performer of the most fatiguing part of his work, but also increases in a vast measure the power of the instrument. By means of this large bellows, of a structure similar to that which is seen in an accordion, and worked by a lever-handle, air is forced into a closed chest or reservoir, where it can be stored up in a compressed state. In the modern bellows, the horizontal as distinguished from the old-fashioned diagonal, there are two divisions—a feeder and a temporary air-chest. The air is unable to return by the way it came, and can only find vent above through its upper floor, called the sounding-board. This sounding-board separates the air-chest from the organ-pipes, which are arranged above it. The air is admitted to the pipes by the action of certain slides and valves which are set in motion by drawing out the registers and by pressing down the keys, digitals, or pedals. The drawing out of a slide partly opens up to the air a whole set of pipes of one peculiar quality or tone, so that when any of the keys is pressed down the air finds its way into the appropriate pipe of this particular series. Of course, when more than one stop is drawn out the air is admitted simultaneously into several distinct

groups of pipes. The larger organs consist of three or more distinct partial organs, each of which has its peculiar keyboard, and a separate air-chest and sounding-board for its pipes.

The sound of an organ is produced by the vibrations of the column of air within the pipe. The compressed air of the air-chest, as soon as obstacles are removed by the action of the stop and of the key, rushes upward into the pipe, and so produces the tone. The shape of a metal organ-pipe is very much the same as that of a common tin whistle. The stem or "body" of the pipe is cylindrical. The lower part or "foot" is an inverted cone with its apex cut off. At the juncture of the body and the foot there is an opening in the side of the pipe called its "mouth." There is also a horizontal plate termed the "languid" or "language," which partly divides the foot from the body, and leaves a narrow egress for the air coming from below close to the mouth of the pipe. The wooden pipes are of a slightly different structure, being commonly square instead of round, but their mode of action is not materially different. When the air rushes up into the pipe it is driven against the upper edge or "lip" of the mouth-hole. Breaking against the sharpened edge, it produces a peculiar hissing or rushing noise, which is all we hear when the pipe does not "speak." The agitation thus set up at the mouth communicates itself to the column of air within the body of the pipe, which is thus made to vibrate with a rapidity determined by its length. The shorter the pipe the more rapid the series of vibrations, and the higher consequently the pitch of the note produced. Organ-pipes are of a great many varieties, according to the material used and the shape of their several parts. Metal pipes are made of tin, "metal" (a mixture of tin and lead), zinc, etc., while wooden pipes are generally constructed out of cedar, deal, or pine. The shape of pipes also varies considerably. Thus, among metal pipes we have the forms of cylinder, cone, and inverted cone, while among wooden pipes we have the forms of quadrilateral, trilateral, cylinder, pyramid, and inverted pyramid. Further, there is a distinction between pipes which are open and those which are stopped or plugged at their upper extremity. An open pipe produces a tone with a wave of air twice as long as the body of the pipe, and a stopped pipe produces a tone with a wave four times the length of its body. Thus, a stopped pipe is always an octave deeper than an open pipe of the same length.

The peculiar quality of sound belonging to an organ-stop is due to the structure of the pipes belonging to the stop. According to the researches of Prof. Helmholtz, the *timbre* of a musical instrument is determined solely by the number and strength of the upper partial tones which enter into the tones of the instrument. Thus, he found that wide-stopped organ-pipes have scarcely any upper partial tones at all, and that all stopped pipes are wanting in the even members of the series of upper tones. Hence, stopped pipes give a soft hollow sound, while open pipes produce a sharp brilliant style of tone. The number of partial tones, and so the timbre of a pipe, vary with the shape and size of the pipe, and also with the material of which it is made. Certain stops called "reeds" owe their peculiar character to the addition of a vibrating tongue, like those of a harmonium, to the pipe. This tongue is a thin, oblong brass plate fitted into the aperture of a cylindrical tube called a reed. The tongue in its oscillations alternately opens and closes the aperture of the tube through which the air seeks to pass. The consequence is, that the stream of air is separated into a series of individual pulses. The sound of a reed pipe is the result of these interrupted pulses of air, together with the vibrations of the metal tongue itself. Other stops having a peculiar quality of tone are in reality compound stops; that is, they bring into simultaneous action a plurality of pipes of different pitch. The twelfth, fifteenth, sesquialtera, and mixture are among the best-known compound stops. The notes of these combined pipes have the same relation to one another as the partial tones of a single musical tone. Thus, it is usual to connect the upper octave with the prime tone, and after that the twelfth. Some of these compounds give as many as the first six partial tones. The number and strength of the combining tones in the note of one of these compound stops give to it a peculiarly bright, and in some cases a dazzling and overpowering, character.

The names of the several organ-stops point partly to the quality of the sound produced, partly to the range or compass of the pipes belonging to it, and to other circumstances. Thus, the trumpet and the oboe, which are both reed-stops, are so named from the resemblance of their tones to those of these instruments. The diapason-stops again are so called because their pipes extend through the whole compass of the organ. The stop principal, which is an octave higher than the open diapason, is so named from the fact that it is the first stop tuned, and the standard, therefore, for the pitch of the remaining stops.

The organ, as may be seen from its structure, is adapted to a solemn and sustained kind of music. Unlike the pianoforte, its tones are capable of being prolonged with an even, undiminished intensity. Its limitations are those of all mechanical substitutes for human action. It is incapable of rendering the finer gradations of force, the contrast of forte and piano being attainable (except in the case of the swell organ, which is provided with a screen for breaking the sound) only by the rough device of increasing or decreasing the number of pipes sounding.

History.—The history of the organ forms a not unimportant branch of the history of music as a whole. We are able to trace back the pedigree of this instrument to the humble ancestry of the bagpipe and the pipes of Pan. It is difficult to fix the date of the first organs referred to in ancient writers, owing to the ambiguity of the word *organ* (*ὄργανον*), which was properly fitted to denote any musical instrument. Indeed, so late a writer as St. Augustine attempts to claim for this name the right of denoting all musical instruments alike. The organ, properly so called, originated among the Greeks of Alexandria in the second century B. C. The first species of organ of which we have a description is the water-organ, ὕδραυλος (literally, "water-flute"). It is described by Vitruvius and Athenæus as sweet though not powerful. This instrument was designed not for the church but for domestic amusement. On a Roman monument we have a bass-relief representation of a domestic organ. It contains sixteen pipes, and the performer, a lady, plays with both hands on the keyboard. It is placed on a table, and looks easily portable.

The organ is said to have been introduced into the Church by Pope Vitalian in the seventh century, but its employment in church services probably dates from a much earlier period. Organs were certainly used in churches very commonly in the time of the Carlovingians. We read of organs being sent to King Pepin and Charlemagne as presents by the Byzantine emperors. The first of these is described as a wonderful structure of the form of a tree, in the branches of which were birds of various species, each bird giving forth the note peculiar to its species. At a much later period than this we find the structure of the organ to be exceedingly rude. The keys were often from four to six inches broad, and were struck with the closed fist or in some cases with the elbow, so that only two tones could be produced simultaneously. The compass was sometimes as great as twenty-one notes, the series being that of our diatonic scale (the white notes of a piano). In addition to these more common instruments, we read of gigantic organs, such as that built for Winchester in the year 951, which is said to have contained 400 pipes and 26 bellows, requiring 70 strong men, and to have been played by two performers or four fists. From the twelfth century on we read of a light portable organ named "portative," which was distinguished from the fixed organ or "positive." The performer, who carries the instrument by means of a belt, plays with one hand, and manages the bellows with the other. Italian painters of the fourteenth and fifteenth centuries were fond of representing this instrument in the hands of saints and angels. In the fourteenth century the structure of the organ underwent certain improvements. A step had been taken before this towards enabling the organist to produce a larger number of simultaneous tones. By the invention of mixture or compound stops—which seems to have been arrived at at a very early date—two or three notes could be sounded by means of one key, the combinations being selected according to the strange ideas respecting sequence of accords prevalent at this age (as illustrated in the *Organon* or mode of harmony of Hucbald and his successors). In the fourteenth century this capability of uttering simultaneous tones was much further increased by the reduction of the size of the keys, so as to make them workable by means of the fingers. This change also involved a large extension of the compass of the keyboard. We read of organs of this period having three octaves, including semitone intervals.

The period of the supremacy of the polyphonic music of the Netherlands (1450–1550) was marked by considerable improvements both in the structure and in the art of performance of the organ. The development of the contrapuntal or fugue style of music, which was diffused from the Netherlands through Germany, Italy, England, etc., gave a great impetus to the art of organ-playing. There are still preserved volumes of organ compositions used by the German performers of this time, from which we see that organ pieces were now growing into independent productions. In Germany the art of organ-playing was diligently cultivated by a series of musicians, of whom the family of the Kochs were among the most distinguished.

Thus were laid the foundations of the art which Sebastian Bach was afterwards to carry to so high a degree of perfection. We must not forget to refer, too, to the study of the organ in England and in Italy at this period. In Italy, during the sixteenth century and at the commencement of the seventeenth, organ compositions very ornamental in design and containing the germs of our modern harmony became common. The seventeenth century, too, was marked by great progress in organ-building and in organ-playing. Germany and Holland trained builders of great eminence, whose works may be found in other countries besides, including England. Some of the finest old organs of England, including those of Westminster Abbey, the Temple church, and Durham cathedral, were erected by a German named Schmidt. The style of organ composition was greatly elevated in this century by the addition of harmony in the modern sense, of which Palestrina had laid the foundations in Italy.

From the beginning of the last century to the present date the organ has undergone a vast though gradual improvement of structure, which has served to increase its scope and variety by lessening the mechanical difficulties of performance. In this way it became possible to execute such rich and elaborate works as later composers have produced. The principal mechanical additions to the instrument have been directed to a more varied combination of pipes by compound stops, to a diminution of the labor of the manual performance by means of arrangements which facilitate the drawing of stops and the depression of keys. Among the methods used to lessen this last ingredient in the labor of the organist are pneumatic action (which is commonly adopted in the best modern organs) and electrical agency. Among the more curious recent experiments in organ-building it may be well to mention the very successful attempt of Mr. J. Baillie Hamilton, stimulated by the experiments of Mr. John Farmer, organist of Harrow School, to produce tones from strings by means of a blast of air, and so construct a "string-organ." The wire is attached in a peculiar manner to the tongue of a reed, and the current of air acting on this metal tongue causes both the tongue and the connected wire to vibrate. The tone resulting is produced by both sets of vibrations in combination, and is said to resemble very closely the tone of a metal diapason organ-pipe. This instrument may be said to be an expansion and elaboration of the Eolian harp. Though resembling the harmonium rather than the organ in construction, in quality of tone it is most closely allied to the latter instrument. An allusion may also be made to the curiosity in organ-building produced by Mr. Arthur Denny — namely, the steam-organ, in which an immense force of sound is obtained by sending a jet of steam through an organ-pipe. This instrument, the maximum sound of which is said to be audible twelve miles off, has little value in a musical point of view, but it has been turned to practical account both in America and in England as a fog-signal and as a substitute for the chime of bells. It is worth observing that a monster organ, most probably a steam organ, was invented so long ago as the year 997 by the monk Gerbert Sylvester.

Among the largest European organs still to be seen, the following may be mentioned: the Weingarten organ (66 stops and 6666 pipes), the Haarlem organ (60 stops), the organ of the church of the Cavalieri di San Stefano at Pisa (over 100 stops), that of the church of S. Alessandro in Colonna (100 stops, circa), the Crystal Palace organ, London (65 stops), and the transept organ of St. Paul's, London (60 stops).

The reader is referred to the following works on the structure and history of the organ: *The Organ, its History and Construction*, by Edward J. Hopkins, with a new history of the organ by Edward F. Rimbault (London). This is by far the most complete treatise on the subject. The nature of the sounds of organ-pipes is elucidated by Prof. Helmholtz in his great work on *The Sensation of Tones (Die Tonempfindungen)*, recently translated by Mr. A. J. Ellis (London). In an appendix to this work Mr. Ellis gives a full account of the string-organ invented by Mr. Hamilton. Many curious chapters in the history of the organ and of organists may be found in the histories of music of Dr. Burney and Sir John Hawkins, and of the German historian Kiesewetter Torkel, and especially A. W. Ambros.

James Sully.

Organ'ic Anal'ysis, Prox'imate. This term is applied to an important branch of chemical analysis which seeks to separate and determine the *proximate* constituents of vegetable and animal matter and of products therefrom; that is, instead of separating *ultimately* the elementary constituents from each other, it is the function of proximate analysis to set apart by themselves the different important definite *compounds* which make up the immense variety of mixtures occurring in animal and vegetable structures, and the various tissues and juices thereof. This field of investigation it will be seen is of immense magnitude and importance, but of corresponding, indeed unlimited, complexity and difficulty. Nevertheless, certain general principles have been arrived at; and an American chemist, Albert B. Prescott, of the University of Michigan, has, during the past year, produced a systematic treatise upon the subject, to which the reader may be referred with confidence as well worthy of study. The subject, however, is one which has not received the attentive and systematic care from laboratory chemists that its importance demands; and it yet remains true that in proximate organic analysis success depends chiefly upon the original inventive talent and individual research of the chemist occupied therein, in too great a number of important cases that are constantly liable to turn up. H. Wurtz.

Organ'ic Anal'ysis, Ul'timate, a special branch of chemical analysis, which may also be appropriately designated the elementary analysis of hydrocarbon compounds, as a vast majority of the bodies to which it is applicable contain both carbon and hydrogen. It is founded on the general method of burning in a close apparatus a weighed quantity of the organic substance to be analyzed, which has been previously mixed with some mineral compound of oxygen capable of furnishing the latter element to the carbon and hydrogen of the organic substance. The mineral oxygen compounds mostly used are black oxide of copper and fused yellow chromate of lead. The carbonic acid gas and water (as steam) formed in this combustion are made to pass through another apparatus, or train of apparatuses, containing chloride of calcium, to absorb all the water, and potash-ley, to absorb the carbonic acid gas. The tubes containing these latter two absorbents are weighed before and after the process, and the differences are the amounts of water and carbonic acid formed, from which the amounts of carbon and hydrogen in the original substance are readily computed. If oxygen is contained in the substance, it appears as the difference between the whole original weight and the sum of the carbon and hydrogen. If nitrogen be present, it has to be determined by a separate process, but it also necessitates certain precautions in the above process, to prevent the formation of oxides of nitrogen, which would be absorbed by the potash and vitiate the carbon determination. The products of combustion are therefore first passed over metallic copper heated to incandescence, which decomposes such oxides of nitrogen.

Determination of Organic Nitrogen.—The prevailing methods are two in number. By the Will-Varrentrapp method the nitrogen is converted into gaseous ammonia by ignition in admixture with a caustic alkali. A mixture of the hydrates of soda and lime, called "soda-lime," is used for the purpose. The ammonia is absorbed by an acid, and its amount determined by subsequent operations. By the Dumas-Melseus method the nitrogen is converted into its gaseous elementary form and measured in a eudiometer. Combustion with oxide of copper is generally employed in this method, with numerous essential precautions. Other modifications are employed when sulphur, phosphorus, chlorine, etc. are to be determined in organic compounds. To explain the apparatus required in these different methods, and the details, manipulations, and precautions necessary to practical success, would require a considerable treatise with numerous illustrations. For these it is necessary to refer, therefore, to the elementary text-books of chemistry. Henry Wurtz.

Organ'ic Chem'istry. This is the division of the universal science of chemistry which relates to the materials and laws that govern the transformations involved in the processes of life, death, and decay. It has of late been quite a fashionable notion among chemists that no such division exists, and that the science is a unit; but this notion does not and will not prevail, for the reason that there is an unquestionable foundation in nature for the distinction. Others, more inductively, acknowledge the distinction and seek to define it, the most prevalent definition being that "organic chemistry is the chemistry of carbon compounds," though these usually confess that they thus include carbonic acid with the carbonates, undeniably mineral bodies, besides carbonic oxide, sulphides of carbon, cyanogen, and cyanides, which are never found except as artificial products having no natural relation to life, death, or decay. The present writer believes that the difficulty will be entirely overcome by giving to organic chemistry a new definition, by calling it the "chemistry of hydrogen and its transformations and combinations." The transformations referred to are those of molecular volume. This definition includes water and ammonia as organic substances; but as water, both free and combined, is the chief constituent and the most essential substance in all liv-

ing bodies, this should present no obstacle; and as to ammonia, its functions and relations to life in nature are obvious enough. The illustrious chemist Leopold Gmelin, appreciating the difficulty above referred to in the ordinary definition as "chemistry of carbon compounds," proposed to amend the matter by excluding all carbon compounds containing but one equivalent of carbon, a subsidiary hypothesis by which he got rid of the compounds that are above referred to. But at the same time he threw out marsh-gas, a universal product of natural organic decay, and one of the most abundant. This is sufficient to invalidate the hypothesis. The great Liebig had another definition of organic chemistry, as the "chemistry of compound radicals." In a certain sense, which is quite wide, however, of the sense attached by the author, this definition may have some applicability. Though the organic radicals of Liebig, on which he founded the definition, are now matters of controversy, no doubt can be entertained of at least one compound organic radical, H_2C, as yet without a name, which plays an almost universal part in organic transformations. Unfortunately for Liebig's definition, however, there are unquestionably mineral compound radicals. Cyanogen may be considered one of these, whose existence is demonstrated, and many chemists admit many others. Upon the whole, Liebig's definition could not be regarded as conveying a generalization likely to be founded in nature. The true chemical and natural distinction between organic or zoic and azoic chemistry will be found, it is believed, in the new definition above proposed, making zoic chemistry the chemistry of hydrogen and its transformations. HENRY WURTZ.

Organic Radicals. See NOMENCLATURE, in chemistry, also ORGANIC CHEMISTRY.

Organism. See BIOLOGY.

Organization, of troops. See ARMY, ARTILLERY, CAVALRY, ENGINEERS, INFANTRY; as also TACTICS and WAR. For review of existing armies see WAR.

Organon. See NOVUM ORGANUM.

Organ-Point [Fr. *point d'orgue*], in music, a series of harmonious combinations having for its bass one long, sustained, and unvarying note. As the organ is the only instrument on which these passages can be performed with full effect, the origin of the name and of its substitute, "pedal" or "pedale," is readily explained. This holding or pedal-note is usually either the dominant or the keynote of the piece, and the upper parts consist partly of harmonies related to the bass, and partly of accidental or passing chords, serving as links in the general course of the harmony. Organ-points are of great variety in structure and duration, occupying sometimes as many as twelve or sixteen bars, and seldom less than three. They generally terminate with the perfect or imperfect cadence, or with a chord of the seventh and a pause, and may be classified as follows: (1) Those consisting of a train of simple chords, chiefly derived from the bass; (2) those formed of plain harmonies, with suspensions; (3) those which consist of a number of deceptive or interrupted cadences; (4) those formed of sequences variously elaborated; and (5) those of a more abstruse character, in which harmonies of a foreign, and even discordant, nature are introduced. An organ-point is sometimes *double*, the former part having the dominant for its bass, and the latter part the tonic or keynote. Instances are occasionally found of *inverted* organ-points, or those in which the holding-note is not in the bass, but in one or more of the upper parts. WM. STAUNTON.

Organ-Stop. See STOP.

Or'ganzine [It. *organzino*] is silk which has been wound, cleaned, thrown, and twice or thrice doubled and twisted. It is also known as "thrown silk."

Or'geat [Fr.], a flavoring substance much used in medicinal and other drinks, especially in France. It is essentially a syrup of sweet and bitter almonds, and possesses a rich almond flavor, but it is often modified by the use of other ingredients. The *Amande de terre,* the bulb of *Cyperus esculentus,* is a good substitute for true almonds in this preparation.

Orge'torix, a wealthy and noble Helvetian who formed a conspiracy among the nobility, and persuaded the people themselves to go forth from their territory with all their possessions (B. C. 61); was appointed to carry out the necessary arrangements; persuaded Casticus of the Sequani and Dumnorix of the Ædui to seize upon the supreme power in their states, assuring them that he should obtain the sovereignty of his own. His plans having been disclosed, he was brought to trial. By the aid of his friends and retainers he rescued himself, but died soon after—many thought by his own hand. HENRY DRISLER.

O'ria [anc. *Uria, Hyria*], town of Italy, province of Lecce, situated on an elevation between two lakes, about 20 miles from Brindisi. Here are cotton and other manufactories of some importance. The foundation of Oria is pre-historic. It was twice sacked and burnt by the Saracens (924–977); in the time of the Suabian Frederick II. it was a walled and fortified town; in the fifteenth century it was the chief place of refuge for Christians flying from Constantinople; later, having become a possession of the Borromeo family, St. Charles sold it for 40,000 ducats, which he distributed among the poor in a single day. It is a bishop's see. Pop. 7085.

Oria'ni (BARNABA), b. at Garegnano, near Milan, about 1750. His teacher in mathematics was Lagrange, to whom he succeeded as astronomer, and he continued the *Effemeridi Astronomiche,* which had been begun by his great master. He strove to perfect a map of the kingdom of Italy, and the observatory of Milan is largely indebted to him. Oriani was a man of very noble character, and he was complimented with various decorations and the membership of many learned societies. His principal publications are—*Lettera ad un Amico Astronomo,* etc.; *Lettere Astronomiche,* etc.: *Risposta alle Note che l'Abate Frisi fece,* etc.; *Obliquità dell'Eclittica dedotta dalle Osservazione solstiziali,* etc.: *Distanza dallo Zenit del Sole e delle Stelle fisse presso il Meridiano; Rifrazione osservata,* etc.: *Elementi di Trigonometria Sferoidica.* D. in Milan Dec., 1832.

Oriba'sius ['Ορειβάσιος], a Greek physician, b. at Pergamus (not at Sardis), according to Eunapius, who is the principal authority for his life, in the early part of the fourth century, A. D. He studied first at Pergamus, then at Alexandria under Zeno of Cyprus. He early acquired a high reputation, and was taken by Julian with him to Gaul as his physician (A. D. 355), and when Julian succeeded to the imperial throne (A. D. 361) he made Oribasius quæstor of Constantinople. Oribasius accompanied the emperor on his last fatal expedition against the Persians, and attended him on his deathbed. He was banished, with loss of property, by Julian's successors, but was afterward recalled with honor, and lived quietly to the end of the century; the exact date of his death is not known. We have from Oribasius three works; the largest and most important, which was composed at the request of and dedicated to Julian, is entitled Συναγωγαὶ Ἰατρικαί, and consists of selections from Galen and other medical writers, divided into 70 or 72 books. He also prepared an abridgment of this, entitled Σύνοψις, in 9 books, for his son, Eustathius; and a shorter condensation in 4 books, entitled Εὐπόριστα, addressed to his friend and biographer, Eunapius. Of the larger works considerable portions are lost or exist only in manuscript; the two abridgments have been published only in Latin translations. The best edition of the extant works of Oribasius is that of Bussemaker and Daremberg, with a French translation (Paris, 1851–60, 6 vols. 8vo). HENRY DRISLER.

O'riel Window [Late Lat. *oriolum,* an "opening," also a "chamber"], called also **Bow** (or **Bay**) **Window,** is a window which projects from the side of the house, and has three glazed sides. It is often divided by mullions.

O'rient, post-v. and tp., Aroostook co., Me. Pop. 219.

Orient, tp. of Osceola co., Mich. Pop. 54.

Orient, post-v. of Southold tp., Suffolk co., N. Y.

Orient (JOSEPH), b. at Burbach, Westphalia, in 1677; studied painting under Faistenberger, and was appointed vice-director of the imperial collection of pictures at Vienna, where he d. in 1737. He painted a great number of landscapes, which were much appreciated in his time, partly on account of a really effective rendering of nature, partly on account of an unusually brilliant and refined coloring. Several of his pictures were engraved by Leichsenring and Rosel, and became very popular, though they subsequently fell into neglect. (See Meusel, *Deutsche Künstler-Lexikon;* and Nayler, *Künstler-Lexikon.*)

Or'iflamme [Fr., from Lat. *auri flamma,* "golden flame"], the ancient battle-standard of France, once a banner belonging to abbey of St. Denys. After 1124, when it was adopted as a royal standard by Louis VI., it was often borne in battle, but seems never to have been employed after the battle of Agincourt in 1415. The accounts of its form and color differ considerably, but it was of flame-colored silk beautifully adorned.

Or'igen, surnamed ADAMANTIOS, which he received from his untiring energy, one of the most learned and spirited of the Christian Fathers, b. at Alexandria in 185; was early initiated both in Christianity by Clemens Alexandrinus and in Greek wisdom by his father, Leonides, who was a teacher of rhetoric. During the persecutions which took place in the reign of Severus, Leonides suffered martyrdom, and the son now undertook to maintain the family by opening a school, in which at first he simply taught the Greek language and literature, but soon also

began to expound the doctrines of Christianity with great success. He sold his library and subjected himself to the severest asceticism, at the same time pursuing his mental development with unflagging vigor. He made an exhaustive study of Greek philosophy, and became a pupil of Ammonius Saccas, and during a visit to Rome he made himself master of the Hebrew language. His school, which he still continued, prospered in spite of occasional disturbances by the pagans, and his fame increased. In 228, Demetrius, bishop of Alexandria, sent him to Greece to disperse some heresy which had lately arisen there. On his return he visited Palestine, was everywhere received with great attention and invited to preach, and at Cæsarea he was ordained a presbyter. This ordination Demetrius refused to recognize as valid, partly because it was not given by the bishop of that diocese to which Origen belonged, partly because he knew that Origen, misunderstanding the passage in Matt. xix. 12, had mutilated himself. Two synods held in Alexandria supported the bishop; and as the broad and liberal views which Origen held on many points, and the critical examination and allegorical explanation to which he subjected the Scriptures, had made him many enemies, the second synod even condemned several of his ideas as heretical, and excommunicated him. In the West, where his writings were very little known, the case attracted no attention, but the bishops of the East—of Syria, Palestine, and Arabia—declared for him, and he found refuge in Cæsarea, where he reopened his school with still greater success. During the persecutions under Maximinus he fled to Cappadocia, where he lived for two years. Under Gordianus he returned and continued his beneficial activity, but the sufferings and torture to which he was subjected during the Decian persecution broke his strength; he d. at Tyre in 254. Of his many writings (6000, it is said) only a few have come down to us. Of his *De Principiis* there exists only a free and perhaps even interpolated translation into Latin by Rufinus, edited by Redepenning (Leipsic, 1836) and by Schnitzer (Stuttgart, 1836). Of his *Hexapla*, an edition of the Old Testament in six parallel columns in Hebrew, Hebrew text in Greek letters, and in the four versions by Aquila, Symmachus, the Septuagint, and Theodotion, we have only fragments, edited by Montfaucon (2 vols. fol., Paris, 1713). The beautiful treatise on martyrdom and the celebrated eight books against Celsus, an apology for Christianity, are entire. Complete editions of what remains of his works have been given by De la Rue (4 vols. fol., Paris, 1733–59) and by Lommatzsch (25 vols., Berlin, 1831–48), and an English translation in "Clark's Library." (See Redepenning, *Origenes, eine Darstellung seines Lebens und seiner Lehre*, Bonn, 1841–46.)

Orig′inal Sin (*peccatum originale*) is that act or state of sin from which all other sins originate. It is distinguished into *original sin imputed*—*e. g.* the guilt of Adam's apostasy charged to his descendants (see IMPUTATION)—and *original sin inherent*—that innate subjective moral corruption which is inherited by all men at birth, and which is the immanent cause of all actual transgression. The term is taken in the latter sense in this article, the *peccatum habituale* as distinguished from the *peccatum actuale*. It is proposed to state in historical order the principal opinions which have been entertained, first, as to its *nature* and *extent*, and, second, as to the manner of its propagation.

I. *Its Nature and Extent.—Opinions prevalent* (A.) *before the Controversies of Augustine with Pelagius.*—There prevailed no definite and generally accepted views as to the nature and extent of the moral ruin wrought in human nature in consequence of Adam's sin. All agreed in the fact of a sinful taint, and of the need of redemption. The Eastern portion of the Church generally, and more particularly the Alexandrian school founded by Origen, in extreme reaction alike from Gnostic and from Neo-Platonic dualism, emphasized the self-determining power of the human will and man's responsibility, and consequently his ability to co-operate with any divine assistance vouchsafed for his recovery. On the other hand, the Latin Fathers, especially Tertullian, Hilary, and Ambrose, the immediate teacher of Augustine, emphasized hereditary sin and guilt, and the absolute dependence of the soul upon grace.

(B.) *The Opinions entertained by the several Parties to the Anthropological Controversies of the Fifth Century.*—(1) Pelagius and his party held that Adam's sin injured only himself; that men are now born in the same moral state in which they were created; that *liberum arbitrium*, the power to choose indifferently good or evil, is essential to moral responsibility in every stage of action, and an inalienable prerogative of human nature. Hence man is morally well. (2) The *Semi-Pelagians* held that human nature is seriously injured by Adam's sin, and that hereditary corruption is a fault or disease, rather than a sin properly so called, since it involves no guilt (either *reatus pœnæ* or *culpæ*) previous to actual transgression. Man can choose and attempt the good, but through weakness is unable to effect it. Hence they denied *gratia preveniens*, predisposing grace, but admitted the necessity of *gratia cooperans*, which is rendered efficient by the spontaneous co-operation of the human will. (3) Augustine taught that the apostasy of Adam, in whom all men sinned, is the common guilt of all his natural descendants, who, while retaining freedom in the sense of rational spontaneity, come into being spiritually dead, unable either to begin or to effect any really good act before God—free only to sin, and dependent for salvation upon unmerited, sovereign, omnipotent grace. Before regeneration the soul can only resist grace; afterwards, by the assistance of grace, it may co-operate with grace. Hence the necessity of *gratia preveniens*, disposing grace, *gratia operans*, regenerating grace, and *gratia co-operans*, grace assisting the regenerated to every holy act. (See G. F. Wiggers, *Hist. of Augustinianism and Pelagianism*, pt. i. and pt. ii. For the history of the condemnation of Pelagianism and the adoption of Augustinianism in the Roman Catholic Church, see ARMINIUS and CALVINISM.)

(C.) *The Tridentine Doctrine*, or the later Catholic doctrine formulated by the Council of Trent (1545–63). It is admitted that human nature bears the guilt of Adam's sin, is morally corrupted, and without grace helpless. It distinguishes, however, between the *dona naturalia*, the soul with its constitutional faculties, and the *dona supernaturalia*, the superadded gift of supernatural righteousness. In the original creation all Adam's faculties, physical, intellectual, and moral, were in perfect equilibrium, the lower held in due subordination to the higher. To confirm this equilibrium, God added the gift of original righteousness. This supplementary gift Adam lost for himself and his descendants, and this loss (1) involves guilt; (2) leaves the natural powers in a state of instable equilibrium, so that the free will certainly falls into actual transgression as soon as moral agency commences. Yet man may seek the grace offered in baptism, which effects justification *ex opere operato* in all non-resistants (*non ponentibus obicem*). "Original sin" in the Roman Church consists, therefore, in the loss of "original righteousness," which nevertheless involves "obliquity of will from God;" and yet free will must co-operate with grace. (See *Counc. of Trent*, sess. 6, 1, 3, 5, 7; Bellarmine, *Amiss.*, gr. iv. 3 and v. 17.)

(D.) *All the original Protestant Churches, Lutheran and Reformed*, agree, as to "original sin," that it includes (1) moral corruption of the whole man as well as the loss of "original righteousness." (2) This implies no physical change in the substance of the soul, but a depraved moral habit. (3) All the faculties, intellectual as well as emotional or volitional, as far as they relate to moral objects, are depraved. (4) This depravity, although admitting many civil virtues, is called total, because (1st) the whole man is involved; (2d) the breach with God is complete, and, without supernatural aid, irremediable; (3d) the tendency is ultimately to all sin. (5) This condition involves guilt (both of blame and punishment). Some say, because all sin is inherently blameworthy; others say, because it originated in Adam's abuse of free-will, for which we are all responsible. (6) Man is morally impotent to change his own general disposition to evil. Hence he cannot co-operate with grace before regeneration, but afterwards by the continued operation of grace the free will acts graciously. (See *Form of Concord* (Hase), pp. 639, 640, 645, 662, 681; *Gal. Conf.*, art. ii.; *Heidel. Cat.*, ques. 7–10; *West. Conf. Faith*, chs. 6, 9; *Thirty-nine Articles*, art. 9.)

(E.) *The Arminian Doctrine*, as held by the Dutch Remonstrants, regarded "original sin" rather as a fault or defect of nature than a sin. As held by the Wesleyans, it admits that man's nature is corrupted, indisposed, and disabled from all spiritual good. But both parties differ from the Lutheran and Reformed churches in holding (1) that it involves no guilt, since it is not brought upon us by our own agency; and (2) that every soul retains power to co-operate with the grace with which God for Christ's sake endows every soul. (*Conf. Remonstr.*, pp. 84 and 162; and Dr. D. D. Whedon in *Bib. Sacra*, Apr., 1862.)

(F.) *The Socinian and Rationalistic doctrine* is nearly the same with that of Pelagius, above stated. There is no innate corruption. Sin is propagated by example. Man always retains plenary power to do all God requires of him. There is no grace beyond providential advantages and objective instruction. (*Racov. Cat.*, p. 294 and ques. 428–430.)

II. *The Mode of its Propagation.*—(1) Origen taught the doctrine of the pre-existence of human souls, and their personal sin and *self*-corruption in a previous state of probation. This view, which denies the propagation of inherent

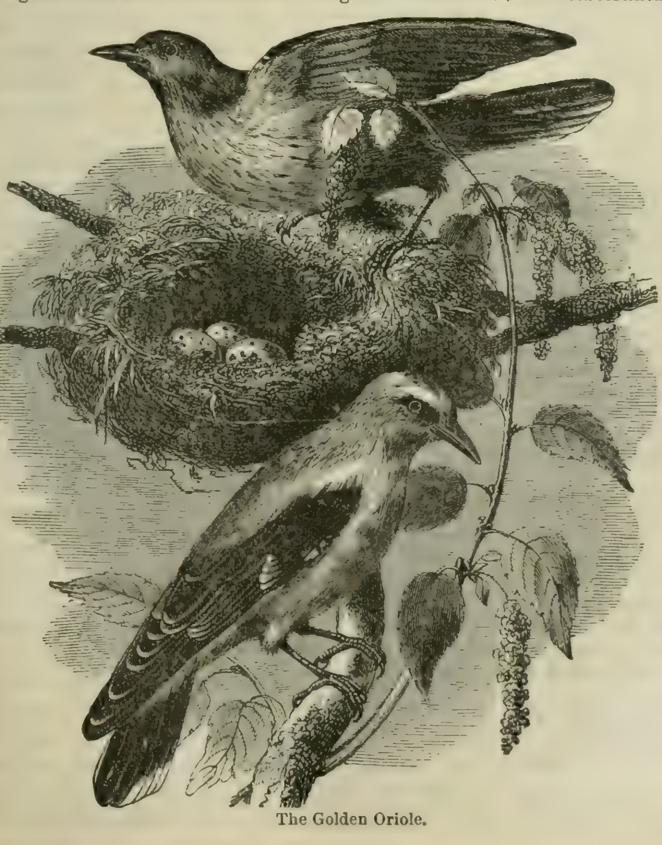
corruption from Adam altogether, has been revived in this age by Dr. Edward Beecher in his *Conflict of Ages.* (2) Tertullian taught the doctrine that souls as well as bodies are derived by generation from parents, and that sin, like every essential quality and many acquired accidents of nature, is propagated *ex traduce.* Augustine hesitated to decide between this origin of souls and their immediate creation. Many of the Greeks were creationists, and many of the Latins traducianists. Since the Reformation most of the Lutherans have been traducianists, and most of the Reformed creationists. (3) Jerome held that each soul was immediately created by God. Creationists account for inherent moral corruption either (*a*) *per corpus*—that is, from the union of the soul with a body in which sin is propagated by generation (*Lampe* (Utrecht, 1683–1729), tom. i., p. 572) or (*b*) *per culpam*—from the judicial withholding from the new created soul of the life-supporting influence of the Holy Ghost, as the punishment of Adam's first sin. (Dr. R. Ridgeley (Lon., 1667–1734); Turretine, L. ix. Ques. 12.) A. A. HODGE.

Orihue'la, town of Spain, province of Alicante, is on both sides of the Segura, in the middle of a most fertile plain. It has manufactures of hats, linen and silk fabrics, and paper, and many corn and oil mills. Pop. 9933.

Oril'lia, post-v. of Simcoe co., Ont., Canada, on Lake Couchiching, and on the Northern Railway, 90 miles from Toronto. It is the seat of a provincial lunatic asylum. The town is connected by steamboat with Lake Simcoe and the Muskoka country. It has a good trade, and 1 monthly and 2 weekly papers. Pop. 1322.

Orino'co, a river of South America, rises in lat. 3° 40′ N., in the Sierra Parime, flows first in a northern, and after its junction with the Apure in an eastern, direction, and enters the Atlantic in lat. 8° 40′ N., through a large delta. After its junction with the Apure, 777 miles from its mouth, it is navigable; above that point its navigation is made impossible by numerous rapids and cataracts. It receives 436 rivers and nearly 2000 streams, and at Bolivar, 250 miles from its mouth, it is 4 miles broad and 390 feet deep. Its waters rise from April to October, and attain their greatest height, from 30 to 36 feet, in July and August; large portions of the surrounding llanos are then overflowed. Of the cataracts of its upper course, those at Atures and Maypures are celebrated for their romantic beauty.

O'riole [Lat. *aureolus*], a name properly belonging to bright-colored Old-World birds of the genus *Oriolus* and the family Merulidæ; but in the U. S. the name is given to various brightly-colored birds of other families, especially to the Baltimore oriole. (See BALTIMORE BIRD.) The only European oriole is the *O. galbula*, or golden oriole.


The Golden Oriole.

Ori'on [Gr. Ὠρίων]. This well-known constellation is mentioned (Job ix. 9; xxxviii. 31) by the Hebrew word *cesil*, which signifies a "fool," and also an "impious, godless man," called by the Arabs "the giant." The giant of ancient astronomy was Nimrod, who was fabled to have been bound to the sky for his impiety. The Greek mythology in various ways represents him as a giant who was slain by Diana, who in remorse placed him among the stars. The constellation is represented by the figure of a man with a sword by his side. Though a southern constellation with regard to the ecliptic, the plane of the equator passes through its middle. It contains seven conspicuous stars; the three forming the belt are also called "Jacob's staff" and the "yard wand." One of the most remarkable nebulæ of the heavens is situated in the sword-handle of Orion.

Orion, post-tp. of Pike co., Ala. Pop. 1530.

Orion, tp. of Fulton co., Ill. Pop. 1082.

Orion, post-v. of Henry co., Ill., on the Peoria and Rock Island and the Rockford Rock Island and St. Louis R. Rs., 25 miles from Rock Island, has several churches and manufactories, 1 newspaper, and the usual stores. Grain is the chief article of trade. Pop. about 1500. FRANK SEATON, ED. "CHIEF."

Orion, post-v. and tp., Oakland co., Mich. Pop. of v. 304; of tp. 1151.

Orion, tp. of Olmsted co., Minn. Pop. 637.

Orion, post-v. and tp., Richland co., Wis. Pop. 697.

Oris'kany, post-v. of Whitestown tp., Oneida co., N. Y., near the mouth of the creek of the same name, on the Erie Canal and New York Central R. R. The battle of Oriskany was fought here Aug. 5, 1777. Pop. 584.

Oriskany Falls, post-v. in Augusta and Marshall tps., Oneida co., N. Y., on Oriskany Creek, has 1 weekly newspaper. Pop. 628.

Orista'no, town of Sardinia, province of Cagliari. It is situated in a well-cultivated region near the gulf of the same name, and is the residence of commercial agents of England, France, Germany, Sweden, and Norway. Of its solid old fortifications only two towers now remain, and the castle is converted into a prison. The Tirso sometimes becomes a furious torrent in winter and spring, and does great mischief to the town and neighborhood. The trade of Oristano, once comparatively flourishing, is now of little importance, owing to the lack of commercial facilities. In the fifteenth century this town was foremost in sustaining Sardinian independence. Pop. 6996.

Oriza'ba, town of Mexico, state of Vera Cruz, lies in a beautiful, forest-clad valley at the foot of the famous volcano of the same name. It has several good educational institutions, an extensive cotton-spinning factory, and other manufactures. Pop. about 20,000.

Ork'ney Islands, a group of 67 islands, of which 28 are inhabited, lie off the northern coast of Scotland, from which they are separated by Pentland Frith. They comprise an area of 244 square miles, with a population of 32,395. The largest is Pomona or the mainland; the most remarkable among the others are South Ronaldshay, Hoy, Flotta, Ronsay, and Sanda. With the exception of the Hoy, which is rocky and mountainous, its western coast reaching a height of 1600 feet, the Orkney Islands are low, presenting an irregular coast-line, in some places rocky, in others sandy. The climate is mild, considering the northern latitude; frosts are very rare, but the summers are often chilly, and always moist. Agriculture produces barley, oats, and potatoes, and sheep and cattle are extensively reared. Fishing, hunting for wild birds and eggs, rearing of poultry, and distilling are important occupations; 100,000 lobsters are annually shipped to the market of

London; 20,000 gallons of whisky are annually produced from the distilleries of Kirkwall, the capital. From the earliest times the Orkney Islands were often visited by the Norwegians, who in 876 conquered them, together with the Hebrides. During the tenth and eleventh centuries they were ruled by independent Scandinavian jarls, until in 1098 they were formally annexed to the Norwegian crown. In 1397 they were united to Denmark, and in 1468 the Danish king, Christian I., gave them to the Scotch king, James III., who married his daughter, as a security for her dowry. The dowry was never paid, and in 1590 the islands were formally turned over to Scotland. The value of exports amounted in 1861 to £181,483.

Or′land, post-v. and tp., Cook co., Ill. Pop. 1130.

Orland, post-v. of Steuben co., Ind.

Orland, post-v. and tp., Hancock co., Me., on the Penobscot River. Pop. 1701.

Orlando, post-v., cap. of Orange co., Fla.

Orléanais′, an ancient province of France, situated nearly in the centre of the country, bounded by the provinces of Ile de France, Champagne, Burgundy, Berry, Touraine, Maine, Perche, and Normandy, consisted of Orléanais proper, with the capital of Orléans; Beauce, comprising Pays Chartrain, Dunois, and Vendomois, with the capital of Chartres; Blaisois, with the capital of Blois; and Gatinais-Orléanais, with the capital of Montargis. Its territory constitutes the three departments of Loire-et-Cher, Eure-et-Loire, and Loiret, and parts of Indre, Indre-et-Loire, Nièvre, and Yonne.

Orléans′, city of France, capital of the department of Loiret, on the right bank of the Loire, which here is crossed by a magnificent bridge of nine arches. It has many fine promenades, handsome public squares, and elegant buildings, among which the cathedral is one of the most magnificent Gothic edifices of France; but generally the town is ill built. Its educational institutions, especially its medical schools, its museums, and its collections are excellent, and its sugar-refineries and manufactures of vinegar and woollen fabrics are very extensive. It contains three beautiful statues of Joan of Arc, the "Maid of Orleans." Pop. 48,976.

Or′leans, parish of Louisiana, extending N. and E. from the Mississippi River, and bounded N. by Lake Pontchartrain and S. E. by Lake Borgne. It is low and level, and mostly subject to overflow. The leading agricultural industry is gardening for the New Orleans market. The important manufacturing and commercial interests of the parish are described in the article NEW ORLEANS (which see). The parish is traversed by several railroads, centring at New Orleans, the capital. Pop. 191,418.

Orleans, county of W. New York, bounded N. by Lake Ontario. Area, 405 square miles. It is uneven and generally fertile. Agriculture is the leading industry. Livestock, grain, hay, wool, tobacco, dairy products, beans, potatoes, and fruit are extensively raised. Lumber, cooperage, lime, carriages, flour, etc. are leading articles of manufacture. Sandstone, hydraulic, and ordinary limestone, and salt springs are found at various points. The county is traversed by the Rochester and Niagara Falls R. R. and by the Erie Canal. Cap. Albion. Pop. 27,689.

Orleans, county of Vermont, bounded N. by Canada. Area, 700 square miles. It is hilly and in part mountainous, but is mostly a good farming region. Grain, wool, potatoes, and dairy products are the agricultural staples. Lumber, starch, carriages, are articles of manufacture. The county is traversed by the Connecticut and Passumpsic Rivers R. R. Cap. Irasburg. Pop. 21,035.

Orleans, post-v. and tp. of Humboldt co., Cal., on Klamath River, has 1 weekly newspaper and considerable mining interests. Pop. 173.

Orleans, post-v. and tp., Orange co., Ind., on the Louisville New Albany and Chicago R. R. Pop. of v. 905; of tp. 1865.

Orleans, post-v. of Washington tp., Appanoose co., Ia. Pop. 38.

Orleans, tp. of Winneshiek co., Ia. Pop. 674.

Orleans, post-v. and tp., Alleghany co., Md. Pop. 633.

Orleans, post-v. and tp., Barnstable co., Mass., on Nansett Harbor and Cape Cod division of Old Colony R. R. Pop. 1323.

Orleans, post-v. and tp., Ionia co., Mich, on the Detroit Lansing and Lake Michigan R. R. Pop. 1426.

Orleans, post-tp., cap. of Harlan co., Neb., has 1 weekly newspaper.

Orleans, tp. of Jefferson co., N. Y., on Lake Ontario, and on the Sodus Point and Southern R. R. Pop. 2445.

Orléans′, Duchy of, consisting of Orléanais proper, with the capital of Orleans, formed a countship under the Carlovingian and Capetian dynasties, but was erected into a duchy in 1344 by Philip VI. of the house of Valois, and given to his son as an appanage. Subsequently, it was held in the same way by different younger branches of the reigning families of Valois and Bourbon. Thus LOUIS, the second son of Charles V. of Valois, and for a time lieutenant-general of France during the insanity of his brother the king, Charles VII., received the duchy of Orleans in 1392 as a fief, and after his death, in 1407, his son CHARLES held it to 1465; but when, in 1498, his grandson, LOUIS, ascended the throne of France as Louis XII., it returned to the French crown. In 1626 it was bestowed on JEAN BAPTISTE GASTON, brother of Louis XIII., the youngest son of Henry IV. of the house of Bourbon, and famous in history for the unflagging steadfastness with which he formed one conspiracy after the other against Richelieu, and the cynical treachery with which he every time sacrificed his accomplices; he died in 1660, leaving no male heirs. But the most remarkable of the several families which have held the title and possessions of the duchy is that descending from the younger brother of Louis XIV., PHILIP, a son of Louis XIII., b. in 1640, married in 1661 to Henrietta of England, and after her death, in 1671, to Charlotte Elizabeth of Bavaria; d. in 1701. He fought with distinction in the Netherlands, but was deprived of his command by the jealousy of Louis XIV. He protested, but in vain, against the will of Charles II., which called the duke of Anjou to the Spanish throne. But the question of hereditary rights was finally settled by the Treaty of Utrecht, the duke of Orleans waiving all rights to succession to the throne of Spain, and the duke of Anjou (Philip V.) relinquishing all hereditary rights to the French succession. It is in virtue of these stipulations that after the count de Chambord (grandson of Charles X.) the count of Paris stands next in succession, to the exclusion of the Spanish line, to the regal rights of the Bourbon family. The second duke, PHILIP, known as the "Regent," son of the preceding (b. 1674), married in 1692 Mademoiselle de Blois, daughter of Louis XIV. and Madame de Maintenon. "Of all the race of Henry IV.," says Voltaire, "Philippe d'Orléans resembled him most. He had his valor, his kindness, his indulgence (Fr. *l'indulgence*), his gayety, his facility, his frankness, combined with a cultivated mind." A soldier of no ordinary ability, he commanded the armies of France in Italy and Spain. His defeat in Turin was due to the tutelage he was under, which overbore his own judgment. His campaigns in Spain of 1707 and 1708 were brilliant and successful. His reputation was tarnished, however, by alleged intrigues to gain for himself the throne of Spain. On the death of Louis XIV. he became sole regent during the minority of Louis XV., and his government showed several features to command respect. The Stuarts left France, the Jesuits lost their influence, the enormous standing army was dissolved, and the English alliance formed; against which are to be set off the "Law" financial schemes and the profligacies of his private life, which we may in charity partly impute to the corrupt morals of the times, the unhappy influences which surrounded him, and the tutelage of the infamous Cardinal Dubois. His great-grandson, LOUIS PHILIPPE JOSEPH, fifth duke of Orleans, but best known under the name of PHILIPPE ÉGALITÉ, was b. at St. Cloud Apr. 13, 1747, and married, in 1769, Adelaide of Bourbon-Penthièvre, a great-granddaughter of Louis XIV. and Madame de Montespan, who brought him immense wealth. Of a weak character, yet ambitious and craving popularity, he early imbibed the crude perversions of "liberty" and "equality" which the *doctrinaires* of the time falsely drew from American examples. An alienation grew up between him and the court, and to the queen, Marie Antoinette, he became an object of hatred almost, which he reciprocated; and he is charged with the instigation of the libels circulated against her. His exalted rank made him a nucleus for the opposition to the court and to the monarchy. At the famous "Séance royale" he resisted the king, declaring that to the States-General alone belonged the right of imposing taxes. Carried along by the swift current of events, he renounced his rank and titles, and assumed the designation of "Citizen Égalité." Too hesitating and weak to be really a leader in such a cataclysm, to be swept away by it was the inevitable dénouement. At the trial of Louis XIV., influenced by fear rather than by malice or envy, he gave his vote "*pour la morte*." His own fall was not thereby long delayed. "Suspect," as the phrase went, from the very facts of his life and his rank, he soon followed the king to the guillotine. His natural weakness of character, combined with the unnatural relation in which he placed himself, made him a puppet of the Jacobins. Only in his trial and on the scaffold did he by his

self-possession and coolness reassume the dignity of a prince of the house of Orleans. His grandson, FERDINAND, the eldest son of Louis Philippe, was b. at Palermo Sept. 3, 1810, and educated in Paris at the College of Henry IV. He distinguished himself greatly in Algeria, and his many noble qualities made him much beloved in France; but he was killed, July 13, 1842, by accident, his horses running wild. In 1837 he married Hélène Louise Elizabeth (b. Jan. 24, 1814), daughter of Prince Frederick Louis of Mecklenburg-Schwerin, who bore him two sons—Louis Philippe, count of Paris, Aug. 24, 1838, and Robert, duke of Chartres, Nov. 9, 1840. She died at Richmond, England, May 18, 1858. J. G. BARNARD.

Orleans, Maid of. See JOAN OF ARC.

Orloff', a Russian family, which became noted during the reign of Peter the Great, and rose to eminence by the revolution of July 9, 1762. There were five brothers, and Catharine II. made them all counts and gave them high offices, great honors, and rich dotations. The two most remarkable were GREGORI and ALEXEI. The former, b. in 1734, was the lover of Catharine, and from the son she bore him descend the Counts Bobrinski, a family still flourishing. He is said to have planned and conducted as the chief leader the whole revolution by which Peter III. was murdered and Catharine II. established on the throne; but his rudeness and violence subsequently alienated him from the empress. He was banished from the court, lived in exile at Tzarskoe Selo, travelled much, and d. insane at Moscow in 1783.—The latter, b. in 1737, is said to have strangled the emperor with his own hand, and became celebrated as commander of the Russian fleet in Archipelagus. At Tchesme he vanquished and destroyed the Turkish fleet, July 7, 1770, whence he received the surname of Tchesmenski. Under Paul he was banished from the court, and d. on his estate in 1808.—From a third brother, FEDOR, b. in 1741, d. in 1796, descend the present members of the family through his four illegitimate sons.—The most remarkable of these was ALEXEI, b. in 1787. He entered the army, served in the campaigns of the French war, became aide-de-camp to Alexander I., and distinguished himself greatly during the military insurrection at St. Petersburg Dec. 26, 1825. After that time Nicholas always showed great confidence in him, and he proved a very able diplomatist; he negotiated the treaties of Adrianople in 1829 and Unkiar-Skelessi in 1833. In 1844 he took charge of the secret police of Russia, and the ability he showed in this position was acknowledged by all. At the Congress of Paris in 1856 he represented Russia, and was made a prince. D. at St. Petersburg May 21, 1861.—The present head of the family is NIKOLAI, son of the preceding, b. in 1827, and since 1872 Russian ambassador in Paris.—There is another Russian family, the counts of Orloff-Denissoff, prominent among the Cossacks of the Don, and conspicuous in the military history of the country, but not related to the above-mentioned family.

Orme (ROBERT), F. S. A., b. at Anjenga, Travancore, India, Dec. 25, 1728, son of a physician in the service of the East India Company; educated at Harrow; went to Calcutta 1742; held various offices; settled in London 1760; appointed historiographer to the East India Company; published *A History of the Military Transactions of the British Nation in Indostan* (3 vols., 1763–78) and a volume of *Historical Fragments of the Mogul Empire* (1782), to the second edition of which (1805) a *Life* of the author was prefixed. D. at Ealing, near London, Jan. 13, 1801.

Orme (WILLIAM), b. at Falkirk, Scotland, in 1787; was minister of Congregational churches at Perth and Camberwell, and became foreign secretary of the London Missionary Society; author of *A Historical Sketch of the Translation and Circulation of the Scriptures* (Perth, 1815), *Memoir of John Owen, D. D.* (1820), and *Bibliotheca Biblica* (1824), with carefully prepared notices, biographical, critical, and bibliographical. D. at London in 1830.

Orme'a (*Ulmea, Ulmeta*), town of N. Italy, province of Cuneo, about 30 miles S. of Mondovì and 2200 feet above the sea. Its old walls are in ruins, and there are no public buildings of importance. This place was the subject of much contention among the feudal lords of N. Italy. Pop. 5308.

Ormerod (GEORGE), F. R. S., F. S. A., b. at Manchester, England, in 1785; educated at Brasenose College, Oxford; author of *The History of the County Palatine and City of Cheshire* (3 vols. folio, 1819), one of the most valuable of the English county histories; edited several volumes for the Chetham Society, and published several other works in the departments of archæology and heraldry. D. at Sedbury Park Oct. 9, 1873.

Ormolu' [Fr., "milled gold"], or **Mosaic Gold,** an alloy of zinc and copper, containing from 25 to 75 parts of zinc in 100 of the alloy, a considerable proportion of the zinc being volatilized, unless the lowest possible temperature be employed in fusing the metals. The fused mass is kept until it takes on a white color, when it is cast at once, for if remelted it becomes a comparatively worthless kind of brass. It is largely employed in making household ornaments, which are colored by pickling in dilute oil of vitriol and then washed and varnished. (See MOSAIC GOLD.)

Or'mond (JAMES **Butler**), FIRST DUKE OF, b. at London, England, Oct. 19, 1610; educated by Archbishop Abbot as a ward of the king; succeeded to the earldom of Ormond on the death of his grandfather 1632; was commander of the royal troops in Ireland as lieutenant-general during the insurrection of 1641; was created marquis 1642; was forced to make a disadvantageous armistice with the rebels 1643; became lord-lieutenant 1644; resigned his office to the Parliamentary commissioners, and retired to France 1647; proclaimed Charles II. in Ireland, and made an unsuccessful attempt to capture Dublin 1649; was driven from Ireland by Cromwell Dec., 1650; was created duke by Charles II. 1660; was viceroy of Ireland 1662–69; Chancellor of the University of Oxford 1669; narrowly escaped assassination by Col. Blood 1670; again viceroy of Ireland 1676–85, and made a duke in the English peerage 1682. D. at Kingston Hall, Dorsetshire, July 21, 1688.

Ormond (JOHN J.), an able lawyer of Tuscaloosa, Ala., was associate judge of the State supreme court in 1837–48, and was famed for the uprightness of his decisions; a liberal Whig in politics. D. at Tuscaloosa in 1865.

Orms'by, county of Nevada, extending E. from Lake Tahoe, on the California State line, to El Dorado Cañon. Area, 200 square miles. It is mountainous, with some fertile valleys. Lumbering is the chief industry, but gold and silver quartz-mining is also carried on. Carson City is the capital of the county and State. Pop. 3668.

Ormsby, post-b. of Allegheny co., Pa. Pop. 2225.

Orms'kirk, town of England, county of Lancaster, has some manufactures of silk and cotton, and rich collieries in the vicinity. Pop. 6426.

Or'mus, a small island 12 miles in circumference, lies in the Strait of Ormus, at the entrance of the Persian Gulf, and belongs to the sultan of Muscat. It is important now only on account of its salt-works, in which some 500 men are employed, but in the sixteenth and seventeenth centuries, when it belonged to the Portuguese, it had a large and wealthy city, the entrepôt of the European-Indian commerce, fortified and with 40,000 inhabitants. In 1622 the English helped the Persians to destroy the city.

Or'muzd [from the Zend *ahurô-mazdaô*, the "Spiritual, the Creator of all Things"], in the Zend, Magian, Guebre, or Parsee religion, is the supreme principle of good and the great enemy of Ahriman, the wicked one. In the Zoroastrian writings this name designates the absolute deity, who, according to that system of theology, included in one existence both the good and evil principles; but in later times, when the dualistic doctrine took on its later developments, the name Ormuzd was used to denote the principle of good, the friend of mankind, the enemy of impurity and wickedness.

Orne, department of France, part of the old province of Normandy, comprises an area of 2329 square miles, with 398,250 inhabitants. It is traversed by a range of wooded hills rising 1370 feet above the sea and rich in iron, copper, marble, and granite. To the north and south of these hills large pasture-grounds extend, where numerous cattle and horses are reared, the breed of horses enjoying the reputation of being the best in France. Hemp is extensively cultivated, and apples and pears for the fabrication of cider. Different kinds of manufactures, especially of metal-ware, are carried on. Of 44,919 children of school age, 8636 received no school education at all in 1857. Cap. Alençon.

Orne'ville, post-v. and tp., Piscataquis co., Me., on the Bangor and Piscataquis R. R. Pop. 575.

Ornithol'ogy [Gr. ὄρνις, "bird," and λόγος, "discourse"], that branch of zoology which treats of birds and the literature respecting them. The present article must be confined to an enumeration or account of some of the principal contributions to their classification; those alone which have essentially paved the way toward the systems now generally adopted can be noticed.

We look in vain in the ancient authors for any clear idea of the relations of the various groups of this class; birds are chiefly considered (*e. g.* by Aristotle) with relation to their food and the means by which they obtain it, or (*e. g.* by Belon and Aldrovandi) with respect to their adaptation for progression and their habitat. Willoughby,*

* *Ornithologiæ libri tres* (Londini, 1676)—a posthumous work edited by Ray.

and his commentator Ray,* first gave a reasonable arrangement of the constituents of the class, dividing it, primarily, into land and water birds; the former were then differentiated into those organized as birds of prey and those adapted for a less carnivorous or for a frugivorous diet; the latter were divided into waders and swimmers. The only feature of superiority in this system above previous attempts, however, was rather in an approach to a conception of the principles of classification than as an expression of morphological facts.

Linnæus † is celebrated as a systematist, and is looked up to as the father, to a great extent, of the modern methods; it is necessary, therefore, that his system should be alluded to. In the final edition of the *Systema Naturæ* (ed. 12, 1766) he divided the class into six orders—viz. (1) *Accipitres*, in which the bill is hooked and decurved; the upper mandible projecting beyond the lower, and on each side dilated or armed with teeth; and the feet provided with acute arched claws; (2) *Picæ*, in which the bill is cultriform and with the dorsal outline convex, and the feet short and quite strong; (3) *Anseres*, in which the bill is smooth, covered with an epidermis, and enlarged at the tip; the feet webbed, and with the tibiæ compressed and short; (4) *Grallæ*, in which the bill is subcylindrical, the feet elongated and adapted for wading, and the femora partially naked; (5) *Gallinæ*, whose species have the bill convex, the upper mandible arched above the lower, and the nostrils overarched by a cartilaginous membrane, the feet adapted for walking, and the toes rough beneath; and (6) *Passeres*, in which the bill is conical and pointed, and the feet slender, with the toes separated and adapted for hopping. It will be thus seen that these groups were based entirely on the consideration of the structure of the bill and feet, the other characters enumerated by Linnæus, but not here reproduced, relating to the body, food, and nesting habits, being quite subsidiary; but this classification was generally accepted, and the views involved therein prevailed with naturalists generally until very recent times, and even with the greater portion probably to-day. Cuvier ‡ in 1797 slightly modified the classification of Linnæus in its details, but the orders were essentially the same as those of his predecessor. Lacépède in 1799 divided the birds into two classes—differentiated because in the one case the leg is furnished with feathers, and in the other destitute of them. Fourteen orders were recognized. Meyer and Wolff § in 1810 primarily divided the birds into terrestrial and aquatic species; (*a*) the former into the orders (1) *Accipitres*; (2) *Coraces*; (3) *Picæ*; (4) *Oscines*, or singing birds; (5) *Chelidones*, including the swallows, swifts, and goatsuckers; (6) *Columbæ*, or the pigeons; and (7) *Gallinæ*; (*b*) the latter into the orders (8) *Grallæ*, or waders, and (9) *Natantes*, or swimming birds.

Illiger,‖ who attempted to reform the classification as well as nomenclature of the mammals and birds, presented an arrangement of the latter in which he grouped the various genera of birds into 41 families combined under 7 orders. The orders were distinguished, as by his predecessors, chiefly on account of the feet; the families by various characters, but more especially by the form of the bill and minor details of structure of the feet and wings. As the families were for the first time systematically introduced into this work, a synopsis of the system is worthy of reproduction:

ORDER I. Scansores, with families—1, Psittacini (parrots); 2, Serrati (toucans, plantain-eaters, etc.); 3, Amphiboli (cuckoos, etc.); 4, Sagittilingues (woodpeckers); 5, Syndactyli (jacamars).

ORDER II. Ambulatores, with families—6, Angulirostres (kingfishers, bee-eaters); 7, Suspensi (humming-birds); 8, Tenuirostres (sunbirds, hoopoes, etc.); 9, Pygarrhichi (creepers, Dendrocolaptes); 10, Gregarii (orioles, starlings, etc.); 11, Canori (song-birds); 12, Passerini (sparrows); 13, Dentirostres (motmots, hornbills); 14, Coraces (Corvidæ, birds of paradise, grakles, etc.); 15, Sericati (Ampelis, Procnias); 16, Hiantes (swallows, swifts, goatsuckers).

ORDER III. Raptatores, with families—17, Nocturni (owls); 18, Accipitrini (Falconidæ); 19, Vulturini (vultures).

ORDER IV. Rasores, with families—20, Gallinacei (fowls, etc.); 21, Epollicati (Ortygis, Syrrhaptes); 22, Columbini (pigeons); 23, Crypturi (tinamons); 24, Inepti (dodos).

ORDER V. Cursores, with families—25, Proceri (ostriches); 26, Campestres (bustards); 27, Littorales (shore-birds).

ORDER VI. Grallatores, with families—28, Vaginati (Chionis); 29, Alectorides (mixture); 30, Herodii (cranes, etc.); 31, Falcati (Tantalidæ); 32, Limicolæ (Scolopacidæ, etc.); 33, Macrodactyli (jacanas, rails); 34, Lobipedes (lobe-footed birds); 35, Hygrobatæ (incongruous mixture).

ORDER VII. Natatores, with families—36, Longipennes (Laridæ); 37, Tubinares (Procellariidæ); 38, Lamellosodentati (Anatidæ); 39, Steganopodes (swimmers with four anterior toes); 40, Pygopodes (swimmers with legs far back); 41, Impennes (penguins).

Many of the families thus introduced are more unnatural even than the explanatory examples would indicate. The classification, however, is worthy of remembrance, as being the first comprehensive recognition of the necessity of a more rigorous subordination of groups than had been previously admitted.

In 1812 a German zoologist, Blasius Merrem,¶ proposed a new arrangement, which was destined to be ignored by his contemporaries, but, in its primary features at least, after being almost dormant for half a century, to be revived and quite generally accepted. Instead of differentiating the class into orders distinguished by differences of bill, wings, and feet, he took the sternum as the essential feature, and divided the class primarily into two groups—(1) Aves carinatæ, in which the sternum was produced at the median line and provided with a keel; and (2) Aves ratitæ, in which the sternum was flat toward the middle and entirely destitute of a keel. The former (1) included all the ordinary birds, which were further differentiated into aërial birds (Aves aëreæ), including the Raptores, Pici, and Passeres; terrestrial birds (Aves terrestriæ), embracing the gallinaceous forms; water-birds (Aves aquaticæ), represented by the swimming types; and marsh-birds (Aves palustres), corresponding with the waders of other authors. The latter division (2) was limited to the ostriches, nandus, cassowaries, emus, and kiwis. The only really important modification introduced into the classification was the distinction of the two primary groups.

In 1815, Temminck ** proposed a classification which he subsequently modified, and which, as thus developed, for a time his reputation as a learned ornithologist made somewhat popular. He distinguished in the class at first thirteen, and later, when he embraced the extra-European types, sixteen orders, viz.:

1. Rapaces.	9. Pigeons.
2. Omnivores.	10. Gallinacés.
3. Insectivores.	11. Alectorides.
4. Granivores.	12. Coureurs.
5. Zygodactyles.	13. Gralles.
6. Anisodactyles.	14. Pinnatipèdes.
7. Alcyons.	15. Palmipèdes.
8. Chelidons.	16. Inertes.

This cannot be considered as an improvement on the systems of Temminck's predecessors.

In 1816, De Blainville †† proposed a new arrangement; the class was named Pennifères, and divided into 9 orders, commencing with the parrots—viz.: (1) les Préhenseurs (*Prehensores*) or parrots; (2) les Ravisseurs (*Raptores*) or birds of prey; (3) les Grimpeurs (*Scansores*); (4) les Sauteurs ou Passereaux (*Saltatores*); (5) les Pigeons (*Giratores*); (6) les Marcheurs ou Gallinacés (*Gradatores*); 7 les Autruches (*Cursores*); (8) les Echassiers (*Grallatores*); and (9) les Palmipèdes (*Natatores*). There is nothing specially noteworthy in this save the recognition of the ordinal values of the groups Prehensores and Cursores, and the application of the latter name for the Ratitæ of Merrem.

Mr. N. A. Vigors in 1823 read a memoir before the Linnæan Society of London ‡‡ on the classification of the class, which deserves special mention, less because of any improvements in classification than because in it was for the first time given a uniform nomenclature of families ending in *-idæ*. Vigors applied the fanciful quinarian system introduced by MacLeay to the arrangement of the birds, and divided the class into five orders—two (Raptores and Insessores), "endowed with feet formed for grasping," and three (Rasores, Grallatores, and Natatores), "endowed with feet incapable of grasping." These were subdivided into families, and in one case (Passeres) into 5 tribes. The leading groups are as follows:

ORD. I. Raptores, with the families—(1) Vulturidæ, (2) Falconidæ, (3) Strigidæ, (4) unknown, and (5) Gypogeranidæ.

* *Synopsis Methodica Avium et Piscium* (Londini, 1713).
† *Systema Naturæ.*
‡ *Tableau élémentaire de l'Histoire naturelle des Animaux* (Paris, 1797).
§ *Taschenbuch der deutschen Vogelkunde* (Frankfurt-am-Main, 1810).
‖ *Caroli Illigeri Prodromus Systematis Mammalium et Avium* (Berolini, 1811).
¶ *Tentamen Systematis Naturalis Avium* (in Abhandl. K. Pr. Akad. Wissensch., 1812).
** *Manuel d'Ornithologie, ou Tableau systématique des Oiseaux qui se trouvent en Europe* (Amsterdam et Paris, 1815).
†† *Prodrome d'une Nouvelle Distribution méthodique du Règne animal*, in *Bull. Soc. Philomatique de Paris* (1816).
‡‡ *Observations on the Natural Affinities that connect the Orders and Families of Birds*, in *Trans. Linn. Soc. London* (vol. xiv. pp. 395–517, 1825).

ORD. II. Insessores, with 5 tribes (1–2 of normal group; 3–5 of aberrant group) and 25 families—viz.:

(1) Dentirostres, with the families of normal group Laniadæ, Merulidæ; of aberrant group Sylviadæ, Pipridæ, Muscicapidæ.

(2) Conirostres, with the families of normal group Sturnidæ, Corvidæ; of aberrant group Buceridæ, Loxiadæ, Fringillidæ.

(3) Scansores, with the families of normal group Psittacidæ, Picidæ; of aberrant group Certhiadæ, Cuculidæ, Ramphastidæ.

(4) Tenuirostres, with the families of normal group Cinnyridæ, Trochilidæ; of aberrant group Promeropidæ? Meliphagidæ? Nectariniadæ?

(5) Fissirostres, with the families of normal group Hirundinidæ, Caprimulgidæ; of "typical group" Todidæ, Halcyonidæ, and Meropidæ.

ORD. III. Rasores, with the families of normal group Phasianidæ, Tetraonidæ; of aberrant group Struthionidæ, Cracidæ, Columbidæ.

ORD. IV. Grallatores, with families of normal group Ardeidæ, Scolopacidæ; of aberrant group Rallidæ, Charadriadæ, Gruidæ.

ORD. V. Natatores, with families of normal group Colymbidæ, Alcadæ; of aberrant group Pelecanidæ, Laridæ, Anatidæ.

Mr. Vigors thus groups the families into normal and aberrant, in pursuance of the views of Mr. M. S. MacLeay; for it is, says he, "certainly a more scientific mode of exhibiting the series of affinities" (op. cit. p. 426); but he preferred "to view it with more perfect or typical form in the centre," "and with its less perfect forms on each side." In this way the last of the "scientific" mode became always the first of the "convenient" mode, the sequence being otherwise the same, save that it was unbroken in the latter. The arrangement, it will be seen, practically starts with the assumption that all the types, down to families at least, were known, and consequently no provision or room was made for the extinct types that were to be afterward discovered. In other respects, too, whatever may be the "philosophical" value of the scheme, it is a most inapt expression of the morphological facts of avine structure, the only true basis for scientific classification.

In 1826, Sundevall,* an eminent Swedish naturalist, introduced an entirely new idea in his proposed arrangement of the class. Recalling that some species when hatched were almost featherless, blind, and incapable of taking care of themselves, while others were covered with down or feathers, fully endowed with sight, and able to run about at once, he proposed to consider these characteristics as of primary importance in the determination of the relations of species, and therefore divided the class into two legions: (1) Altrices, including those whose young were callow and incapable of taking care of themselves; and (2) Præcoces, comprising those competent of caring for themselves. In outline his classification is as follows:

SECTION ALTRICES.
- Legion Volucres.
  - Ord. 1, Passeres (Fringillidæ).
  - " 2, Oscines.
- Legion Gressores.
  - Ord. 1, Macrochires (Cypselidæ, Trochilidæ).
  - " 2, Pici (Picidæ).
  - " 3, Psittaci.
  - " 4, Coccyges (Rhamphastidæ, Bucconidæ, Cuculidæ, Galbulidæ, Alcedinidæ, Meropidæ, Bucerotidæ, Trogonidæ, Caprimulgidæ, etc.).
  - " 5, Accipitres.
  - " 6, Pullastræ (including Cracidæ, Menuridæ, Musophagidæ, and Columbidæ).

SECTION PRÆCOCES.
- Legion Cursores.
  - Ord. 1, Gallinæ.
  - " 2, Struthiones.
  - " 3, Alectorides.
  - " 4, Grallæ.
- Legion Natatores.
  - Ord. 1, Gaviæ (= Longipennes).
  - " 2, Steganopodes (= Totipalmes).
  - " 3, Anseres (= Lamellirostres).
  - " 4, Urinatores (= Colymbidæ).

These divisions of *Altrices* and *Præcoces*, based on the physiology of the newly-hatched young, were quickly adopted by several authors. Bonaparte especially, in one of his numerous new classifications (that published in 1853†), adopted the divisions in question, and ranked the several orders of birds in parallel columns under the heads *Altrices* and *Præcoces*, considering that the orders of the one group or sub-class were, to a certain extent, represented by those of the other. Inasmuch as this is the most perfected form of the arrangement, and will give a very good idea of the relations of altricism and præcocism to structure, the classification is reproduced in the following paragraph:

AVES.

ALTRICES.	PRÆCOCES.
1, Psittaci.	
1, Americani; 2, Orbis antiqui.	
2, Accipitres.	
3, Passeres.	
1, Oscines; 2, Volucres.	
1, Zygodactyli; 2, Anisodactyli.	
4, Columbæ.	
1, Inepti.	7, Struthiones.
2, Gyrantes,	8, Gallinæ.
	1, Passeripedes; 2, Grallipedes.
5, Herodiones.	9, Grallæ.
	1, Cursores; 2, Alectorides.
6, Gaviæ.	10, Anseres.
1, Totipalmi; 2, Longipennes.	1, Lamellirostres; 2, Urinatores; 3, Ptilopteri.

In 1867 ‡, Prof. Thomas Henry Huxley made known a new system of classification of birds, which excited great interest, and has had a very decided influence on the recent progress of ornithology, as much by the spirit infused into the mode of investigation as by the innovations that were proposed. The author, like Merrem and Blanchard, recognized as the primary divisions of the class the *Carinatæ* and *Ratitæ*, and these, like Blanchard, he dignified as the only existing orders, degrading the subordinate groups, equivalent in rank at least to many of those which had been called orders by others, to inferior rank. Four secondary groups were distinguished among the Carinatæ, more especially by the condition of the vomer and its relation to the neighboring bones. Tertiary groups were combinations of families or peculiar isolated families, characterized by osteological and other characters of moment. This classification had the merit of being the first expression, in a rigorous systematic form, of combinations of anatomical facts, and first gave due weight to aggregates of osteological and other anatomical features characteristic of the several groups of birds. But the secondary groups of Carinatæ or sub-orders distinguished by the condition of the vomer seem scarcely to warrant the value assigned to them; indeed, the question of the natural combination of the families, or at least of super-families, into more comprehensive groups, and the determination of their exact relations, is a problem that is yet far from being solved. The following synopsis, modified from Prof. Huxley's *Manual of the Anatomy of Vertebrated Animals*, is an exhibit of the chief features of this classification:

I. ORDER SAURURÆ. The metacarpals not ankylosed together. The tail longer than the body.

1, Archæopterygidæ (extinct).

II. ORDER RATITÆ. The metacarpals ankylosed together. The tail considerably shorter than the body. The sternum devoid of a keel.

a. The wing with a rudimentary, or very short, humerus, and with not more than one ungual phalanx.
- 2, Apterygidæ (the kiwis).
- 3, Dinornithidæ (the moas).
- 4, Casuaridæ (the cassowaries).

b. The wing with a long humerus and with two ungual phalanges.
- 5, Rheidæ (the nandus).
- 6, Struthionidæ (the ostriches).

III. ORDER CARINATÆ. The metacarpals ankylosed together. The tail considerably shorter than the body. The sternum provided with a keel.

a. The vomer broad behind, and interposing between the pterygoids, the palatines, and the basisphenoidal rostrum.

[I. SUB-ORDER] DROMÆOGNATHÆ.

7, Tinamomorphæ (the tinamons).

b. The vomer narrow behind; the pterygoids and palatines articulating largely with the basisphenoidal rostrum.

* *Ornithologiskt System af C. J. Sundevall*, in *K. Vetenskaft Academiens Handlingar för ar 1835, 1836.*

† *Comptes Rendus.*

‡ *On the Classification of Birds; and on the Taxonomic Value of the Modifications of certain of the Cranial Bones observable in that Class*, in *Proc. Zool. Soc. London* for 1867, pp. 415–472.

a. The maxillo-palatines free.
i. The vomer pointed in front.
[II. Sub-order] Schizognathæ.
8, Charadriomorphæ (plovers, etc.).
9, Cecomorphæ (gulls, petrels, divers, and auks).
10, Sphenisc omorphæ (penguins).
11, Geranomorphæ (cranes).
12, Turnicimorphæ (hemipods).
13, Alectoromorphæ (fowls).
14, Pteroclomorphæ (sand-grouse).
15, Peristeromorphæ (pigeons).
16, Heteromorphæ (hoazin).
ii. The vomer truncated in front.
[III. Sub-order] Ægithognathæ.
17, Coracomorphæ (passerines).
18, Cypselomorphæ (humming-birds, swifts, and goatsuckers).
19, Celeomorphæ (woodpeckers).
β. The maxillo-palatines united.
[IV. Sub-order] Desmognathæ.
20, Ætomorphæ (birds of prey).
21, Psittacomorphæ (parrots).
22, Coccygomorphæ (colies, plantain-eaters, cuckoos, barbets, toucans, capitonidæ, galbulidæ, kingfishers, hornbills, hoopoes, bee-eaters, motmots, coraciidæ, and trogons).
23, Chenomorphæ (anatidæ, palamedeidæ).
24, Amphimorphæ (flamingoes).
25, Pelargomorphæ (storks, ardeidæ, plataleidæ, etc.).
26, Dysporomorphæ (cormorants, pelicans, tropic-birds, darters).

In 1873 and 1874, Mr. A. H. Garrod* based a classification of birds upon the consideration of the muscles of the thigh. Among the more important of these, from a taxonomic point of view, were considered to be the femoro-caudal, the accessory femoro-caudal, the semitendinosus, and the accessory semitendinosus. But most important of all is the ambiens muscle; this arises from the tip of the short anteriorly directed spine, which is situated just above the anterior border of the acetabulum, and runs along the inner side of the thigh to the inner side of the knee, where it is covered by the sartorius, which is above it in the former part of its course. Its thin tendon then crosses the knee, running in the substance of the fascial extensor tendon, just in front of the patella, to the outer side, where it joins the fibres of the origin of the flexor perforatus digitorum. The presence or absence of this muscle determined Mr. Garrod to differentiate the class into two sub-classes. Those forms in which it is present were designated Homologonatæ, or typical kneed; while those in which it is absent were combined as Anomalogonatæ, or abnormally kneed. "There are," said Mr. Garrod, "peculiarities in the arrangement of the cæca of the intestine and of the tuft of feathers on the oil-gland which are correlatable with this presence or absence of the ambiens muscle." The secondary and tertiary groups of these sub-classes were distinguished by the combinations of the muscles already alluded to, and the presence or absence of cæca to the intestine, the development of a tufted or nude oil-gland, and the combinations in which those characters occur; and further, in the homologonatous birds, by the development of either a left or right carotid, or of both. The characters thus appreciated were generalized in the classification herewith exhibited. In this the femoral-caudal muscle is represented by the letter A, the accessory femoro-caudal by B, the semitendinosus by X, and the accessory semitendinosus by Y; the homologonatous families with an asterisk (*) affixed do not possess an ambiens muscle at all; of those with a dagger (†) only a few genera want it.

CLASS AVES.

Sub-Class Homologonatæ.
Order I. Gralliformes.
Cohort (*α*) Struthiones.
Family 1, Struthionidæ. B X Y.
Sub-family 1, Struthioninæ.
" 2, Rheinæ.
Family 2, Casuariidæ (*). B X Y, A B X Y.
" 3, Apterygidæ. A B X Y.
" 4, Tinamidæ. A B X Y.
Cohort (*β*), Gallinaceæ.
Family 1, Palamedeidæ. A B X Y.
" 2, Gallinæ. A B X Y or B X Y.
" 3, Rallidæ. A B X Y.
" 4, Otididæ. B X Y.
Sub-family 1, Otidinæ.
Sub-family 2, Phœnicopterinæ.
Family 5, Musophagidæ. A B X Y.
" 6, Cuculidæ.
Sub-family 1, Centropodinæ. A B X Y.
" 2, Cuculinæ. A X Y.
Cohort (*γ*) Psittaci (†). A X Y.
Order II. Anseriformes.
Cohort (*α*) Anseres.
Family 1, Anatidæ. A B X.
" 2, Spheniscidæ. A B X.
" 3, Colymbidæ. A B X.
" 4, Podicipididæ (*). B X.
Cohort (*β*) Nasutæ.
Family 1, Procellariidæ (†). A B X Y.
" 2, Fulmaridæ.
Sub-family 1, Fulmarinæ. A B X.
" 2, Bulweriinæ. A X.
Order III. Ciconiiformes.
Cohort (*α*) Pelargi. A X Y.
" (*β*) Cathartidæ. A X Y.
" (*γ*) Herodiones (*). A X Y or X Y.
" (*δ*) Steganopodes.
Family 1, Phaethontidæ. A X Y.
" 2, Pelecanidæ.
" 3, Phalacrocoracidæ. A X.
" 4, Fregatidæ. A.
Cohort (*ε*) Accipitres. A.
Family 1, Falconidæ.
" 2, Strigidæ (*).
Order IV. Charadriiformes.
Cohort (*α*) Columbæ (†). A B X Y (A X Y).
Family 1, Columbidæ.
" 2, Pteroclidæ.
Cohort (*β*) Limicolæ.
Family 1, Charadriidæ. A B X Y and A X Y.
" 2, Gruidæ. A B X Y.
" 3, Laridæ. A X Y.
" 4, Alcidæ (*). A B X.
Sub-class Anomalogonatæ.
Order I. Piciformes.
Family 1, Picariæ. A X Y.
Sub-family 1, Picidæ.
" 2, Ramphastidæ.
" 3, Capitonidæ.
Family 2, Upupidæ. A X Y.
" 3, Bucerotidæ. A X Y.
" 4, Alcedinidæ. A X.
Order II. Passeriformes.
Family 1, Passeres. A X Y (A X).
" 2, Bucconidæ.
" 3, Trogonidæ. A X.
" 4, Meropidæ. A X Y.
" 5, Galbulidæ. A X Y, or A X.
" 6, Caprimulgidæ. A X Y.
" 7, Steatornithidæ. X Y.
" 8, Coraciidæ. A X Y.
Sub-family 1, Coraciinæ.
" 2, Momotinæ.
" 3, Todinæ (?).
Order III. Cypseliformes.
Family Macrochires. A.
Sub-family 1, Cypselinæ.
" 2, Trochilinæ.

The chief and apparently only merit of this arrangement is the generalized information respecting the muscles in question therein conveyed. The exceptions noted above suggest the inadequacy of the combinations in question to serve as the expressions of the natural affinities of the various forms. Combined with other information, it will be of use in the construction of a more perfect system.

The most useful books for the student in general ornithology are the *Genera of Birds: comprising their Generic Characters, a Notice of the Habits of each Genus, and an Extensive List of Species referred to their several Genera*, by George Robert Gray; illustrated by David William Mitchell, in 3 vols. (London, 1844–49, 4to); *Conspectus Generum Avium*, auctore Carolo Luciano Bonaparte (Lugduni Batavorum, 1850, 2 vols. 8vo); *The Hand-list of Genera and Species of Birds, distinguishing those contained in the British Museum*, by George Robert Gray (London, 1869–71, 3 vols. 8vo); and *The Catalogue of the Birds in the British Museum*, of which two have been published—viz. *Catalogue of the Accipitres, or Diurnal Birds of Prey*, and *Catalogue of the Striges*, by R. Bowdler Sharpe (London, 1874 and 1875). There cannot be said to be any good manual expressive of the present condition of scientific ornithology. The works of Rev. J. G. Wood, Brehm, etc. are rather anecdotal than reliable for scientific information. The best epitome of facts respecting the structure of birds may be found in Huxley's *Manual of the Anatomy of Vertebrated Animals* (London, 1872).

* *On Certain Muscles of Birds, and their Value in Classification.* Part II. By A. H. Garrod, B. A. *Proc. Zool. Soc. London* (1874, pp. 111–123).

The birds of the various countries have each their special historians. The most celebrated and reliable of those of North America are L. P. Vieillot (*Histoire naturelle des Oiseaux de l'Amérique septentrionale; contenant un grand nombre d'espèces décrites ou figurées pour la première fois*, Paris, 1807); Alexander Wilson (*American Ornithology, or the Natural History of the Birds of the United States*, Philadelphia, 1828), and his continuator, Charles L. Bonaparte (*American Ornithology, or the Natural History of Birds inhabiting the United States not given by Al. Wilson*); J. J. Audubon (*The Birds of America, from Drawings made in the United States and their Territories*, illustrated by 500 finely-colored drawings, New York, 1828–30); Spencer F. Baird (*Reports of Explorations and Surveys to ascertain the most Practicable and Economical Route for a Railway from the Mississippi to the Pacific Ocean*, vol. x., by S. F. Baird); S. F. Baird, T. M. Brewer, and Robert Ridgway (*A History of North American Birds*, Boston, 1874, 4to); and Elliot Coues (*Key to North American Birds*, Salem, 1874).

The ornithological faunas of South American countries have been less studied; the chief works are on Brazilian birds, by C. H. Burmeister (*Systematische Uebersicht der Thiere Brasiliens*, Berlin, 1855–56, 8vo), and J. T. Descourtilz (*Ornithologie brésilienne, ou l'Histoire des Oiseaux du Brésil remarquables par leur Plumage, leur Chant et leurs Habitudes*, Rio Janeiro, 1854–56, fol.); also noteworthy are those of Felix de Azara (*Apuntamientos para la Historia natural de los Paxaros del Paraguay y Rio de la Plata*, Madrid, 1803, 4to) and Des Murs (in *Historia fisica y politica de Chile*, by Claudio Gay, *Zoologia*, vol. i., Paris, 1847, 8vo).

The species of Europe have had many historians; the most notable perhaps are C. D. Degland and Z. Gerbe's *Ornithologie européene, ou Catalogue descriptif, analytique et raisonné des Oiseaux observés en Europe* (Paris, 1st ed. 1849; 2d ed. 1867); John Gould's *Birds of Europe* (London), a luxurious work in elephant folio; and, lastly, *A History of the Birds of Europe, etc.*, at first by R. B. Sharpe and H. E. Dresser, and later by Dresser alone, now in course of publication. The fauna of each country, too, has been especially elucidated, generally by numerous naturalists; the most celebrated of those relating to Great Britain are P. J. Selby's *Illustrations of British Ornithology* (Edinburgh, 1821–34); William Macgillivray's *History of British Birds, indigenous and migratory, including their Organization, Habits, and Relations; Remarks on Classification and Nomenclature; an Account of the Principal Organs of Birds, and Observations relative to Practical Ornithology* (London, 1839–41); John Gould's *The Birds of Great Britain* (London, 1850–68); and *A History of British Birds*, of which a 1st ed. was issued by William Yarrell in 1839–42, and a 3d ed. is now in course of publication under the auspices of Alfred Newton.

The avifauna of Africa has also had a number of iconographic monographers. The oldest, and formerly much esteemed, is François Levaillant's *Histoire naturelle des Oiseaux d'Afrique* (Paris, 1799–1805). Among the later and more reliable works are those of G. Hartlaub (*System der Ornithologie Westafrikas*, Bremen, 1857); M. T. von Heuglin (*Ornithologie Nordost-Afrika's, der Nilquellen und Küsten-Gebietedes Rothen Meeres und des nördlichen Somali-Landes*, Erster Band, Erste Abtheilung, Cassel, 1869); O. Finsch and G. Hartlaub (*Baron C. C. von der Decken's Reisen in Ost-Afrika, Vierter Band, Die Vögel Ost-Afrika's*, Leipsic and Heidelberg, 1870); and Edgar Leopold Layard (*The Birds of South Africa, a Descriptive Catalogue of all the Known Species occurring South of the 28th Parallel of South Latitude*, Cape Town and London, 1867).

For the avifauna of Asia the most magnificent work is one by John Gould, entitled *The Birds of Asia* (London, 1850–69), in elephant folio.

On the ornithology of Australia several fine works have also been contributed; the most luxurious is by John Gould (*The Birds of Australia*, London, 1848). A noteworthy one has more recently been published by Sylvester Diggles (*The Ornithology of Australia*, Brisbane, Queensland, 1868).

The birds of Polynesia have been monographed by O. Finsch and G. Hartlaub (*Beiträg zur Fauna Centralpolynesiens. Ornithologie der Viti-, Samoa- und Tonga-Inseln*, Halle, 1867).

Numerous monographs, many of which are beautifully illustrated with life-size figures of all the species and printed in large elephant folio form, have been published on various families and other groups of the class. Aside from the earlier works of the kind by Vaillant, Desmarest, Vieillot, etc., the most notable of those by recent authors are by John Gould, *A Monograph of the Trogonidæ, or Trogons* (London, 1838); *A Monograph of the Odontophorinæ, or Partridges of America* (London, 1850); *A Monograph of the Rhamphastidæ, or Family of Toucans* (London, 1854); *A Monograph of the Trochilidæ, or Humming-birds* (London, 1861, 5 vols.); Alfred Malherbe, *Monographie des Picidées, ou Histoire naturelle des Picidés, Picamnés, Tuncinés ou Torcols* (Metz, 1861, 4 vols.); Daniel Giraud Elliot, *A Monograph of the Pittidæ* (New York, 1861); *A Monograph of the Tetraoninæ, or Family of the Grouse* (New York, 1864–65); *A Monograph of the Phasianidæ, or Family of Pheasants* (London, 1870–72), and *A Monograph of the Paradisiidæ, or Birds of Paradise* (London, 1873); C. H. T. and G. F. L. Marshall, *A Monograph of the Capitonidæ, or Scansorial Barbets* (London, 1871); and R. B. Sharpe, *A Monograph of the Alcedinidæ, or Kingfishers* (London, 1871).

It may be well to remark, in conclusion, that some of the folio monographs of birds above enumerated are rather to be admired for the beauty and often the aptness of the illustrations than for the scientific merit of the text: in truth, the most scientific and ablest of ornithologists are not those who have published the large folios. Ornithologists, however, are so numerous that it is difficult to select. Suffice it to observe that among the most active at the present time in America are J. A. Allen, Elliot Coues, and Robert Ridgway; in England, Alfred Newton, Osbert Salvin, P. L. Sclater, and R. Bowdler Sharpe; in Germany, O. Finsch and A. von Pelzeln; and in the Netherlands, H. Schlegel. These, however, are only a few of the innumerable writers that are engaged in various departments of ornithology. THEODORE GILL.

Ornithorhynch'idæ [from ὄρνις, ὄρνιθος, "bird," and ῥύγχος, "beak"], one of the two families representing the order Monotremata and sub-class Ornithodelphia, and including the "water-mole" of Australia. The general form of the body is somewhat beaver-like; the covering is a dense and soft fur; the jaws are produced into a depressed bill-like snout resembling somewhat (but only superficially) the bill of a duck; the nostrils are above and near the end of the bill; no external ears are developed; there are eight horny teeth—*i. e.* each jaw is provided on each side behind with a broad and nearly oval tooth with a flattened crown adapted for grinding, and toward the front it has a long and narrow one; the tongue is short, and covered, to some extent, with horny papillæ; the legs are short; the feet well adapted for swimming, and each provided with five toes; the anterior ones have a web extending considerably beyond the toes, and the claws are depressed; the posterior feet have webs only between the toes, and the claws are curved; in the male a spur is developed on the hinder surface of each hind leg, which has no representative in the female; the tail is rather short, depressed, and quite broad. These are the characters which at once superficially distinguish the Ornithorhynchidæ from the Tachyglossidæ, but in addition to these are numerous anatomical characters. The family is peculiar to Australia, and is represented by but a single genus containing but one certainly known species, which, however, exhibits differences which have caused a distinction, by some authors, of two species. The species was first made known in 1799 by Shaw, under the name of *Platypus anatinus*, and in the following year by Blumenbach under that of *Ornithorhynchus paradoxus*; the name *Platypus* having been previously used in ornithology, that of *Ornithorhynchus* has been almost universally retained. When first discovered, it excited great surprise, and the specimen which served for description was supposed by some to be a made-up specimen composed of the bill of some unknown duck-like bird and the body of a mammal. As indicated by the webbed feet, it is an aquatic form, living by preference in the still portions of rivers and streams, seeking its food among the plants which grow upon the river-banks, and excavating burrows in the banks, to which it retreats, and in which it forms its nest. This burrow, according to Bennett, is projected in a serpentine course into the bank, and ascends upward toward its termination, and at the end the nest is built. The nest is composed of dried grass, weeds, etc., strewn over the floor. The burrow is expanded toward the end, and measures there about a foot in length and six inches in breadth; the entire length of the burrow is considerable, sometimes being about 20 feet, and occasionally exceeding even 50 feet. Besides the principal entrance, there is also generally a second one below the surface of the water, communicating with the interior just within the aperture. The food is of an animal nature, chiefly consisting of water-insects, mollusks, and the eggs of fishes and frogs. THEODORE GILL.

Ornithorhynchus. See DUCK-BILL.

O'ro, tp. of Butte co., Cal. Pop. 281.

Orobancha'ceæ, the broom-rapes, a natural order of exogenous plants, parasitical herbs growing from the roots of other plants. Being completely parasitic, and

feeding upon the elaborated juices of the foster-plant, they are destitute of green herbage, and have dry or fleshy scales in place of leaves. This mode of life, however, is shared by a few species of related orders. This order is distinguished from the other gamopetalous families with irregular or bilabiate corolla and didynamous stamens by the 1-celled ovary with two (or by division four) parietal placentæ, innumerable small albuminous and minute embryo. Some of the broom-rapes, which abound in Europe, are injurious, especially one which lives upon clover. None are really of any economical importance, but two U. S. plants (*Epiphegus* and *Conopholis*), called beech-drops and cancer-root, have been vaunted in popular and empirical medicine. ASA GRAY.

Orodus [Gr. ὄρος, a "hill," and ὀδούς, a "tooth"], a genus of cestraciont sharks of which the remains are found in the Carboniferous rocks. The teeth have their crowns set with a series of blunt but frequently highly-ornamented cones. The spines called *Ctenacanthus* probably belonged to the same fish. Some of the species of *Orodus* must have been of immense size, as the teeth, of which the number was large, are occasionally found four to five inches broad and very massive. J. S. NEWBERRY.

Orohippus. See HORSE, FOSSIL.

Oromoc'to Village, post-v., cap. of Sunbury co., N. B., on the St. John, 11 miles from Fredericton. It has some shipbuilding. Pop. about 400.

O'rono, tp. of Muscatine co., Ia. Pop. 372.

Orono, post-v. and tp., Penobscot co., Me., on the Penobscot River and European and N. A. R. R.; seat of the State Agricultural College. Pop. 2888.

Orono, post-v. of Elk River tp., cap. of Sherburne co., Minn.

Orono'co, post-tp., Olmsted co., Minn. Pop. 753.

Orono'go, post-v., Jasper co., Mo., on the Memphis Carthage and North-western R. R., 10 miles W. of Carthage, has 2 schools, churches representing all denominations, and several stores. The principal industry is the mining of lead and zinc. Pop. about 1500.
JOHN LOWRY, ED. "ORONOGO ADVOCATE."

Orono'ko, tp. of Berrien co., Mich. Pop. 1615.

Oron'tes ['Ορόντης], the modern *Nahr-el-Asi*, a river of Syria, rises in Anti-Libanus and flows westward into the Mediterranean, which it enters after a course of 240 miles. It is not navigable.

Oroomiah. See URUMEYAH.

O'Rorke (PATRICK H.), b. in Ireland in 1835; graduated at the U. S. Military Academy in June, 1861, at the head of his class, and entered the army as second lieutenant of engineers; served on the staff of Gen. Tyler at the battle of Bull Run July 21; subsequently assistant engineer on the defences of Washington, and at Fort Monroe till October, when he accompanied the expedition to Port Royal; for his services on this occasion he received the brevet of captain; in Sept., 1862, he was commissioned colonel of the 140th New York Vols., which regiment he led with distinction throughout the campaigns of the army of the Potomac, receiving the brevets of major and lieutenant-colonel for gallantry at Fredericksburg and Chancellorsville; and in the Pennsylvania campaign at the battle of Gettysburg, July 2, 1863, where he met his death while gallantly leading his men forward to repel an attack made upon the left of the line. G. C. SIMMONS.

Orosha'za, town of Hungary, has 12,663 inhabitants, mostly engaged in rearing cattle and cultivating vines.

Oro'sius, b. toward the end of the fourth century A. D. at Tarragona in Spain; took orders, and engaged with zeal in the controversies of his time. Having by direction of his bishop visited Africa to confer with St. Augustine, he was sent by the latter to Palestine, where Pelagius was spreading his heresies. At a synod held at Jerusalem he opposed Pelagius, and in so doing provoked the hostility of John, the bishop of Jerusalem. Orosius wrote in justification of himself a work entitled *Liber Apologeticus* (*contra Pelagium*) *de Arbitrii Libertate*. He returned to Africa, and probably to Spain, and after his return composed, at the request of his friend Augustine, or completed, his *Historiæ* (*adversus Paganos*), a "History of the World," in 7 books, from the beginning of the world to A. D. 417, against the charge of pagan writers that the calamities of Rome, especially the capture of the city (A. D. 410), were chargeable to Christianity for having abolished the worship of the old heathen gods. The date of his death is not known. The best edition is by Havercamp (Leyden, 1738, 4to; reprinted in Migne's *Patrologiæ Cursus*). King Alfred translated the history of Orosius into Anglo-Saxon, the best edition of which, with a translation into English, is that of Dr. Bosworth (London, 1856). (See Teuffel's *Hist. Rom. Lit.*, § 448; Mörner, *De Orosii Vita ejusque Historiarum Libris Septem* (Berlin, 1844). HENRY DRISLER.

Orota'va, town of the Canary Islands, on the northern coast of Teneriffe, stands in a most beautiful and fertile valley, with an elevation of 1027 feet above the sea, and is, next to Santa Cruz, the most important town of the island. Pop. 8628. Its port is situated at a distance of 2 miles (*Port Orotava*), on the shore of the Atlantic. It is fortified, and carries on a considerable trade with Europe and America. Pop. 3800.

O'roville, post-v. of Ophir tp., cap. of Butte co., Cal., 75 miles N. of Sacramento; has a ladies' library, 1 weekly newspaper, 3 churches, a Chinese theatre, extensive water-power, 1 flour and several saw mills. The Ophir Ditch and Mining Company is located here, and the largest nugget of gold cast in the U. S. was moulded at Cherokee, 9 miles distant. Pop. 1425.
JOHN C. GRAY, ED. "WEEKLY MERCURY."

Or'phan [Gr. ὀρφανός], a person not of full age who has been deprived by death of one or both parents. A child in this situation is in a condition which appeals to the best feelings of humanity. Accordingly, we find in all literature many references to the wrongs which such may suffer at the hands of the cruel or the covetous. The Bible is frequent in its denunciations of those that rob the fatherless. At Athens there were officers appointed to administer a fund for the rearing of indigent orphans, whilst the errors or misdeeds of guardians were amenable to the courts of law. The power of bringing an action of this nature was limited to a term of five years. The archon was considered to be the natural guardian of widows, orphans, etc. The Roman law preserved the right of nominating guardians to every testator. The administration of a republic, says Cicero, is like a guardianship, and ought to be managed for the profit of those who are under protection, and not for the emolument of those who fulfil the functions of protectors. The appointment of guardians for the children of intestate citizens was sometimes vested in the prætors and tribunes, and sometimes in the consuls. The misconduct of guardians was severely punished. Under Galba one who had poisoned his pupil pleaded his Roman citizenship as a reason against the shameful death of the cross, to which he had been sentenced. His plea procured him a higher cross, whited over, that his punishment might be the more conspicuous. Cicero alludes to the wards falling a certain prey to the prætors. In England the guardianship of orphans of the king's tenants was the prerogative of the Crown, the king enjoying the profits of their lands and having the disposal of their bodies until they came of age. Under the feudal system the orphan vassal was the ward of his lord. The law of wardship was no doubt productive of much hardship and injustice. The court of wards, which had jurisdiction in these matters, was abolished by act of Parliament under Charles II., having fallen into desuetude during the Commonwealth. From this time the right of appointing a guardian to an infant without one has been vested in the court of chancery, as representative of the king. By the custom of London the guardianship of orphans is vested in the city.

The defenceless position of the orphan of the poor, exposed to all the whips and scorns of fortune, has appealed to philanthropy alike in our own age and in the past. Charitable institutions for the nurture and education of orphans have existed. These orphanages vary greatly in constitution, some being catholic in plan and liberal in management, and others devised on the narrowest bases of sectarianism and party. Perhaps the most remarkable one that has ever existed is that founded at Bristol by George Müller, a native of Halberstadt in Prussia, who after a stormy youth adopted views of an extreme evangelical type, and became pastor of an "Ebenezer chapel" at Teignmouth. In 1835 he published a proposal to establish an orphan-house. This work has progressed so that in the present year 2000 children are being educated in the orphan-town of Ashley Downs. The usual methods of obtaining support are studiously avoided. There is no committee, no advertising, no patronage, no collecting. The only mode employed for its continuance and extension is prayer to God. In 1856, Mr. Müller could write that £86,441 6*s.* 3½*d.* had been sent to him by unsolicited donors for the work he was doing. The *Narrative* he has published from time to time of the history of the orphanage records with minute particularity the gifts which had been sent. Not only money, but goods of the most heterogeneous nature have been received for the benefit of the work. WILLIAM E. A. AXON.

Or'pheus and the Orphic Poems and Mysteries. After all that has been written about Orpheus and the Orphic poems, we are still far from having arrived at any clear and distinct knowledge on this interesting but in-

tricate subject. To begin with, the etymology of the name Orpheus, unlike Musæus, Eumolpus, etc., is unknown to us; whether such a person did ever exist or not it is useless to inquire. "Certe hodie neminem tam lynceum esse existimo ut ejus cognationis aliquod vestigium possit indagare," says the latest German critic on the Orphic theogony, Schuster (1869).

No mention of Orpheus appears in Greek literature before Pindar and the dramatists. Aristophanes alludes to him as the one who brought religious rites among men and restrained them from rapine (Ran. 1032–33). In Plato, Orpheus is not only frequently mentioned, but verses by him are quoted (Cratylus, p. 402 b.; Phileb., p. 66 b.). Further, verses quoted by Plato have been identified as belonging to the fragments of the Orphic theogony that have come down to us. We find a reference in Euripides which would appear to connect together the Orphic and Pythagorean; Theseus says to his son Hippolytus, "Boast now and traffic with viands of lifeless food; take Orpheus for your master and revel, honoring the smoke of many letters" (Hippol., 952–54). The Pythagoreans made a custom of abstaining from animal food, and we learn from other sources besides Euripides that the Orphic societies had a similar custom. When we compare lines of Euripides with a reported statement of Aristotle in Cicero (N. D., I. 38, 107) "that the song ascribed to Orpheus was the work of a Pythagorean philosopher named Cercops," we shall see that there is much to support the view of K. O. Müller (Hist. Anc. Greek, lib. i. 310) that the Pythagoreans after the disestablishment of the clubs in Magna Græcia (510 B. C.) took refuge in the Orphic societies.

As to the origin and peculiar worship of these Orphic societies opinion among the ancients was widely at variance. Eratosthenes (c. 24) states, on the authority of the Bassarides of Æschylus, that Orpheus was torn to pieces by Dionysus by reason of jealousy for the excessive honor paid by the poet to Apollo or Helius. In the passage quoted from the *Hippolytus*, Euripides without doubt represents the popular feeling with regard to these Orphic mysteries in using the word βάκχευε (revel). We find in Herodotus (ii. 81) Bacchic and Orphic ceremonies coupled together: "τὰ Ὀρφικὰ καλεόμενα καὶ Βακχικά." In the later circle of the Orphic poets the adventures of Dionysus are a constant theme; the strangest metamorphoses are related of him, capable of the most mystical interpretations. By the few fragments still extant of the Orphic theogony we see that Dionysus must have occupied in the original work a most prominent place. The question then comes, Who is this Dionysus? He was evidently not the deity ordinarily known by that name. In the usual Bacchic festivals the greatest excesses prevailed; in the Orphic rites, as we have seen, the custom was quite the opposite. It was, then, to the mystical Chthonian deity, Dionysus Zagreus, that these Bacchic-Orphic rites were paid. Thus we get a connection between the Orphic mysteries and the Eleusinian mysteries of Demeter. The whole history of the mysteries and secret societies of Greece is involved in great doubt; the ancients themselves, as we see by the various contradictory reports, had scarcely any clear knowledge on the subject. The nature of the Chthonian deities and their worship is obscure in the extreme; we only know that the worship was conducted with the greatest possible solemnity and had some reference to an existence after death.

Of the poems that have come down to us under the name of Orpheus criticism has long ago proved the larger part to have no claim to antiquity. The poem on the Argonautic expedition and that on the nature of stones (Λιθικά) are the works of Alexandrian grammarians; the eighty-seven or eighty-eight hymns show on every page their Neo-Platonic origin. The only portion, therefore, of the so-called Orphic poems in which we can discern any traces of antiquity is fragments. These fragments, small as they are, must be sifted still further from the interpolations of Christian and other writers before we can reach the few remains of the early Orphic poetry, the theogony, probably of Onomacritus (520–485 B. C.), extant in Plato's day. Onomacritus, according to Herodotus (vii. 6), made a collection of the oracles ascribed to Musæus, and was accused at the time of making interpolations in the collection; long afterwards Pausanias (i. 22) declared his opinion that the poems in his day ascribed to Musæus were the work of Onomacritus. Thus everything points to Onomacritus as the author of the Orphic theogony. The only question is whether the theogony of Onomacritus was an original work or a modification of an earlier one. There may have been an earlier work of the kind, itself an advance upon the theogony of Hesiod, but yet preparatory to the more elaborate system of the later poet. But such a view is purely speculative. We have not enough evidence on either side to give a decisive answer to the question. A. H. BULLEN.

Or'phic Brotherhood [Gr. οἱ Ὀρφικοί], in ancient Greece, a society of ascetic persons who devoted themselves to a mystical worship of Bacchus (Dionysus) and the elaboration of a system of theology under the professed guidance of the spirit of Orpheus. They dressed in white, ate no animal food, avoided all excesses, and professed to aim at purity of life, an exalted religious experience, and an immortal existence after death.

Or'piment [Lat. *auripigmentum*, "golden pigment"], synonyme **King's Yellow**, a mineral tersulphide of arsenic, As_2S_3, orthorhombic in form, lemon yellow, sometimes nearly transparent, cleaves into thin laminæ, which are flexible and non-elastic, like those of gypsum; powder has a rather pale canary yellow color; as a mineral, very rare in America; found sparingly at Edenville, Orange co., N. Y. It may be prepared artificially by precipitating a solution of arsenic with sulphuretted hydrogen gas, and by fusing together equal parts of white arsenious acid and sulphur. It is stated on good authority that, when entirely *free from arsenious acid*, orpiment is not poisonous when swallowed, owing to its insolubility even in acids. As, however, it is easily soluble in alkalies, it is a dangerous material, and should be banished from common use as a pigment by those unfamiliar with its nature. It is employed, in admixture with lime, as a depilatory, and in another dangerous way, which should be prohibited by law, as an ingredient in fireworks. HENRY WURTZ.

Orr (HUGH), b. at Lochwinoch, Scotland, Jan. 13, 1717; settled in 1740 as a gunsmith at Bridgewater, Mass.; manufactured scythes and agricultural implements; made 500 muskets for the State about 1748, believed to have been the first manufactured in New England; cast iron and brass cannon and cannon-balls during the Revolution; invented machines for cleaning flaxseed and for manufacturing cotton, and was for some years a State senator. D. at Bridgewater Dec. 6, 1798.

Orr (ISAAC), b. at Bedford, N. H., in 1793; graduated at Yale College 1818; was for some years a skilful teacher of the deaf and dumb in the asylum at Hartford; became a missionary to the colored population in Washington, D. C., and other Southern cities, in the employment of the American Colonization Society; was skilled in mathematics and physics; invented an airtight stove, and wrote in the New York *Commercial Advertiser* and the Boston *Courier*. D. at Amherst, Mass., Apr. 28, 1844.

Orr (JAMES LAWRENCE), b. at Craytonville, S. C., May 12, 1822; graduated at the University of Virginia 1842; admitted to the bar and practised in Anderson, S. C.; member of the legislature 1844–45; member of Congress 1848–59, and Speaker of the Thirty-fifth Congress; in 1860 was one of the convention that inaugurated secession, and a State commissioner to Washington to treat with the U. S. government for partition of property in South Carolina; Confederate State senator 1862–65. At the close of the war he accepted the result, and was provisional governor of South Carolina 1865–69; appointed judge of the circuit court of South Carolina 1870, and in 1873, U. S. minister to Russia. D. at St. Petersburg May 5, 1873.

Or'rery. An orrery may include parts of two or three planetary machines. These are—the *planetarium*, which is constructed to represent the motion of planets about the sun, sometimes in circular orbits, sometimes in those which are elliptical; the *tellurium*, which is made to represent the motion of the moon about the earth, the motion of the earth about the sun, the varieties in the lengths of days and nights, and the consequent vicissitudes of the seasons, and sometimes also the moon's motions as respects her perigee, nodes, etc., and the occurrence of eclipses; and the *satellite-machine*, intended to illustrate the motions of the satellites of Jupiter around their primary, and Jupiter's own motion around the sun.

Planetary machines constructed in accordance with the idea that the earth was the centre of motion were very early in use. Such were the Chinese spheres, said to have been made some 2000 years before the Christian era, and more recently the spheres of Archimedes and Posidonius, concerning which Cicero, speaking of the Epicurean philosophy, says in his treatise *De Natura Deorum* (lib. ii. cap. 34 and 35): "If the sphere lately made by our friend Posidonius, which marks the course of the sun and moon and the five wandering stars, were to be transferred into Scythia or Britain, who, even in those barbarous countries, would doubt whether reason had presided over its construction? Yet these people (the Epicureans) doubt whether the universe, whence all things arise and are made, is not the effect of chance, or of some necessity, rather than of reason and a divine mind; and they regard Archimedes as more deserving of praise in imitating the changes of the sphere than nature in producing them." (As quoted in the

Penny Cyclopædia, article "Orrery.") It is thought that the earliest machine representing the Ptolemaic system may have been that of Chromatus. This system continued to be represented in all planetary machines "until about fifty years after the death of Copernicus, when the last of the kind of any note was erected in the library of the Pantheon at Paris by Orone Finnée." (*Penny Cyclopædia.*) Machines intended to represent the Copernican system were invented in the latter part of the seventeenth century by Huyghens and Römer, Huyghens introducing a method of calculating the wheelwork with precision. His machine was named by himself the "automaton." It was moved by a spring regulated by a balance. Then Römer invented a planetarium, and also a satellite-machine, the latter "prior to the year 1679." In the edition of Desaguliers' *Lectures of Experimental Philosophy*, published in 1719, a description is given of a machine styled an *orrery*, which is attributed to Mr. Rowley. The *Penny Cyclopædia* states that the origin of the name "was given by Mr. Desaguliers in his *Course of Experimental Philosophy*" (4to, London, 1734, i. p. 431). After stating his belief that Mr. George Graham, about the year 1700, first invented a movement for exhibiting the motion of the earth about the sun, at the same time that of the moon revolving round the earth, he remarks: "This machine, being in the hands of an instrument-maker to be sent with some of his own instruments to Prince Eugene, he copied it, and made the first for the earl of Orrery, and then several others with additions of his own. Sir Richard Steele, who knew nothing of Mr. Graham's machine, in one of his lucubrations, thinking to do justice to the first encourager, as well as to the inventor, of such a curious instrument, called it an *orrery*, and gave Mr. J. Rowley the praise due to Mr. Graham."

To the astronomer James Ferguson we are indebted for an orrery, a tellurium, the calculator (viz. of new and full moons, etc.), a cometarium, and an improved celestial globe, all described in his *Treatise on Astronomy*. Perhaps the most perfect of orreries were two invented and constructed by the distinguished American astronomer David Rittenhouse, LL.D., one of which is in possession of the College of New Jersey. The date on the face of the instrument is 1768. It is fitted for exhibiting continually the motions of the moon, as well as those of the earth and other principal planets to Saturn inclusive, then the outermost known. It is furnished with dial-plate arrangements for the current month and the day of the month, as well as the passing year, and the successive positions, at the dates thus recorded, of the bodies already specified, and the years of cycles; the whole kept in motion by a clockwork attachment. The orbits of the moon and of the planets are all elliptical, and the surrounding graduated circular ring, representing the arrangement of the twelve signs, has a rackwork and a screw of slow motion attached, by which even the precession of the equinoxes is allowed for.

Orreries, planetariums, etc. are not regarded with much favor by those best qualified to judge, as it is impossible to preserve the ratio both of the sizes and the distances throughout, on any practicable scale, in the same machine, so that erroneous notions with respect to the one or to the other must almost, of course, be superinduced. Telluriums seem to meet with most favor, as giving adequate ideas of the varieties in the length of the days and the vicissitudes of the seasons. S. ALEXANDER.

Or'rington, post-tp. of Penobscot co., Me. Pop. 1768.

Orris Root. See IRIS.

Orrs'town, post-v. of Southampton tp., Franklin co., Pa. Pop. 305.

Orr'ville, post-tp. of Dallas co., Ala. Pop. 2124.

Orrville, post-v. of Green tp., Wayne co., O., on Cleveland Mt. Vernon and Delaware and Pittsburg Fort Wayne and Chicago R. Rs., in a fine farming region; has 1 weekly newspaper and a considerable trade. Pop. 745.

Orsa'ra Dan'no Irpi'na (*Ursaria*), town of S. Italy, province of Avellino, on the Apennines. Pop. 5117.

Or'say, d' (ALFRED GUILLAUME GABRIEL), COUNT, b. at Paris, France, Sept. 4, 1801; served in the French army; married in 1827 a daughter of the earl of Blessington by his first wife; was separated from her 1829; lived thenceforth chiefly in London, where he was regarded as a model of elegance and courtliness; was the most conspicuous member of the social circle at Gore House; was for many years a constant companion of Lady Blessington; was distinguished for a handsome person, a fascinating conversation, and artistic skill; became director of fine arts at Paris under Louis Napoleon, and d. there Aug. 4, 1852.

Orseille. See ARCHIL.

Orsi'ni, a wealthy Roman family of princely rank; belonged to the party of the Guelphs, and became very conspicuous in the history of Rome during the Middle Ages by its perpetual feuds with the family of the Colonnas, which belonged to the Ghibelline party. It spread very widely, acquired immense possessions, and culminated in the latter part of the thirteenth century, when one of its members became pope under the name of Nicholas III. (1277–81). Of its many branches only one is still flourishing, the Neapolitan, at present represented by the dukes of Gravina. A member of this branch became pope under the name of Benedict XIII. (1724–30). The family-seat is still at Rome, where the Orsini palace stands on the spot where formerly stood the theatre of Marcellus.

Orsini (FELICE), b. in 1819 at Meldola in the province of Forli, Italy, at that time a part of the papal states; joined while yet a student at the University of Bologna a secret society for revolutionizing Italy; was imprisoned and condemned to the galleys for life, but restored to liberty in 1846 by the amnesty of Pius IX.; acted as a deputy for Bologna in the constituent assembly at Rome in 1848, and after the fall of the Roman republic was an agitator in Genoa and Modena; fled in 1853 to England, but reappeared in 1854 in Italy, agitating in Parma, Milan, Trieste; was captured at Vienna and put in the fortress of Mantua, but escaped to England in 1856; repaired in 1857 to Paris, having formed a conspiracy with three others, Pieri, Rudio, and Gomez, for the assassination of Napoleon III.; on Jan. 14, 1858, he, with his accomplices, threw three explosive bombs under the carriage of the emperor in the rue Lepelletier, which killed eight persons and wounded over one hundred; was caught, condemned, and guillotined Mar. 13, 1858.

Orso'gna, town of S. Italy, province of Chieti, about 7 miles from Lanciano. The inhabitants are better educated than those of the southern provinces generally, and are distinguished for their love of music. Pop. 6216.

Or'ta, da (GARCIA), best known under the Latinized form **Garcia ab Horto,** b. in Portugal about 1500; studied at Salamanca and Alcalá de Henares; became professor of mathematics at Lisbon and chief physician to the king; went to Portuguese India 1534; displayed his medical skill at the courts of the friendly princes of India; was an intimate friend of Camoens; wrote in Latin and printed at Goa in a Portuguese translation his important *Dialogues* upon the medicinal productions of India (1563), in which work the Asiatic cholera was described for the first time, and the earliest printed notice of the caves of Elephanta was given. D. probably at Goa.

Or'ta No'va, town of S. Italy, province of Foggia. Near this town is the famous Villa dell' Orta, once the valuable property of the Jesuits of Naples. Pop. 5434.

Or'ta Novare'se, town of N. Italy, province of Novara, situated on the E. shore of a most picturesque lake of the same name. This town has many superb villas in its neighborhood, and near it rises a hill known as the Sacro Monte, on which, in the midst of lofty trees, stand some 20 or 30 chapels, several oratories, and a church, all decorated by eminent artists of the sixteenth century. The view from this sanctuary is remarkably fine, and the Lago d'Orta is now much frequented by summer travellers, who should not fail to visit the old church on the island of San Giulio, containing curious documents of the ninth century and other objects of interest. Pop. 1000.

Orte'lius (ABRAHAM), b. at Antwerp, Holland, Apr. 4, 1527; visited England in the prosecution of geographical studies; became geographer to Philip II. of Spain 1575, and published a great atlas, *Theatrum Orbis Terrarum* (1570), long the standard work on the Continent, and was author of geographical treatises. D. at Antwerp Jan. 1598.

Orth (GODLOVE S.), b. near Lebanon, Pa., Apr. 22, 1817; was educated at Pennsylvania College, Gettysburg; became in 1839 a lawyer of Indiana; was six years in the State senate, of which he was one year president: in 1848 a Presidential elector; captain of troops on the U. S. ram Horner in the Ohio River 1862; in Congress from Indiana 1863–75; appointed U. S. minister to Austria 1875.

Orthacan'thus [Gr. ὀρθός, "straight," and ἄκανθα, "spine"], a name given to certain defensive spines of sharks found in the coal-measures. They are slender and acute, but not always straight, though the name indicates this, and are ornamented with two rows of sharp, depressed hooks on the posterior face. They probably belong to the shark of which the teeth have received the name of *Diplodus*. J. S. NEWBERRY.

Orthagoris'cidæ [from *Orthagoriscus*—ὀρθαγορίσκος, a "sucking-pig"—the first genus], a family of plectognath fishes, of the sub-order Gymnodontes, distinguished from all other fishes by the peculiar truncation of the posterior region of the body. The form varies, being either oblong or higher than long, but in all ends abruptly behind, and is entirely destitute of anything like a tail or caudal

peduncle; the abdomen is never distensible by air, as in the swell-fishes; the skin is rough or covered with hexagonal scutellæ; the head externally inseparable from the body, and with all the bones covered by the integument; nostrils inconspicuous; mouth terminal, small; the jaws, both upper and lower, developed into cutting ridges, and each destitute of a median suture; branchial apertures very small; slits in front of the pectoral fins; dorsal and anal fins far back, opposite each other, and developed alike, higher than long, and united with the caudal fin when present; this is absent in *Molacanthus*, but in others forms a margin to the truncated rear; pectorals well developed; ventrals entirely wanting. The skeleton is peculiar for the small number of caudal vertebræ, there being less than twenty, and in the adult of *Orthagoriscus* there are ten abdominal and about eight caudal; no pelvic bones are developed; the air-bladder is absent; many other peculiarities are observable in the anatomy. The family is represented by three well-established genera: *Mola* (= *Orthagoriscus* of some), *Orthagoriscus* (= *Ranzarea*), and *Molacanthus*. The species of the first two attain a large size, *Mola rotunda* sometimes weighing as much as 800 pounds; the last remains comparatively very small, and hence has been supposed to be the young of *Mola*, from which, however, it differs greatly. *Mola* is represented by species in the Atlantic on both sides, as well as in the seas of Southern Africa; *Orthagoriscus* occurs in both the Atlantic and Pacific, but not on the American coasts; and *Molacanthus* is represented by a small species occasionally stranded on the eastern American and probably other coasts. (See Putnam in *American Naturalist* for December, 1870.) THEO. GILL.

Orthalic'idæ [from the generic name, *Orthalicus*], a family of land gasteropods belonging to the order Pulmonata and sub-order Geophila, distinguished by the composition of the jaw. The animal is provided with a shell, and has mantle moderate; the respiratory apparatus beneath the margin of the foot; the head is continuous with the body, with a small and ovoid buccal mass, and has no labial processes; the usual four retractile tentacles are developed, the posterior with the eyes, the anterior sub-marginal and small; the lingual ribbon has numerous rows of nearly similar teeth, these being stout, blunt, and widened towards the extremities, and with their apices recurved; the jaw is crescentiform and composed of a median triangular and numerous lateral semitriangular imbricated plates; the foot has no independent disk and is simple behind; vent near the respiratory orifice. The shell is spiral and oblong, like that of *Bulimus*, and has a narrow aperture. The family is represented by tropical species in both the eastern and western hemispheres, *Orthalicus* and *Lignus* being the principal American genera, and *Perideris* an African one. Some of the species at least (*e. g. Orthalicus undatus*) inhabit trees, to which they attach themselves during hibernation, and in favorable places are found in large numbers. THEODORE GILL.

Orthez', town of France, department of Basses-Pyrenées, on the Gave de Pau. From its salt-springs is made an excellent white salt, to which the peculiar delicacy of the so-called Bayonne ham is generally ascribed. Pop. 6724.

Orth'idæ [ὀρθός, "straight," in allusion to the hinge-line], an extinct family of brachiopods abundantly represented in Palæozoic rocks by several genera, more properly known under the name STROPHOMENIDÆ (which see).

Ortho-Acids and Ortho-Salts. The prefix *ortho* [Gr. ὀρθός, "right" or "true"] was applied by Odling to the tribasic phosphates and nitrates, and extended to basic carbonates, silicates, borates, etc., the prefix *meta* (also Greek) being used for the monobasic salts and hydrates. The terms, it must be observed, are not applicable to anhydrous acids or "anhydrides," orthophosphoric acid being of course trihydric phosphate. It is unfortunate that these convenient terms are really inapplicable in the common case of nitrates, the common or normal nitrates being the monobasic or meta-nitrates, and the ortho-nitrates, unlike the tribasic or ortho-phosphates, being really exceptional. For this and other reasons that might be given, it seems better to adhere to the terms monobasic, dibasic, and tribasic salts, and in the case of acids (that is, hydrated acids) to use the word *hydric*, as monohydric, dihydric, and trihydric phosphate. In the case of salts, a very convenient device of nomenclature (see under NOMENCLATURE, CHEMICAL) is to say monocalcic, dicalcic, or tricalcic phosphate, trisodic borate, diplumbic nitrate, dimercurous nitrate, and so on. HENRY WURTZ.

Orthocerat'idæ [from *Orthoceras*—ὀρθός, "straight," and κέρας, "horn"—the representative genus], a family name under which are combined a varying number of genera belonging to the class of Cephalopods, order of Tetrabranchiates, and sub-order Nautiloidea. All have a shell furnished with numerous chambers, which extend across the axis of the shell; the septal margins are simple and the funnel-like throat more or less sub-central and directed backwards; they differ, however, in other respects. In the typical forms (Orthoceras, etc.) the shell is straight and the aperture simple: to this, by some authors, the family is restricted; others (Cyrtoceras) have the shell curved, but the aperture simple; others, again (Gomphoceras), have the shell straight, but a heterogeneous aperture; others still (Phragmoceras) have the shell curved, and the aperture is heterogeneous. The species are numerous, and lived from the Lower Silurian up to the Liassic epoch. They sometimes attained a large size, and casts of the siphuncles of some forms were at one time supposed to indicate a peculiar form of animal life, and called hyolithes by Eichwald. THEODORE GILL.

Or'thoclase [ὀρθός, "straight," and κλᾶν, to "cleave"], the most common species of the feldspar family. It is essentially a potash-feldspar, being composed of silica, 64.8 per cent.; alumina, 18.4 per cent.; potash, 16.8 per cent.; but with the potash frequently in part replaced by soda, magnesia, lime, etc. It crystallizes in the monoclinic system and has two principal distinct cleavages, one of which is very perfect, the second being somewhat less so. It occurs generally in massive cleavable forms, and varies much in color from white and gray to reddish-white and flesh-red; also to greenish and even, rarely, to bright green. Its lustre varies from glassy to somewhat pearly. Its hardness is 6, or one degree less hard than quartz. Potash-feldspar is one of the most abundant of minerals, occurring as an ingredient of the most common granitic, metamorphic, and volcanic rocks, and in its decomposition being the principal source of clay. *Adularia* is a translucent or transparent variety of high lustre, occurring in some granites, and so named from Adula, one of the highest peaks of Mt. St. Gothard in Switzerland. (See MOONSTONE.) EDWARD C. H. DAY.

Orthog'raphy, a Greek word signifying "correct writing," is the name of that part of grammar which teaches how to represent language correctly by writing, and treats of the elementary sounds of which a language consists, and the signs by which these sounds are represented—the letters; of the combination of such sounds into syllables and the correct representation of words—the art of spelling. Originally alphabetic writing was phonetic, the words being written down as they sounded. The invention of an alphabet was the invention of phonetic writing; the difference between alphabetic and pictorial or ideographic writing, depends on the introduction of the phonetic principle instead of the symbolical. Soon, however, orthography was disturbed by an additional principle, and a false one—namely, the etymological; that is, the representation, by the spelling of a word, of its physical relations to other words; and at present the orthography of many modern languages, such as English, German, French, and the Scandinavian languages, is a combination, often bewildering and inconvenient enough, of the phonetic and etymological principles. When an alphabet was transferred to a new language, such as the Phœnician alphabet to the Greek and Roman languages, and the Roman alphabet to the Gothic-Germanic languages, the new languages often contained sounds for which no corresponding signs could be found in the old alphabets, and *vice versa*.

When such discrepancies between the sounds of the language and the signs of the alphabet were wholly irreconcilable, necessary letters were invented and superfluous discarded; but the finer shades of pronunciation were generally represented by the combination of several letters, by the application of dumb letters, and by other orthographical artifices, and thus the free fluctuations of the phonetic principle were early fastened down on certain points by conventionalities. From these conventionalities arose a new principle. As writing on the phonetic principle represents language as it is spoken in a certain district, at a certain time, its practice is subject to two methods, of which Greek and Latin may be taken as the types. In the former each of the principal dialects was written in its locality, until the Attic overpowered the others through the influence of Macedonia, and the works of Plato, Demosthenes, Thucydides, Sophocles, and other great writers. On the other hand, the Latins made concessions to the language as spoken at Rome, where Cicero became the great authority. Similarly, most of the authors of Scotland make use of the English of London, because it gives them a greater number of readers; and the orthoëpists differ but little on the subject of English pronunciation. English has departed so far from its originals that an etymologic orthography is impossible, except in words taken from books, such as *latitude* and *geography*. Even in Italian *petto* must be written for Latin *pectus*, and *dito* for *digitus*, and in English we have *curr-ent, cor-sair, cour-ser, ed-ible,*

and *eat-able*, from the same root respectively. The relation which etymology should bear to the phonetic system, and how the dominion ought to be divided between them, is a disputed question. The orthography of the English language took its more modern form in the time of Queen Anne; that of the German language a little later; that of the French half a century earlier. In all three languages the etymological principle is at present the predominating, but both in English and German a movement is on foot in favor of phonetic reforms. REVISED BY S. S. HALDEMAN.

Orthoptera. See ENTOMOLOGY, by PROF. S. TENNEY.

Or'tolan, a name applied to several species of song-birds. In Europe it was primarily employed for the *Emberiza hortulana*, or garden bunting, common on the continent of Europe and in the Levant. It is a handsome little bird without song, and is chiefly noteworthy for its extensive use as food. Immense numbers are captured in nets, placed in dark rooms, and gorged with millet and other grain mixed with spices, until they undergo a kind of fatty degeneration. In fact, when killed the ortolan is a mere lump of fat, of a flavor highly prized by gourmands. It is some six inches in total length and attains a weight of nearly three ounces. In some parts of the U. S. the name has been perverted to the BOBOLINK (which see).

Or'ton (JAMES), b. at Seneca Falls, N. Y., Apr. 21, 1830; graduated at Williams College, 1855, at Andover Theological Seminary 1858; travelled in Europe and Asia Minor; became a Congregational minister 1860; instructor in natural science in Rochester University 1866; was at the head of the Williams College expedition, which explored the upper Amazonas 1867–68; became professor of natural history in Vassar College 1869, and ascended the Amazonas a second time in 1873, extending the exploration to Bolivia. Was author of *The Andes and the Amazon* (1870); *Underground Treasures: how and where to find them* (1872); *The Liberal Education of Women* (1873); *Comparative Zoology* (1875). D. in Peru, South America, Oct. 24, 1877.

Orton (JASON ROCKWOOD), M. D., b. at Hamilton, N. Y., in 1806; was for many years a physician; settled in N. Y. City 1850, and devoted himself to literature; he edited the N. Y. *Weekly Review* and the Binghamton *Courier*, and wrote much for the *Musical World*. Author of *Poetical Sketches* (1829), *Arnold, and other Poems* (1854), and *Camp-Fires of the Red Men* (1855). D. at Brooklyn Feb. 13, 1867.

Orton (WILLIAM), b. in Cuba, Allegany co., N. Y., June 14, 1826; learned the printer's trade; taught school; was in the book business 1850–62; member of common council N. Y. City 1860; collector of int. rev. 1862–65; com. int. rev. 4 months, when he resigned to accept the presidency of U. S. Tel. Co. In 1867 established the *Journal of Telegraphy*; Apr. 1, 1866, vice-pres. of Western Union Tel. Co., with which the U. S. Tel. Co. had been consolidated. Pres. of same 1867–78. D. in N. Y. City Apr. 22, 1878.

Orto'na, town of Southern Italy, province of Chieti, situated near the Adriatic and commanding a magnificent view. It is respectably built, and the cathedral is said to contain the body of St. Thomas the apostle. The town has been twice nearly destroyed by earthquakes (1571, 1782), but it still carries on an active trade with Dalmatia, Germany, and Greece, and important improvements are now making in the harbor. Ortona was a Roman town of some consequence, and after the fall of the empire suffered for many centuries the common calamities of siege, famine, and pestilence. It claims to have been an Episcopal see from the time of the apostles. Pop. 11,884.

Ortygia. See DELOS.

Ortyg'inæ, or **Odontophor'inæ** [from ὀδούς, ὀδόντος, "tooth," and φορέω, to "carry"], a sub-family of Tetraonidæ, including the so-called American quail and partridges, which are, however, not at all related (except within the limits of the family) to the European birds bearing those names. The Odontophorinæ, with the general characters of the Old World quails and partridges (Perdicinæ), have a much stouter and more compressed bill, and the lower mandible is armed with two slight teeth, and hence the name. There are numerous species extending over both N. and S. America, 47 species being recognized by G. R. Gray and distributed by him in five genera, viz. *Odontophorus*, peculiar to S. America, with two sub-genera and 17 species; *Dendrortyx*, with three species; *Cyrtonyx*, with three species; *Ortyx*, with two sub-genera and 17 species; and *Callipepla*, with four sub-genera (*Callipepla*, *Philortyx*, *Lophortyx*, and *Oreortyx*) and seven species. Of the species admitted by Gray, seven occur within the limits of the U. S., which have been reduced by Messrs. Baird, Brewer, and Ridgway to six. These have been apportioned by those gentlemen among five genera, and are (1) *Ortyx virginianus* (with three varieties); (2) *Oreortyx pictus* (with two varieties); (3) *Lophortyx californicus*; (4) *L. gambeli*; (5) *Callipepla squamata*; and (6) *Cyrtonyx massena*. The first species is the common quail or partridge of the eastern and southern U. S.; the others are confined to the south-western portions. The family has been the object of an elaborate folio monograph by Mr. Gould (*A Monograph of the Odontophorinæ, or Partridges of America*, London, 1850).

THEODORE GILL.

Oru'ro, town of Bolivia, South America, stands in lat. 17° 57′ S., at an elevation of 12,455 feet above the level of the sea. It was founded in 1570; and its gold and silver mines were the richest in Bolivia, next to those of Potosi. It rose rapidly, and at the end of the seventeenth century it was a large and wealthy city with 70,000 inhabitants. But when the mines became exhausted, or, at least, difficult and less profitable to work, the city sank as rapidly as it had risen, and it is now almost deserted and lying in ruins. Of its former splendor only the churches and monasteries remain. It has lately been made the seat of the Bolivian government. Pop. 7000.

Orvie'to (*Orbitum, Urbs Vetus*), town of Italy, province of Perugia, in lat. 42° 43′ N.; lon. 12° 6′ E. It crowns an abrupt volcanic hill near the confluence of the Chiana and the Paglia, about 8 miles from Lake Bolsena, and nothing can be more picturesque than the aspect of its old ivy-covered walls as one winds and zig-zags up the steep but smooth road leading to the city gate. The town contains a handsome new theatre and some fine old palaces not without artistic treasures. The Pozzo della Rocca, or the Pozzo di San Patrizio (a circular well excavated by Clement VII. in 1527 after the famous sack of Rome), is worthy a visit. This well is 42 feet in diameter, and 200 in depth; the water is reached by two flights of stairs, ingeniously interlacing and constructed at an angle which allows donkeys to ascend and descend. But the great boast of Orvieto is its marvellously beautiful cathedral, one of the finest in Italy. This church, founded in 1290 in honor of the famous miracle of Bolsena, is built of black and white marble and adorned externally with the richest sculptures and the most brilliant mosaics. The interior, though less gorgeous, is not unworthy the splendid outside. For a most full and interesting account of this remarkable cathedral see Charles E. Norton's *Notes of Travel and Study in Italy*. Orvieto is of Etruscan origin, was not conspicuous under the Romans, but on the breaking up of the empire imitated the example of other strong Italian towns by declaring itself independent, and being Guelph in its policy was long a safe refuge for fugitive popes, no less than 30 of whom are said to have found shelter here at different times either from foreign assailants or rebellious subjects. It has been an episcopal see since 590 A. D. Orvieto is now accessible by railway; it still manufactures its excellent white wine, and has considerable trade in silk, grain, and cattle. Pop. 14,455.

Or'vil, tp. of Logan co., Ill. Pop. 1196.

Or'ville, post-v., cap. of Hamilton co., Neb.

Orville, post-v. (DEWITT P. O.) of Dewitt tp., Onondaga co., N. Y. Pop. 157.

Or'well, post-v. and tp. of Oswego co., N. Y. P. 1215.

Orwell, post-v. and tp. of Ashtabula co., O., on the Ashtabula Youngstown and Pittsburgh R. R. Pop. 936.

Orwell, post-v. and tp. of Bradford co., Pa. Pop. 1296.

Orwell, post-v. and tp. of Addison co., Vt. Pop. 1192.

Or'wigsburg, post-b. of Schuylkill co., Pa. Pop. 728.

Orycterop'idæ [from ὀρυκτήρ, a "digger," and πούς, a "foot"], a family of monodelph mammals of the order Edentata, and alone representing the peculiar sub-order Fodientia. They slightly resemble a hog (whence the name aard-vark, *i. e.* earth-hog, has been given to it by the Cape of Good Hope colonists), but the snout is elongated, the ears long, and the tail stout and tapering; the hair is sparse; the skull is elongated; the frontal enlarged and smaller, with reduced post-orbital processes; the intermaxillary bones well developed, prominent below, not enclosing foramina; the supra-maxillaries lengthened and deep; the lachrymal bone enlarged; the malar also enlarged and extending much upon the face, but with the zygomatic process small and slender; the squamosal with the zygoma slender and twisted, as in the armadillos, with a strong post-articular and post-auditory process, and just within the latter a short truncated styloid process not enclosed by any vaginal process; the tympanic bone much reduced, separate; teeth in the supra-maxillaries and mandible very complicated in structure and in number generally about 26 ($\frac{7}{6} \times 2$); members well developed, each provided with five toes, all of which are armed with stout hoof-like claws admirably fitted for digging. This family, whose osteological characters have been indicated by Turner es-

sentially in the words here borrowed, has been constituted for the reception of two species of mammals confined to Africa: one species (*Orycteropus capensis*) is an inhabitant of Southern Africa, the other (*O. æthiopicus*) of Eastern Africa. They attain a considerable size (the length, including the tail, being about five feet), and live chiefly upon ants, which they obtain by demolishing ant-hills and by their elongated prehensile tongues, enabling them to lick up the insects thus exposed to view. They live in burrows made by themselves, and are nocturnal in their habits. THEODORE GILL.

Oryctol'ogy [ὀρυκτός, "dug up"], "the science of things dug up," a term formerly (1835) applied to the study of fossils, and thus to some extent equivalent to palæontology. The latter term has now altogether superseded it.
EDWARD C. H. DAY.

O'ryx [Gr. ὄρυξ], a name applied by the ancients to a species of North African antelope generally supposed to have been the gazelle; but modern scientists have given this name to the gemsbok. (See GAZELLE; GEMSBOK.)

Or'zi Nuo'vi, town of N. Italy, province of Brescia, once a small but strong fortress, of which only the castle and two gates remain. Pop. 3689.

Osaga, post-v. and tp., Bourbon co., Kan., on the Missouri River Fort Scott and Gulf R. R. Pop. 1053.

Osage', county of Central Kansas. Area, 792 square miles. It is rolling, fertile, and adapted to stock and grain raising. Coal, ochre, fire-clay, and building-stone abound. The manufacturing interests are of increasing importance. The county is traversed by the Atchison Topeka and Santa Fé R. R. Cap. Burlingame. Pop. 7648.

Osage, county of Central Missouri, bounded N. by the Missouri River and W. partly by the Osage River. It is traversed by the Missouri Pacific R. R. and the Gasconade River. Area, 560 square miles. It is hilly and has deep, fertile valleys. Tobacco, live-stock, wool, and grain are leading products. Cap. Linn. Pop. 10,793.

Osage, tp. of Benton co., Ark., includes Bentonville, the county-seat, and the battlefield of Pea Ridge or Elkhorn, fought Mar. 6, 7, and 8, 1862. Pop. 5384.

Osage, post-v. and tp., Carroll co., Ark. Pop. 842.

Osage, tp. of Newton co., Ark. Pop. 248.

Osage, post-v., Franklin co., Ill.

Osage, tp. of La Salle co., Ill. Pop. 1176.

Osage, post-v. and tp., cap. of Mitchell co., Ia., on the Illinois Central R. R. and Cedar River, has a college and public schools, 3 churches, 2 banks, 1 foundry and machine shop, 3 manufactories, 2 hotels, 2 printing-offices, 2 newspapers, and stores. Principal business, farming. Pop. of v. 1400; of tp. 2158.
A. W. CLYDE, ED. "MITCHELL CO. NEWS."

Osage, tp. of Allen co., Kan. Pop. 463.

Osage, tp. of Bourbon co., Kan. Pop. 1053.

Osage, tp. of Crawford co., Kan. Pop. 980.

Osage, tp. of Labette co., Kan. Pop. 930.

Osage, tp. of Miami co., Kan. Pop. 1396.

Osage, tp. of Bates co., Mo. Pop. 500.

Osage, tp. of Camden co., Mo. Pop. 1426.

Osage, tp. of Cole co., Mo. Pop. 604.

Osage, post-v. and tp., Crawford co., Mo. Pop. 784.

Osage, tp. of Dent co., Mo. Pop. 288.

Osage, tp. of Henry co., Mo. Pop. 828.

Osage, tp. of Laclede co., Mo. Pop. 1257.

Osage, tp. of Miller co., Mo. Pop. 695.

Osage, tp. of Morgan co., Mo. Pop. 787.

Osage, tp. of Vernon co., Mo. Pop. 1538.

Osage, post-v. and tp., Otoe co., Neb. Pop. 218.

Osage City, post-v. of Osage co., Kan., 35 miles S. W. of Topeka, in the great coal-basin of the State, has good schools, 6 churches, excellent flag-stone quarries, extensive beds of pure yellow ochre, a steam brick-mill, 1 flour, paint, and stone saw-mill, a bank, 1 newspaper, several hotels, and stores. Pop. about 1500.
W. H. MORGAN, ED. "SHAFT."

Osage Indians, a tribe of Dakota stock formerly inhabiting the valley of the Osage River and the plains beyond. They now occupy a reservation of 1,760,000 acres, bounded N. by the Kansas line, E. by the 96th degree of W. lon., S. and W. by the Arkansas River. It is a broken, hilly region without much fertile land. They have many cattle and some 12,000 horses. They are divided into eight bands: the Big Hills, Clammores, Big Chiefs, Black Dogs, White Hairs, Beavers, Little Osages, and Half-Breeds. They are not very intelligent, and have made little progress in civilization. Pop. 3956.

Osage Mission, post-v. of Mission tp., cap. of Neosho co., Kan., on the Missouri Kansas and Texas R. R., 330 miles S. W. from St. Louis; has 1 academy and 5 public schools, 2 churches, 1 steam grain elevator, 1 newspaper, a savings bank, 2 extensive flouring-mills, 2 wagon and plough factories, 1 cheese factory, and stores. Pop. 791. C. H. HOWARD, ED. "NEOSHO COUNTY JOURNAL."

Osage Orange, or **Bois d'Arc,** the *Maclura aurantiaca*, a North American tree of the Moraceæ, a division of the great order Urticaceæ. It has a handsome, tough, and durable yellow wood, which has been proposed as a substitute for fustic. The fruit is large, yellow, and not altogether unlike an orange, whence the name. It is not edible. The principal use of the tree is as a hedge-plant.

Osage River, rises in Kansas, where it is often called MARAIS DES CYGNES (which see). It traverses Missouri, and falls into the Missouri River 10 miles below Jefferson City. Its lower course is navigable.

Osaka. See JAPAN.

Osa'kis, post-v. and tp. of Douglas co., Minn. P. 400.

Osann' (FRIEDRICH GOTTHILF), b. at Weimar in 1794; studied in Jena and Berlin; in 1817–19 travelled in England, France, and Italy; became professor at Jena in 1821, and in 1825 was made professor of ancient literature and director of the philological seminary in Giessen; published *Sylloge Inscriptionum Antiq. Græc. et Rom.* (Darmst., 1822–34, fol.), *Auctarium Lexicorum Græc.* (*ib.*, 1824, 4to), Cicero's *De Repub.* (1847), Pomponius's *De Orig. Juris* (1848), *Beiträge zur Gesch. d. griesch. und römisch. Literatur* (Darmstadt, 1835–39, 2 vols. 8vo), and minor treatises and editions. D. Nov. 30, 1858. HENRY DRISLER.

Osawat'omie, p.-tp. of Miami co., Kan. Pop. 1182.

Os'born, post-v. of De Kalb co., Mo., on the Hannibal and St. Joseph R. R.

Osborn, post-v. of Bath tp., Greene co., O., on the Atlantic and Great Western R. R. Pop. 639.

Osborn, tp. of Outagamie co., Wis. Pop. 417.

Osborn (JOHN), b. at Sandwich, Mass., in 1713; graduated at Harvard College 1735; studied divinity, and subsequently medicine; settled at Middletown, Conn., as a physician; wrote a number of songs and short poems. D. at Middletown May 31, 1753.

Osborn (SELLECK), b. at Trumbull, Conn., in 1783; received a common-school education; entered a printing-office at Danbury, Conn., at the age of twelve; became editor of the Litchfield *Witness* 1804; served as captain in the U. S. army during the war of 1812–15; afterwards edited papers at Bennington, Vt., and Wilmington, Del.; published a small volume of *Poems, Moral, Sentimental, and Satirical* (Boston, 1823), being selections from his numerous poetical pieces scattered through the newspapers he had edited. D. at Philadelphia, Pa., Oct. 1, 1826.

Osborn (Admiral SHERARD), b. in England Apr. 25, 1822; entered the British navy 1837; served in one of the expeditions in search of Sir John Franklin, in the Crimean war, and in the seas of China and Japan; accepted from the Chinese government the command of a squadron for the suppression of piracy 1862; returned to England 1864 to take command of the turreted monitor Royal Sovereign; was for several years manager at Bombay of the Great Indian Peninsular Railway; became rear admiral 1873, and was a member of the commission for fitting out the great Arctic expedition of 1875. D. in England May 6, 1875. Author of *Stray Leaves from an Arctic Journal* (1852); *A Cruise in Japanese Waters* (1859); *The Past and Future of British Relations in China* (1860), and other works.

Os'borne, county of Central Kansas. Area, 900 square miles. It is traversed by the N. and S. forks of Solomon River. It is undulating, fertile, and well adapted to stock-raising. Cap. Osborne. Pop. 33.

Osborne, post-v., cap. of Osborne co., Kan., on the central branch of Union Pacific R. R., has excellent schools, 4 churches, several mills and mechanical shops, and stores. Pop. about 200. F. H. BARNHART, ED. "FARMER."

Osborne (LAUGHTON), b. in New York about 1806; graduated at Columbia College 1827; author of *Sixty Years of the Life of Jeremy Levis* (1831); *The Dream of Alla-ad-Dean*; *The Confessions of a Poet* (Phil., 1835); *The Vision of Rubeta, an Epic Story of the Island of Manhattan*; *Arthur Carryl, a Novel*; *Calvary*; *Virginia Tragedies* (1867), and a *Treatise on Oil Painting.*

Osborne (SYDNEY GODOLPHIN), LORD, third son of the first earl Godolphin and brother of the present duke of Leeds, b. in England in 1808; graduated at Brasenose College, Oxford, 1830; took orders in the Church of England; was for several years rector of Stoke Pogis; became

rector of Durweston, Dorsetshire, 1841; visited Ireland for philanthropic purposes during the great famine of 1847, and in a subsequent year, during a cholera epidemic, visited Miss Nightingale's hospitals at Scutari during the Crimean war, rendering services for which he was thanked by the government, and was long known as a correspondent of the *Times* upon social and philanthropic topics over the signature S. G. O. Author of *Hints to the Charitable* (1838); *Gleanings in the West of Ireland* (1850); *Lady Eva* (1851); *Scutari and its Hospitals* (1855); *Letters on the Education of Young Children* (1866), and other works, besides many pamphlets in the interests of the laboring class.

Osborne (Gen. Thomas O.), b. at Jersey, Licking co., O., Aug. 11, 1832; graduated at the University of Ohio 1854; studied law, and was admitted to the bar at Crawfordsville, Ind.; settled at Chicago 1858; became colonel of the 39th Illinois regiment 1861; bore a distinguished part in several battles in Virginia, especially at Petersburg, for which he was made brevet brigadier and major-general Apr. 2, 1865. Gen. Osborne lost the use of his right arm at Drury's Bluff.

Os′cans [Lat. *Osci, Opsci;* Gr. Ὀπικοί], an Italian race which originally appears to have been the same as the Ausones. Later they became associated with the Samnites and other peoples of Southern Italy. The Oscans are chiefly interesting from their widely-spoken language, which was kindred to the Latin. No Oscan literature is extant, and the little we know of the language has been mostly gathered from coins and inscriptions.

Os′car II., b. Jan. 21, 1829, was a son of Oscar I. (b. July 4, 1799, king Mar. 8, 1844, d. July 8, 1859), and a grandson of Charles XIV. (General Bernadotte); married June 6, 1857, Sophia, a daughter of Duke William of Nassau, who bore him four sons; and succeeded, Sept. 18, 1872, his brother Charles XV. on the throne of Norway and Sweden.

Osceo′la, county of N. W. Iowa, bounded N. by Minnesota. Area, 432 square miles. It is undulating and adapted to grain culture, but its resources are not yet developed. The county is traversed by the St. Paul and Sioux City R. R. Cap. Sibley.

Osceola, county of Michigan. Area, 576 square miles. It is level and fertile, and mainly covered with dense forests. The lumber trade is the chief industry. The county is traversed by the Grand Rapids and Indiana and the Flint and Père Marquette R. Rs., and by the Muskegon River. Cap. Hersey. Pop. 2093.

Osceola, post-v., cap. of Mississippi co., Ark., 80 miles above Memphis, on the Mississippi River; has 2 schools, 3 churches, a newspaper, a Masonic hall, and stores. Principal business, cotton-growing. Pop. about 400. L. Roussau, Ed. "Osceola Times."

Osceola, post-v. and tp., Stark co., Ill., on the Rockford Rock Island and St. Louis R. R. Pop. 1278.

Osceola, post-v. and tp., cap. of Clarke co., Ia., on the Chicago Burlington and Quincy R. R., 156 miles W. of Burlington; has a good school system, 6 churches, 3 newspapers, 2 banks, several mills, and stores. Pop. of v. 1298; of tp. 1889. Ayres & Miller, Eds. "Beacon."

Osceola, tp. of Franklin co., Ia. Pop. 617.

Osceola, a v. of Bruenburg tp., Green co., Ky. P. 89.

Osceola, tp. of Livingston co., Mich. Pop. 1012.

Osceola, tp. of Osceola co., Mich. Pop. 137.

Osceola, post-v. and tp., cap. of St. Clair co., Mo., on the Kansas City and Memphis R. R., 105 miles S. E. of Kansas City; has 2 banks, 1 newspaper, the usual number of business houses and stores. Pop. of v. 331; of tp. 957. A. C. Appler, Ed. "Democrat."

Osceola, post-v., cap. of Polk co., Neb., located near the centre of Polk co.; has a newspaper and the usual business houses. F. P. Burgess, Ed. "Homesteader."

Osceola, post-v. and tp., Lewis co., N. Y. Pop. 688.

Osceola, post-b. (Osceola Mills P. O.) of Decatur tp., Clearfield co., Pa., on the Tyrone and Clearfield branch of Pennsylvania R. R.; has 1 weekly newspaper. Pop. 813.

Osceola, post-tp. of Tioga co., Pa. Pop. 523.

Osceola, post-v. and tp. Fond du Lac co., Wis. P. 1209.

Osceola (a corrupt form of his native name, signifying "Black Drink," conferred on account of his capacity for that nauseous draught—a capacity which was regarded as a proof of prowess), a Seminole chief, son of William Powell, an Englishman, by an Indian mother, born in 1804 near the river Chattahoochee. Osceola was early distinguished for ability, courage, and hatred of the whites; attained great influence among the Seminoles, and strongly opposed the cession of the tribal lands in Florida; in 1835 his wife, the daughter of a fugitive slave, was stolen as herself a slave, and Osceola, demanding her release of the U. S. agent at Fort King, used language which the latter resented, and the chief was put in irons. Six months later, Col. Thompson, the perpetrator of the outrage, was murdered; the battle on the Withlacoochie, the massacre of Dade, the assaults on Forts Micanopy and Drane, and other spirited actions followed, in which the Indians more than held their own against very great odds; but during a conference with Gen. Jessup, under a flag of truce, Osceola was treacherously seized (Oct. 22, 1837), and imprisoned at Fort Moultrie, S. C., where he d. Jan. 30, 1838.

Osceola Mills, post-v. of Osceola tp., cap. of Polk co., Wis., located on the St. Croix River at the foot of the famous "dalles of the St. Croix;" has 2 schools, 2 churches, 1 newspaper, and stores and mills. Principal business, lumbering and farming. Pop. 710.

Charles E. Mears, Ed. "Polk County Press."

Osch′ersleben, or **Gross Oschersleben,** town of Prussia, province of Saxony, on the Bode; has manufactures of linen fabrics, beet-root sugar, and tiles. P. 6234.

Os′co, post-v. and tp., Henry co., Ill., on the Peoria and Rock Island R. R. Pop. 1216.

Osco′da, county of Michigan. Area, 576 square miles. It is densely covered with forests, and is traversed by the Au Sable River, now famous among anglers for its fine grayling. Pop. 70.

Oscoda, post-v. and tp., Iosco co., Mich. Pop. 476.

Oscula′tion [Lat. *osculatio*], a contact of one curve with another of the highest order possible. (See Osculatrix.)

Os′culatory Cir′cle. A circle is said to be osculatory to a curve when it has a higher order of contact with that curve than any other circle. In the language of the infinitesimal calculus, it is a circle that passes through three consecutive points of the given curve. The first of these points is called the *point of osculation.* From the definition just given, it follows that a plane curve and its osculatory circle have three consecutive ordinates in common, counting from the point of osculation; consequently, the first and the second differential coefficients of the ordinates of the two curves at that point must be equal. Conversely, if a curve and a circle have one point in common, and if the first and the second differential coefficients of their ordinates at that point are equal, the circle is osculatory to the curve at that point. These conditions are sufficient to determine either the equation of the osculatory circle or the value of its radius. As the latter is of the greater practical importance, we append a general formula for finding it when the abscissa is taken as the independent variable; this formula is as follows:

$$R = \frac{(1 + q')^{\frac{3}{2}}}{q''},$$

in which R denotes the radius of the osculatory circle, q' the first differential coefficient of the ordinate of the given curve, and q'' the second differential coefficient of the ordinate, both being taken at the point of osculation. This value of R is called the radius of curvature because its reciprocal is the measure of the curvature of the curve at the point of osculation. It is to be remarked that we cannot assign to a circle a higher order of contact with a given curve than the second; it may happen, however, that it will have a higher order of contact at particular points. This will be the case at those points where the normal divides the curve symmetrically, as, for example, at the vertices of the axis of the conic sections.

In most dynamical problems, and particularly in astronomy, the time is taken as the independent variable, in which case both the co-ordinates x and y are functions of t. In this case the formula for the radius of curvature is,

$$R = \frac{(dx^2 + dy^2)^{\frac{3}{2}}}{dxd^2y - dyd^2x}.$$

In what precedes, the curves whose radius of curvature has been treated of are supposed to be plane curves, in which case the osculatory circle lies in the same plane. If the curve is one of double curvature, given by its projections on two co-ordinate planes, the most general formula for the radius of curvature is,

$$R = \frac{ds^2}{\sqrt{(d^2x)^2 + (d^2y)^2 + (d^2z)^2 - (d^2s)^2}}.$$

In this case the osculatory circle lies in the plane passing through three consecutive points of the curve, which plane is called the plane of osculation.

If a plane curve is determined by the relation between

the polar co-ordinates of its points, r and θ, its radius of curvature is given by the formula,

$$R = \frac{(r^2 + p'^2)^{\frac{3}{2}}}{r^2 + 2p'^2 - rp''},$$

in which p' and p'' are the first and the second differential coefficients of r in terms of θ. (See OSCULATRIX.)

W. G. PECK.

Oscula'trix. If two plane curves have two consecutive points in common, the straight line passing through these points is tangent to both curves at the first point, and the two curves are said to have a contact of the first order. In general, if two plane curves have $n+1$ consecutive points in common, they will have n consecutive rectilinear tangents in common, and the two curves are then said to have a contact of the nth order. If two curves have a contact of the nth order, they must have $n+1$ consecutive ordinates in common, counting from the first point, and consequently they must have n successive differential coefficients of their ordinates at that point equal to each other. Conversely, if two curves have a common point, and if n successive differential coefficients of their ordinates at that point are equal, they will have a contact of the nth order. A curve which has a higher order of contact with a given curve at a given point than any other curve of the same kind is an osculatrix. This definition, together with the preceding principles, indicates the methods of solving the following problems:

1. *To find whether two given curves have any contact; and if so, to determine the order of contact.*—Combine the equations of the curves and find the values of x and y. For every pair of real values found there will be a point common to the two curves: let there be one such point, and denote its co-ordinates by x' and y'. Differentiate the equations of the curves; find the first differential coefficients of their ordinates, and in them make x and y equal to x' and y'; if the results are equal, the curves have a contact of the first order. Then find the second differential coefficients of the ordinates of the curves, and in them make x and y equal to x' and y'; if these results are also equal, the curves have a contact of the second order. Continue this operation of differentiation, substitution, and comparison, till two differential coefficients of the ordinates are found that are unequal. Then will the order of contact be denoted by the number of successive differential coefficients that have been found equal.

2. *To find the equation of a curve which is given in kind that shall be osculatory to a given curve at a given point.*—Assume the most general form of the equation of the curve which is given in kind, and suppose that it contains n arbitrary constants. Substitute in it for x and y the co-ordinates of the given point, denoted by x' and y'. The resulting equation will express the condition that the curves shall have a common point. Find the first differential coefficients of the ordinates of the two curves, and in them make x and y equal to x' and y', and place the results equal; the equation thus found will express the condition that the two curves have a contact of the first order. Continue this operation till $n+1$ equations of condition have been found. Then combine these equations and find the values of the arbitrary constants, which substitute in the equation of the curve that was given in kind, and the resulting equation will be that of the required osculatrix.

The most general form of the equation of a straight line can always be reduced so as to contain but two arbitrary constants; hence, it is impossible to assign a contact of a higher order than the *first* to a straight line with a given curve. It may happen, however, that a straight line may have a contact of the second order, as, for example, at a point of inflexion. The most general form of the equation of a conic section can be reduced so as to contain but five arbitrary constants; hence, we may assign to a conic section a contact of the *fourth* order, but we cannot assign to it a contact of a higher order. The condition ($b^2 = 4ac$) that makes the conic section a parabola reduces the number of arbitrary constants in its general equation to four; hence we cannot assign to the parabola a contact of a higher order than the *third*. We have already seen (article OSCULATORY CIRCLE) that no order of contact higher than the second can be assigned to a circle.

It is a property of osculatrices that no osculatrix whose contact is of an odd order can cut the curve to which it is osculatory at the point of osculation, and that every osculatrix whose contact is of an even order must cut the curve to which it is osculatory at the point of osculation.

W. G. PECK.

Os'good, post-v. of Ripley co., Ind., on the Ohio and Mississippi R. R., 51 miles W. of Cincinnati; contains 3 churches, 1 newspaper, 2 limestone quarries, 1 flouring-mill, and stores. Pop. about 800.

R. N. PAPET, ED. "RIPLEY COUNTY JOURNAL."

Osgood (DAVID), D. D., b. at Andover, Mass., Oct. 14, 1747; graduated at Harvard 1771; was ordained to the Congregational ministry in 1774, and was after 1777 the minister of Medford, Mass.; distinguished as an able preacher and a zealous Federalist. D. at Medford Dec. 12, 1822. Author of *Sermons* (1824) and political addresses.

Osgood (FRANCES SARGENT), b. in Boston, Mass., June 18, 1811; married S. S. Osgood, an artist, in 1835. Her father was Joseph Lock, a merchant. She resided in England 1836–40, and while there published *The Casket of Fate* and *A Wreath of Wild Flowers from New England* (1838), the last a very successful volume of poems. Mrs. Osgood subsequently published other volumes of poetry and some books for children. Her collected poems appeared in 1849. D. at Hingham, Mass., May 12, 1850.

Osgood (HELEN LOUISE **Gilson**), b. at Boston, Mass., about 1835; was left an orphan in childhood; received a liberal education through the care of her guardian; became noted for musical ability and conversational powers; was one of the earliest organizers of soldiers' aid societies on the outbreak of the civil war; went to the army of the Potomac as a nurse early in 1862, remaining through the war; organized and directed a hospital for 1000 colored soldiers; married a gentleman connected with the Sanitary Commission; lost her health through her patriotic labors, and d. at Newton Centre, Mass., Apr. 28, 1868.

Osgood (SAMUEL), b. at Andover, Mass., Feb. 14, 1748; graduated at Harvard 1770; studied divinity, but became a merchant; was much in public life; an officer in the Revolutionary army, in which he attained the rank of colonel and assistant commissary; served in the Massachusetts legislature; was in Congress 1780–84; was first commissioner of the U. S. Treasury 1785–89; postmaster-general 1789–91; became Speaker of the New York house of assembly; supervisor in New York 1801–03; naval officer of the port of New York 1803–13; author of various works, chiefly on religious questions.

Osgood (SAMUEL), D. D., b. at Fryeburg, Me., Feb. 3, 1784; graduated at Dartmouth 1805; was pastor of the first Congregational church, Springfield, Mass., 1809–62. An able preacher, distinguished for active labors in every good work, he lived to be widely known and venerated. D. Dec. 8, 1862.

Osgood (SAMUEL), D. D., clergyman and man of letters, b. in Charlestown, Mass., Aug. 30, 1812; graduated at Harvard College 1832, and at Cambridge Theological School 1835; settled in Nashua, N. H., 1837, in Providence 1841, and in New York 1849; in 1870 left Unitarianism for the Episcopal Church, but assumed no pastoral charge. His writings are numerous: *Studies in Christian Biography* (1851); *The Hearth-Stone* (1854); *God with Men* (1854); *Mile-Stones in our Life-Journey* (1855); *Student Life* (1860); he translated from the German De Wette's *Human Life* (1842) and Olshausen's *History of the Passion* (1839); edited the *Western Messenger* two years and the *Christian Inquirer* four; has written articles in the *North American Review, The Christian Examiner, The Bibliotheca Sacra, Harper's Monthly Magazine*, besides sermons, orations, and discourses; was for many years home corresponding secretary of the New York Historical Society. Resides in New York.

O. B. FROTHINGHAM.

Osgood (THADDEUS), b. at Methuen, Mass., Oct. 24, 1775; graduated at Dartmouth College 1803; studied divinity with Drs. Lothrop and Emmons; was ordained about 1806; preached at Southbury, Conn.; was a missionary in New York and Canada; organized the first church at Buffalo, N. Y., established Sunday and day-schools and Bible societies at many places in Canada, and collected large sums for benevolent purposes. D. at Glasgow, Scotland, Jan. 19, 1852.

O'Shaugh'nessy (Sir WILLIAM BROOKE), M. D., F. R. S., b. at Limerick, Ireland, in 1809; educated at the University of Edinburgh; entered the Bengal army as a surgeon; devoted himself for many years to scientific inquiries, especially the application of medical science to engineering purposes; published numerous scientific memoirs; studied and wrote upon the subject of telegraphy as early as 1840; became in 1852 superintendent of the Indian telegraph system, which he extended throughout that vast country; was knighted 1856; was instrumental in promoting the construction of the overland and submarine lines of telegraph connecting England with India. D. in England in 1875.

Osh'awa, post-v. and warehousing port of Whitby tp., Ontario co., Ont., Canada, on the Grand Trunk railway, 33 miles N. E. of Toronto and near Lake Ontario. It has extensive manufactures of superior flour, of furniture, farm implements, machinery, steam-engines, printing-presses,

etc., and 1 monthly and 1 weekly newspaper. Pop. of sub-district 3185.

Oshawa, post-v. and tp., Nicollet co., Minn., on the Chicago and North-western R. R. Pop. 2640.

Osh'kosh, city and tp., cap. of Winnebago co., Wis., situated on the western shore of Lake Winnebago, at the mouth of Fox River, possesses an excellent system of public schools, and has the finest high-school building in the State. The city is supplied with water and gas; is the seat of the State Normal School and the Northern Wisconsin Insane Asylum. There are 40 shingle and saw-mills, 12 sash, door, and blind factories, a threshing-machine factory, and other manufacturing industries. Oshkosh has 1 daily and 3 weekly newspapers, an efficient fire department, with 3 steam fire-engines, a public and a law library. The U. S. circuit and district courts meet here annually. The city ranks second in wealth and commercial importance in Wisconsin. Pop. of city 12,663; of tp. 729. JOHN HICKS, ED. "DAILY NORTH-WESTERN."

Osh'temo, post-v. and tp., Kalamazoo co., Mich., on the Michigan Central R. R. Pop. 1594.

Osian'der (ANDREAS), whose true name was **Hosemann,** b. Dec. 19, 1498, at Gunzenhausen, near Nuremberg; studied theology at Ingolstadt and Wittenberg; became preacher at Nuremberg, and being an ardent adherent of Luther he labored with great energy for the reformation. In 1548, however, he was deprived of his office, as he would not agree to the Augsburg Interim, but he was shortly after (1549) made preacher and professor in theology at Königsberg. Here he entered into a hot controversy concerning justification, which greatly disturbed and embittered his last days. Justification and sanctification he represented as forming only one act. He d. suddenly Oct. 17, 1552. His principal works were *Harmonia Evangelica* (1537), *De Lege et Evangelio* (1549), and *De Justificatione* (1550).

O'sier [Fr.], a name properly belonging to those species of willow (such as *Salix vitellina, viminalis, rigida, rubra, angustata, triandra,* and others) which are suitable for basket-making. In England and on the European continent large areas of land are devoted to the cultivation of osiers; and at several times the attempt has been made to start the business in the U. S., but there has been hitherto comparatively small demand for the product. Care should be taken to select species which are not brittle when cured and dried. The plants are put out in rows; and if the best quality is to be produced, the ground is cultivated twice a year between the rows. Large rods are grown in Europe in copses, for hoop-poles, vine-props, charcoal, etc. No little skill is required for the profitable management of the *salicetum,* different climates, soils, and species requiring special treatment.

Osi'lo, town of Sardinia, province of Sassari, situated on a mountain more than 2000 feet above the sea, commanding a fine view, but exposed to violent winds. Pop. 5210.

Osi'mo (*Auximum*), town of Italy, province of Ancona, 11 miles S. of the city of Ancona and 9 miles from the sea. It is surrounded by an old Roman wall, and contains an episcopal, municipal, and many fine private palaces. In the municipal palace are preserved many interesting Latin inscriptions, and the library contains valuable documents of the thirteenth century. The Collegio Campana, founded in 1715, is the largest building in Osimo, and has a high literary reputation. In the various churches may be seen objects of archæological and artistic interest. The town is well supplied with charitable institutions and better provided with common schools than most Italian country towns. The inhabitants are industrious and chiefly occupied in the cultivation of grain, olives, and silk. There are ten silk-reeling establishments, in seven of which steam is employed, and raw-silk fabrics are produced on a large scale. *Auximum* was enclosed with walls by the Romans 174 B. C. Pompey used it as an important military centre, and the town continued flourishing during the early Christian period. Its mediæval history is a succession of civil wars, sieges, and change of masters. In the struggles for Italian independence since 1831, Osimo took a very active part. It has been a bishop's see since early in the fifth century. Pop. 17,086.

Osi'ris, the most celebrated of all Egyptian deities, eldest son of Seb or Saturn, and Nut or Rhea. His name was expressed by the hieroglyphs of an eye and seat or throne, and its etymology is unknown. His worship appears at the time of the fourth dynasty, but was not universally prevalent till the sixth. He belonged to the gods of the first order, and was supposed to have reigned over Egypt for 450 years. Although the details of the legend of Osiris appear at a later period, they are confirmed in a great degree by monumental evidence. He is stated to have civilized the Egyptians by teaching them the art of agriculture, and to have travelled over the rest of the world. At the age of 28, on the 17th day of the month Athor, when the sun was in Scorpio, he fell a victim to the conspiracy of his brother Set or Typhon, Aso, an Ethiopian queen, and seventy-two other accomplices. A mummy-chest which exactly fitted the size of the body of Osiris was brought into a banqueting-room and offered as a present to him whom it fitted. After all the conspirators had unsuccessfully tried it, Osiris did so, and the conspirators nailed down the cover and poured lead over it, or sealed it with a leaden seal. The body and chest were conveyed down the Tanaitic branch of the Nile to the sea. The Pans and satyrs, or rather the local gods of Chemmis, informed Isis, his sister and wife, then at the city of Koptos, and she cut off a lock of her hair and went into mourning. She then, it appears, departed to discover the child of her sister, Nephthys, who had been married to Typhon, but had given birth to a child, the issue of Osiris, and found Anubis. Hearing that the chest had been carried by the waves to Byblos in Phœnicia and lodged in a tamarisk, which, grown into a large tree, enclosed the chest, so that it could not be seen, and that the king of Byblos had made a pillar to his house out of the trunk of the tree, Isis went thither, where she so ingratiated herself with the queen as to be appointed nurse to the royal child. She suckled the boy with her finger and laid him on burning coals, while, transformed into a swallow, she hovered around the pillar at night. Discovered in these actions, she revealed herself, and obtaining, by request, the pillar, took out the chest and body of Osiris, restoring the rest to the king. She then sailed back to Egypt with them, but deposited them in a remote place while about to visit Horus at Butus. The chest was discovered by Typhon in the moonlight, who tore the body into fourteen pieces, which he scattered about the country. These Isis again sought out in a papyrus boat, and discovered all except some portions devoured by the dogs of Anubis and the fish. After this, the goddess contended with Set or Typhon for the supremacy, and Horus defeated Typhon in a battle which lasted three days and nights. (See ISIS.) When, however, Typhon was set at liberty by Isis, and Horus had torn off her diadem, for which Thoth substituted the head of the cow of Athor, Typhon accused Horus of illegitimacy, but that god was justified before the other gods by Thoth, and Typhon, after two battles, was again defeated by Horus. According also to the later legends, Harpocrates was a kind of posthumous son of Osiris by the goddess Isis. It appears from the hieroglyphs that four inferior deities, called Amset, Hapi, Tuaumutt, and Kabhsenut, were also the children of Osiris and Isis, and that Anubis was also the son of Isis, not Nephthys, as stated in the Greek legends.

In the Egyptian mythology Osiris appears to be the Pluto of the Hades or Karneter. Seated on his throne in the hall of the Two Truths, or place of the great judgment, he awards, as judge of the dead, the rewards or punishments of the future state. In this he is assisted by his sisters, Isis and Nephthys, and Thoth, the Hermes or scribe of the Hades, and his children, Horus, Anubis, and the four genii of the head, accompanied by the forty-two demons or gods who avenged the sins committed during life. Although this is his principal function, he was also allied occasionally with other deities, as Sekar or Socharis, a kind of solar Pluto, and then represented with the head of a hawk; often also depicted as the *Tat* or emblem of stability, probably alluding to the region of *Tattu*, Busiris, or the present Abusir, of which he was the lord; and is still more rarely seen wearing the lunar disk and identified with the moon. In the ritual of the dead he is said to have been justified by Thoth fourteen times before the gods of as many regions, a number corresponding with the pieces into which his body was torn and the cities to which they were distributed. His discovery and embalmment, the lamentations of his sisters at his death, and the mystical representation connected with his legend occur on monuments and papyri, especially those of a later age, which describe the reconstruction of his form by the god Chnoumis out of the mud and water of the Nile, and his embalmment by Anubis, the outer bandages with which he was swathed often having over them a net to depict that in which his body was found in the Nile, or, according to some traditions, brought by Horus transformed into a crocodile. In the ritual there is a table of one hundred and twelve different titles of this god, but his chief ones were resident, or dwelling in the west or abode of departed souls and spirits, lord of Tattu or Busiris, of Abut or Abydos, of Rusat or Rosetta, the pathway to the west, and of various other regions of the Hades. He was also called the Unnefer or Onnophris, the revealer of good things, lord of the age, eternal ruler, living lord, and similar

titles. On his head he wore the *att* crown, at the sides of which are the ostrich feathers of his truth, referring to his truth and jurisdiction over the judgment-hall of those goddesses in Hades, his hands emerging from his mummied form, holding the crook and whip, emblems of government and punishment. Dedications to Osiris appear at the time of the sixth dynasty, not earlier, at Sakkarah, but at the age of the twelfth dynasty his worship was universal; and at Abydos, where he was supposed to be buried, he was the local lord, and that cemetery the one whither the dead were transported. About the beginning of the nineteenth dynasty his name was prefixed to the name and titles of deceased persons who were thought to be like him, this title of Osiris or Osirian being prior to that time bestowed only on monarchs—a practice which continued till the latest days of paganism. At the time of the Ptolemies his worship was transferred to Philæ, where he was thought to be buried, and three hundred and sixty cups of milk were filled at the time of the appointed lamentations daily, and the most solemn oath was to swear by him who was buried at Philæ. Mysteries and festivals were celebrated to him, the most remarkable of which was the feast of lamps, held at Sais and elsewhere, and that called Paamylia, in honor of his birth, connected with the Phallophoria. Phallic figures of this god, made of barley and waxed cloth, are also found connected with the same festival and referring to his being the god who produced grain. No deity has been more difficult to explain in all Egyptian mythology, for he was thought to represent the sun, the moon, the constellation Orion, the earth, the inundation of the Nile, the principle of humidity, the reproductive power of nature, the divine beneficence, and even by some to anticipate the doctrine of the resurrection of the body, as his form and type, destruction and embalmment, make him more mortal than ordinary deities of the Pantheon. His particular office of judge of the dead after his own death was explained by his great purity causing him to be removed from earth, and the dead after the future judgment were said to be declared true or justified, as Osiris had been in the great judgment he himself had undergone. In the paintings his flesh is colored black or blue to show that he belonged to the deities of the lower world, or Hades, and he wears either the *att* crown, emblem of his jurisdiction over the dead, and the *hut* or white crown, in his character of lord of the upper world or hemisphere, or else the lunar disk, but this only at a later period. The sepulchral tablets or tombstones of the Egyptians are dedicated to him as the god who gave all the blessings of the future state to the dead, and in the eighteenth and subsequent dynasties his form is constantly seen upon them, and also upon the coffins of the mummies, especially in the judgment scene in Hades. The coffins, too, were modelled on the type of that of the god, as the mummy was supposed to be embalmed in the same manner and to represent Osiris himself. Figures of the god are found in wood, cloth, and barley, and sometimes in porcelain, but they are most common in bronze, although generally of a later age, and all collections of Egyptian antiquities abound in them. At the Greek and Roman period, especially amongst the Alexandrian Greeks, his form was replaced by that of Serapis or Pluto. So diffused was his worship in earlier times that he appears on the Phœnician coins of the group of islands round Malta, but his worship was not so universal in the days of the Roman empire as that of Isis, though it prevailed in Egypt to the last. The Greek writers of a later age regarded Osiris as the prototype of Dionysus or Bacchus, and confused the Osiris-Apis, or deceased Apis, with their Serapis, with whom, indeed, Osiris had no direct connection, as the Apis was in reality a type or avatar of Ptah. SAMUEL BIRCH.

Oskaloo'sa, post-v. and tp., Clay co., Ill. Pop. 1171.

Oskaloosa, city and tp., cap. of Mahaska co., Ia., on the Keokuk and Des Moines and the Central R. R. of Iowa; has 2 colleges, 3 public school-houses, 12 churches, 2 woollen and 2 flouring mills, 3 banks, 3 iron and brass foundries, 4 printing-offices, 3 lumber yards, gas-works, steam fire-engines, 4 weekly newspapers, an artesian well 900 feet deep, 2 planing mills, and stores. Oskaloosa is located in the best coal-region of the West. Large deposits of fire-clay and iron ore exist. Pop. of city 3204; of tp. 3387.

LEIGHTON & NEEDHAM, EDS. "HERALD."

Oskaloosa, post-v. and tp., cap. of Jefferson co., Kan., midway between Leavenworth and Topeka; has 1 academy, 2 school-buildings, 4 churches, 2 banks, 2 newspapers, and stores. Principal employment, stock-raising and manufacturing. Pop. of v. 640; of tp. 1613.

J. W. ROBERTS, ED. "INDEPENDENT."

Osman. See OTHMAN.

Os'mazome, a name given by Thénard to that portion of meat extract which is soluble in alcohol and contains those constituents of the flesh which determine its taste and smell. C. F. CHANDLER.

Os'mium [Gr. ὀσμή, "odor"], an element of matter, one of the "platinum metals;" that is, found in association in nature with platinum. Its only ore is a native compound with another metal of the same natural group, IRIDIUM (which see), forming the mineral metallic alloy called iridosmine or osmiridium, which is excessively hard, and therefore used for tipping gold pens. This native alloy contains also RUTHENIUM (which see). The methods of procuring metallic osmium and its compounds from the ore are complex and difficult. Several allotropic modifications of the metal seem to have been produced, of which the density of one, determined by Deville and Debray, = 21.4, placing this osmium among the heaviest known substances, being equalled in that respect only by two or three of the platinum and iridium allotropes. Moreover, as Deville and Debray's osmium, modified by exposure to the highest obtainable heat, was not wholly fused, it probably was still somewhat porous; and we are justified in concluding that osmium may yet turn out to be the heaviest, as it is the most infusible, of known substances. At the most intense heats it volatilizes, without fusion. In fine division it is very combustible, burning to osmic acid. Osmium is believed to be, in some of its combinations, the most poisonous also of known substances. Its compounds, when heated before the blowpipe, emit, during the combustion to osmic acid, a singular and unpleasant odor, whence the name of the element. HENRY WURTZ.

Os'mose [Gr. ὠσμός, a "push" or "propulsion"], a more general term for ENDOSMOSE (which see) and exosmose. Diasmose is another term which has been used to include the whole subject.

Osmunda. See FERNS.

Os'nabrück, town of Prussia, in Hanover, on the Hase, contains a large cathedral, a town-hall, in which the treaty of Westphalia was signed in 1648, and numerous manufactures of tobacco, chicory, soap, paper-hangings, leather, linen fabrics, and woollen cloths. Its trade is said to have declined since the enactment of the German tariff-union. Pop. 23,308.

Os'naburg, post-v. and tp., Stark co., O. Pop. 2046.

Oso'lo, tp. of Elkhart co., Ind. Pop. 922.

Osphromen'inæ, or **Osphromen'idæ** [from *Osphromenus*—ὀσφρόμενος, "tracking by smell"—the chief genus], a sub-family of Anabantidæ, or a family closely related thereto, containing the celebrated gourami. The body is oblong, compressed, and covered with scales of moderate size; the lateral line uninterrupted; the head compressed, covered with scales similar to those of the body; eyes submedian; opercula unarmed; mouth with cleft lateral and oblique; upper jaw protractile; teeth only on the jaws; branchial apertures rather narrow, the gill-membranes of both sides being connected below the isthmus, and scaly; branchiostegal rays six; dorsal fin with variable spinous and soft portions; anal longer than the dorsal; caudal separate; pectorals generally developed; ventrals thoracic. The skeleton has numerous vertebræ (in the gourami 12 + 18–19); second superior pharyngeal bones are developed; superior branchials also present, and the fourth greatly laminated and modified for the reception and retention of water; the stomach has two pyloric appendages. The group distinguished thus, especially by the pharyngeal apparatus, has been differentiated by Prof. Cope as the type of a distinct family; the genera that belong to it have not been specified, but *Osphromenus* at least is the typical one and that best known, other genera agreeing in most respects being *Trichogaster* and *Betta*, but whether they belong to the same family is uncertain. The gourami, its chief representative, is famous for the fine quality of its flesh, and has been introduced into a number of countries. All the species are natives of Southern and Eastern Asia. THEODORE GILL.

Osprey. See FISH-HAWK.

Os'seine [Lat. *os*, "bone"], the modification of GELATINE (which see) that occurs in bones, forming substantially the whole of the organic part of the bone, apart from the tricalcic phosphate, which makes up the mass of the earthy part. Osseine may be isolated in its natural state by dissolving out the earthy part of the bone with muriatic acid and long and repeated washing with cold water. It then forms, before drying, a soft elastic mass, which is insoluble in cold water, but quickly dissolves in boiling water to a solution of ordinary gelatine, undergoing, no doubt, during the boiling some chemical transformation, of molecular volume, at least, not yet investigated. Osseine forms from 40 to 45 per cent. of the weight of the bones of a human child, which proportion in an adult falls to from 35 to 40 per cent., the variations being

in bones from different parts of the skeleton, the os temporum and humerus in the adult containing least and the costal or rib bones the most. In aged persons the osseine sometimes falls so low that the bones become weak and easily fractured. HENRY WURTZ.

Os'seo, post-v. of Hillsdale co., Mich., on the Lake Shore and Michigan Southern R. R.

Osseo, post-v. of Hennepin co., Minn.

Osseo, post-v. of Trempealeau co., Wis.

Os'sian, post-v. of Wells co., Ind., on the Fort Wayne Muncie and Cincinnati R. R.

Ossian, post-v. of Winneshiek co., Ia., on the Chicago Milwaukee and St. Paul R. R. Pop. about 500.

Ossian, post-v. and tp., Livingston co., N. Y. P. 1168.

Ossian. See MACPHERSON, JAMES.

Ossification. See HISTOLOGY, OSTEOLOGY, and SKELETON.

Os'sifrage (the "bone-breaker"), a name formerly given to various rapacious birds, especially to some of the eagles and to the LAMMERGEIER (which see). The latter is believed to be the ossifrage of the Old Testament Scriptures.

Ossineke, post-v. and tp., Alpena co., Mich. P. 144.

Os'sining, tp. of Westchester co., N. Y., on the Hudson River, includes village of Sing-Sing (originally "Ossinsing"), noted for its prison, and four hamlets; has extensive marble quarries, and was included in the manor of Philipsburgh before the Revolution. Pop. 7798.

Os'sipee, post-v. and tp., cap. of Carroll co., N. H., on the Conway division of the Eastern R. R., in a picturesque region S. E. of the White Mountains. Pop. 1822.

Os'soli (SARAH MARGARET **Fuller**), MARCHIONESS, b. in Cambridgeport, Mass., May 23, 1810; daughter of Hon. Timothy Fuller, a representative in Congress 1817–25; was in early childhood a proficient in the classical languages and modern literature, but noted for eccentricities and the violence of her passions; retired from school at the age of fifteen to devote herself to solitary study; became well acquainted with the modern German classics; taught languages in Boston to private classes and in Mr. Alcott's school after the death of her father in 1835; became principal of a school at Providence, R. I., in 1837; took extreme interest in the philosophical views of R. W. Emerson and his literary associates; gave a series of *conversazioni* for ladies at Boston 1839; was in 1840 editor of the *Dial*, a quarterly magazine devoted chiefly to the propagation of the new ideas; became widely known for brilliant powers of conversation; published in 1839 a translation of Eckermann's *Conversations with Goethe*, and in 1841 the *Letters of Günderode and Bettina;* made in 1843 a journey to Lake Superior, and wrote *A Summer on the Lakes;* removed to New York in Dec., 1844; became an inmate of the family of Horace Greeley and a writer for the *Tribune*, to which she contributed most of the *Papers on Art and Literature* issued in a volume in 1846; expanded an early essay in the *Dial* into a volume entitled *Woman in the Nineteenth Century* (1845); went to Europe early in 1846; visited Rome in May, 1847, whence she wrote letters to the *Tribune;* married in December a Roman nobleman, Giovanni Angelo Ossoli; was a witness of the Roman revolution of 1848 and of the siege of Rome by the French in 1849, at which time she was appointed by Mazzini directress of one of the hospitals; embarked at Leghorn for the U. S. in the ship Elizabeth May 17, 1850, accompanied by her husband and infant son, and with them perished by shipwreck at Fire Island, near New York, July 16, 1850. An unpublished history of the Roman revolution was lost with her. A monument to her memory has been erected in Mount Auburn cemetery. Two volumes of appreciative *Memoirs* by R. W. Emerson, W. H. Channing, and James Freeman Clarke appeared in 1851. A new edition of her work on *Woman in the Nineteenth Century*, to which were added many other scattered papers on the same subject, was issued in 1855 by her brother, Rev. Arthur B. Fuller, and the same gentleman published in 1856 her collected newspaper correspondence under the title *At Home and Abroad*. A new edition of her complete works appeared at Boston in 1874.

Os'sory (THOMAS **Butler**), EARL OF, son of the first duke of Ormond, b. in the castle of Kilkenny, Ireland, July 9, 1634; fought with conspicuous valor in the great rebellion; was imprisoned for several months in the Tower by Cromwell; took refuge in Flanders; returned with Charles II., and was made lieutenant-general of the forces in Ireland 1660; aided the duke of Albemarle in gaining the celebrated naval battle of the Downs over the Dutch fleet June, 1666; was rewarded by the title of Baron Butler of Moore Park Sept. 14, 1666; was made rear-admiral and second in command to Prince Rupert 1673; led the English troops in the service of the prince of Orange 1677; contributed to the defeat of Marshal Luxembourg at Mons 1678, and perished by shipwreck July 30, 1680.

Ostade, van (ADRIAN), (1610–1685), a Dutch painter of genre, b. at Lubeck; studied at Haarlem; made his residence at Amsterdam. His pictures are common in European galleries and favorably seen in England. His works, of which nearly 400 are catalogued, represent scenes of innocent happiness in humble life, and are remarkable for sincerity of feeling, harmony of color, and correctness of drawing. His works are much esteemed by connoisseurs. O. B. FROTHINGHAM.

Ostade, van (ISAAC), younger brother and pupil of Adrian, b. also at Lubeck about 1617; his latest work bears date of 1654. His pictures represent cheerful outdoor scenes in inn-yards and village squares. They are not numerous, and are highly valued.
O. B. FROTHINGHAM.

Ostash'kov, town of European Russia, government of Twer, on Lake Salig, has extensive tanneries and manufactures of booths, axes, sickles, and scythes; also, it has important fisheries. Pop. 10,827.

Ostend', town of Belgium, province of West Flanders, on the German Ocean, has a good harbor, is fortified and neatly built, and communicates daily by steamers with London and Dover. Besides manufactures of linen, sail-cloth, and ropes, it carries on important fisheries of oysters, cod, and herrings, and is much frequented as a bathing-place. Pop. 17,159.

Osteogloss'idæ [from *Osteoglossum*—ὀστέον, "bone," and γλῶσσα, "tongue"—the best-known genus], a family of fresh-water fishes of the order Teleocephali, and sub-order Physostomi, characterized by the peculiar form and bony head. The body is more or less elongated, compressed, and covered with large hard scales composed of mosaic-like pieces; the lateral line high, little incurved from the back, and with widened mucous ducts; the head oblong, with the integument very thin, and cheeks protected, with large suborbital and postorbital plates; opercula large; nostrils double; mouth with a lateral cleft; its upper margin formed by the intermaxillaries at the middle and the supramaxillaries at the sides; teeth acute, on the jaws as well as palate; gill apertures large; branchiostegal rays numerous (8–16); dorsal and anal posterior elongated, the anal originating farther forward than the dorsal; caudal separately developed; pectorals inserted low down on each side of the throat; ventrals perfect, not very far from the head. The skeleton has numerous vertebræ (60–80). The stomach is not cœcal, but has two pyloric appendages. The family is noted for the peculiar distribution of its species. It is divisible into two sub-families: (1) *Osteoglossinæ*, in which the abdomen is trenchant, having two genera, *Osteoglossum*, represented in S. America, and *Scleropages*, with one species in several of the Philippine Islands, and another in Queensland, Australia; and (2) *Heterotinæ*, also with two genera: *Heterotis*, peculiar to West Africa and the Nile, and *Arapaima*, confined to S. America. A species (*Arapaima gigas*) of the last genus reaches a gigantic size, sometimes exceeding 15 feet in length and weighing upwards of 400 pounds. It is taken sometimes with a hook baited with small fishes, and sometimes with a harpoon. It is quite esteemed in Brazil, and sells for a high price. THEODORE GILL.

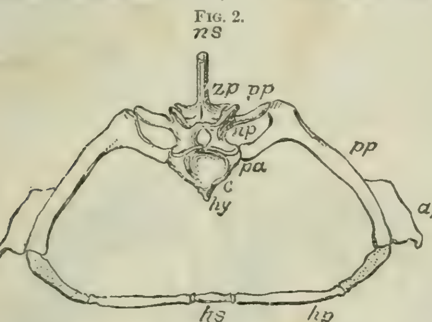
Osteol'ogy [Gr. ὀστέον, "bone," and λόγος, "discourse"], the science of the skeleton of vertebrated animals. This skeleton is composed of bone, or its cartilaginous or membranous basis, the intimate structures of which have been already pointed out in the article COMPARATIVE ANATOMY (which see). The skeleton consists either of a cartilaginous or membranous continuum, or of cartilaginous or osseous segments arranged in continuous succession, so as to form two tubes, one superior and one inferior, attached by a solid axis between them, the whole furnished with various appendages. Each axial segment is in turn composed of sub-segments, each of which arises from a separate (sometimes more than one) centre of ossification in the primal cartilage or membrane. Each primary segment of the skeleton is called a vertebra, and each vertebra is composed of the same elementary segments, some of which may be omitted, subdivided, etc., and also greatly modified in their form for the accommodation of the viscera they enclose. The superior arches or tubes protect the nervous axis of the animal, while the inferior surround the nutritive organs, or the digestive, circulatory, respiratory, and reproductive systems. The elementary segments and their modifications are exhibited in the following sections from the cranial, thoracic, and caudal regions respectively, in order to display the excessive devel-

opments of the *neural* or upper arch (Fig. 1), the *hæmal* or lower arch (Fig. 2), and of the centrum (Fig. 3), by reduction of the arches. The elements are named as follows: *ns*, neural spine: *zp*, zygapophysis; *dp*, diapophysis; *pp*, pleurapophysis; *hp*, hæmapophysis; *hs*, hæmal spine. In addition to these, there are other processes less universally present—namely, on the middle line of the centrum above, *ep*, epapophysis (Fig. 1), on the middle line below, *hy*, hypapophysis (Fig. 2), and on the side of the centrum below the diapophysis, *pa*, parapophysis (Fig. 2, represented by capitular articulation for rib). In the thoracic vertebra

Fig. 1.

Cranial segment: *c*, centrum; *np*, neurapophysis; *ns*, neural spine; *ep*, epapophysis; *pp*, pleurapophysis; *hp*, hypapophysis; *hs*, hæmal spine.

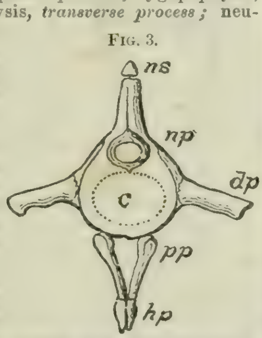
Fig. 2.



Thoracic segment from a crocodile. Letters as in Fig. 1: *zp*, zygapophysis; *dp*, diapophysis; *pa*, parapophysis; *hy*, hypapophysis; *ap*, appendage.

the segments correspond to the following special names of the bones: neural spine, *spinous process;* zygapophysis, *articular process;* diapophysis, *transverse process;* neurapophysis, *superior arch;* pleurapophysis, *rib;* hæmapophysis, *thoracic rib* or *cartilage;* hæmal spine, *sternal segment;* centrum, *body.*

Fig. 3.

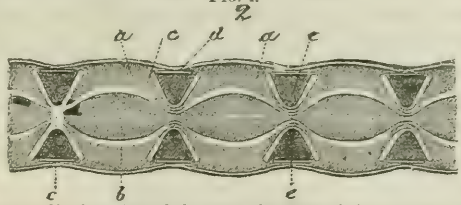


Caudal segment from dugong.

There are many peculiarities in the segments which compose the skull of Vertebrata, on which account the name of vertebræ has been denied them. Since they also present great likenesses to the vertebræ of the body in their growth-history as well as composition, they may be regarded as representing a special class of vertebræ. The limbs of Vertebrata also have received a variety of interpretations. These, when fully represented by a front pair and a hinder pair, are attached to corresponding arches, which depend from the vertebral axis, and are therefore hæmal. The pelvic arch, which bears the hinder limbs, is attached to the vertebræ, hence represents pleurapophysis (*ilium*) and two hæmapophyses (viz. *ischium* and *pubis*). That which supports the fore limbs, or the scapular arch, is not attached to a vertebral body in any class excepting that of the fishes, and then it is to the occipital or posterior segment of the skull and by dermal bones only. It has been supposed to represent a hæmal arch, embracing pleurapophysis (*scapula*) and hæmapophysis (*coracoid*). It is thus represented as shifted from its original position in all animals above the fishes. The limbs have been looked upon as lateral appendages of these arches, like the uncinate processes of the ribs (Fig. 2, *ap*), opercula of the suspensor of the lower jaw in fishes, etc. In order, however, to reach positive conclusions as to the homologies or mutual correspondences of these segments, it is necessary to examine the

Development of the Skeleton.—The spinal column will first claim attention. The germinal layer of the yolk of the egg, or blastoderm, is early marked by a linear impression, the "primitive groove." The blastoderm is divided into three layers, of which the lower or mucous stratum ultimately forms the interior lining of the alimentary canal, and the upper or serous stratum forms the cerebro-spinal nervous axis and the epidermis of the body. From the middle layer, or mesoblast, are developed the remainder of the internal organs, etc. It is the upward longitudinal folding of the upper and middle layers (epiblast and mesoblast) on each side into the "dorsal laminæ" that forms the "primitive groove." The laminæ grow towards each other and unite along the median line, forming the neural canal. The two layers are at the same time folded downwards, forming the outside of the lamina, and with the lower or hypoblast continue downwards as parallel folds, or ventral laminæ. The middle layer divides, the inner lamina, with the hypoblast, forming the alimentary canal, while the outer, with the mesoblast, form the outer walls of the abdominal cavity, or the somatopleure. In the mean time, there appears in the layers below the primitive groove a cylindrical body of large cells filled with transparent protoplasm or jelly, around which are differentiated from two to four layers, forming a sheath. This

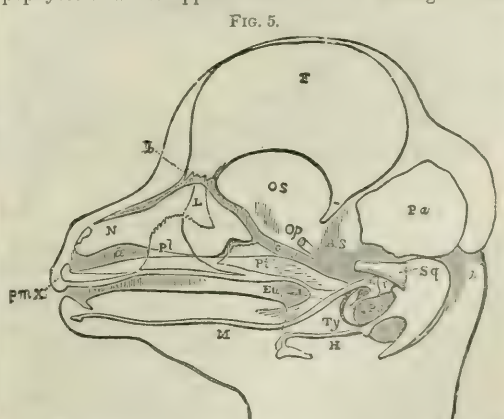
Fig. 4.



Longitudinal section of the posterior part of the vertebral column of *Heptanchus* (from Kölliker): *a*, fibro-cartilaginous part of sheath of chorda dorsalis; *b*, gelatinous chorda; *c*, osseous double cone perforated for the contracted chorda; *c'*, section of a vertebra to one side of the perforation; *d*, the external lateral osseous plates of the vertebræ; *e*, the cartilage filling the interspace of a double cone.

cylinder is the *chorda dorsalis*, which extends forwards to within a short distance of the end of the primitive groove. The portion of the groove above it is enlarged, and then bent downward in front of the chorda. There is a constriction in the horizontal portion of the now enclosed groove, or neural canal, so that three vesicles are formed, which are the concavities of the three axial segments of the future brain. The walls of this neural canal are continuous from the one end of the animal to the other. In the bodily portion of the axis, that part of the blastoderm which surrounds the chorda dorsalis early presents the appearance of sub-quadrate cartilaginous segments or bodies, which, extending, gradually enclose the chorda as rings. At the same time, corresponding segments appear in the dorsal laminæ. These are the bases of the future vertebræ, representing centrum and neurapophysis. The diapophyses and ribs appear in the form of cartilage in the

Fig. 5.



Head of a fœtal lamb, dissected so as to show Meckel's cartilage, M (from Huxley): *M*, the malleus; *i*, the incus; *Ty*, the tympanic; *H*, the hyoid; *Sq*, the squamosal; *Pt*, the pterygoid; *pl*, the palatine; *L*, the lachrymal; *pmx*, premaxillary; *N*, nasal sac; *Eu*, Eustachian tube.

somatopleure. The elements are completed by the deposit of phosphate of lime round the nutritive vessels, or the process of ossification; and they may remain distinct from each other or become co-ossified, according to the type of vertebrate. The manner of ossification of the body of the vertebra varies as follows:

I. Spinal column represented by the membranous sheath of the chorda dorsalis: class *Leptocardii* (lancelet).

II. Spinal column represented by the membranous sheath of the chorda, and cartilaginous neurapophyses and pleurapophyses: class *Dermopteri* (lamprey) and the *Chondrostei* (sturgeon, etc.).

III. Column represented by imperfect ossifications of the sheath of the chorda alone, with similar neurapophyses and pleurapophyses: certain sharks; *e. g. Hexanchus.*

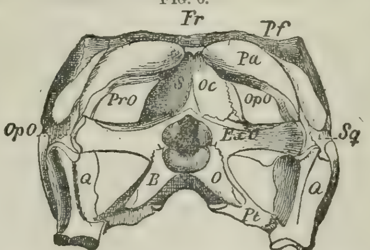
IV. Bodies of column ossifications of the proper sheath of the chorda, together with the investing sheath of blastoderm; *a*, ossification less complete: class *Selachii,* most sharks and rays; *aa*, ossification more complete: *Teleostei,* bony fishes.

V. Centra of vertebræ composed of ossifications of the external or blastodermic investment of the chorda: classes *Batrachia, Reptilia, Aves,* and *Mammalia.*

The ossification of the bodies, commencing in the circumference of the sheath, first completes a ring, which then grows inwards, constricting the chorda. The latter may be nearly or quite divided by the osseous body, and portions of it and the sheath remain between the biconcave centra as doubly-conical or globular bodies, as in the osseous fishes and many salamanders.

When cartilage appears round the chorda dorsalis, in what becomes the base of the skull, it is not segmented. It is plate-like, and sends a bar on each side round that

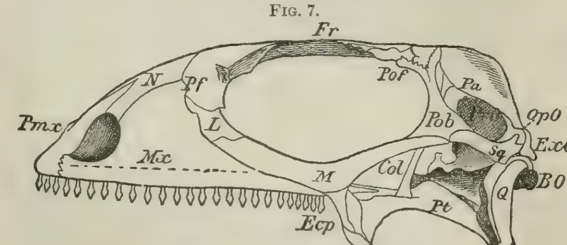
Fig. 6.



Cranium of *Iguana tuberculata*, from behind.

part of the brain cavity (hypophysis) which is decurved in front of the end of the chorda. The bars reunite in front of it, forming another smaller plate. The borders of the plates then curve upwards, forming the sides of the primordial cartilaginous skull, and, meeting above, close it in, frequently, however, leaving a vacuity in the middle line, or a fontanelle. In the cranial as in the spinal parts of the axis, cartilaginous rods appear in the inferior folds of

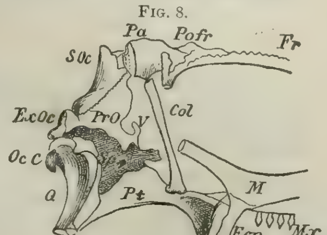
Fig. 7.



Cranium of *Iguana tuberculata*, profile.

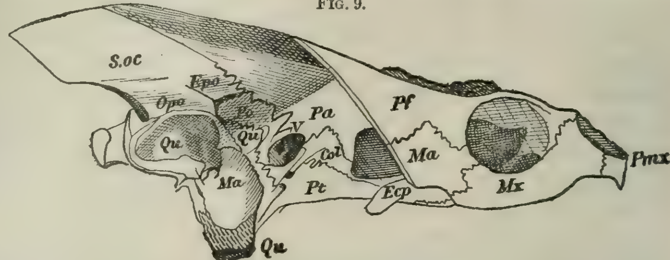
the blastoderm or somatopleure, forming the visceral arches, the upper pieces of which become the ribs. Two of these appear beneath the posterior part of the skull, which become the *hyoid arch,* and the mandibular arch or lower jaw; a third appears as nearly horizontal, extending from the base of the second to near the end of the cartilaginous skull in front. When ossification sets in, the segmentation of the skull appears. This, however, takes place under two forms: the ossific deposit may be made in the cartilage or in the membrane investing that cartilage, forming the cartilage and membrane bones of anatomists. It appears that the membrane bone represents the primary condition, and one that prevailed among the earliest Vertebrata, while the penetration of ossification to the cartilage was the mode of origin of the first cartilage bones. Hence, though corresponding ones of the cranial bones may have different origins to-day, their correspondence is not thereby

Fig. 8.



Posterior part of cranium of iguana, the arches removed.

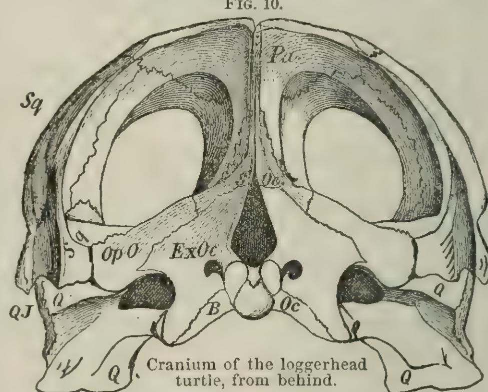
Fig. 9.



Cranium of the snapping-turtle.

destroyed. The base of the brain-case ossifies into three bones, the posterior the *basioccipital,* the next the *basisphenoid,* the anterior the *presphenoid.* The sides of the case ossify three plate-like bones, which correspond to and rest on these; namely, the *exoccipital,* the *alisphenoid,* and the *orbitosphenoid.* Closing the cranial cavity above are the three corresponding bones, the *supraoccipital, parietal,* and *frontal.* Thus, three distinct cranial segments are presented, the occipital, the parietal, and the frontal. A section of the parietal arch is seen at Fig. 1 (*n s*, parietal; *n p*, alisphenoid; *c*, basisphenoid). Of their ele-

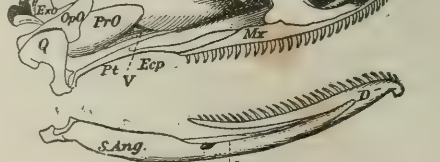
Fig. 10.



Cranium of the loggerhead turtle, from behind.

ments the parietal and frontal bones are membrane bones, the remainder cartilage bones. An extended membrane bone, the *parasphenoid,* takes the place more or less completely of the cartilage bones, forming the axis or base of the brain-case in the fishes and batrachians. In front of it is another membrane bone, which is always present, the *vomer,* which forms the axis of that part of the skull which lies in front of the brain-case. This consists, first, of the ethmoid bone, which is a flattened cylinder formed by the union of the upturned borders of the primitive cartilaginous basal plate of that part of the skull. After uniting at the top, they turn downward in the middle line, forming a vertical septum. Laminæ project into the cavities so formed, from the outer wall, on which the branches of the olfactory nerve are spread; these are the *turbinal* bones. On top of the ethmoid two membrane bones are developed, the *nasals;* at their sides behind and in front of the orbit, two other membrane bones may be present—viz. the *prefrontal* (the upper) and the *lachrymal* (the lower). We have

Fig. 11.



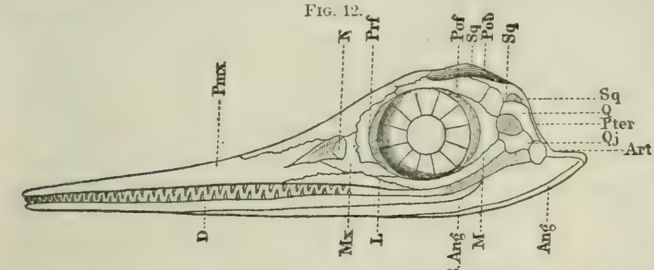
Cranium of the snake *Xenopeltis unicolor.*

then a fourth or *ethmoid* segment. It remains to consider another series of bones situated between the parietal

and occipital segments. These do not extend to the middle line of the superior or neural arch, but are developed in the cartilage in which the semicircular canals of the labyrinth of the auditory organs are embedded. The upper lateral bone, which is usually only present in fishes, is the *pterotic;* it is pierced by the external canal. Below this is the *proötic* bone, which receives the anterior canal. The posterior canal passes through a bone which is situated between the pterotic, the exoccipital, and the supraoccipital; namely, the *epiotic.* The two adjacent bones last named also support portions of its arc. A fourth and membrane bone, the *intercalare,* lies behind the proötic and in front of the exoccipital, but takes no part in the organs of hearing. Its presence is very irregular.

If we turn to the inferior or hæmal arches, we find three constantly (with a few exceptions) and several others occasionally present. The former are, beginning at the front of the skull, the maxillary, the mandibular, and the hyoid arches: the latter are the branchial arches, present only in fishes and some batrachians. The maxillary rods of opposite sides do not meet on the middle line, but the apex of the ethmoid arch is produced and its membrane ossifies on each side, forming the premaxillary bones, which in all vertebrates occupy the space between the maxillaries. The latter result from the ossification of the membrane covering the cartilage of the first visceral rods. Their inner margins

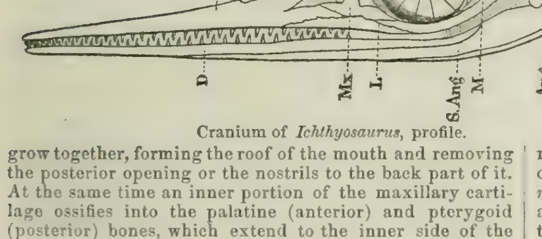
FIG. 12.



Cranium of *Ichthyosaurus*, profile.

grow together, forming the roof of the mouth and removing the posterior opening or the nostrils to the back part of it. At the same time an inner portion of the maxillary cartilage ossifies into the palatine (anterior) and pterygoid (posterior) bones, which extend to the inner side of the mandibular arch. The latter arch in its cartilaginous state is known as *Meckel's cartilage.* The part next the skull becomes separated from the rest, and is the support of the palatopterygoid cartilage. The remaining portion may be wanting, as in the lampreys (*Dermopteri*), or may remain as a movable articulated lower jaw. If these portions remain cartilaginous, we have the permanent condition seen in the sharks and rays. In bony fishes three ossifications appear in it, namely (commencing next the skull) the *metapterygoid,* the *inferior quadrate,* and the *articular.* In the membrane surrounding the latter the *angular* and *coronoid* bones appear in some; round the remainder of Meckel's cartilage the *dentary* is developed in all Vertebrata above Dermopteri. In reptiles and birds the metapterygoid and the inferior quadrate are represent-

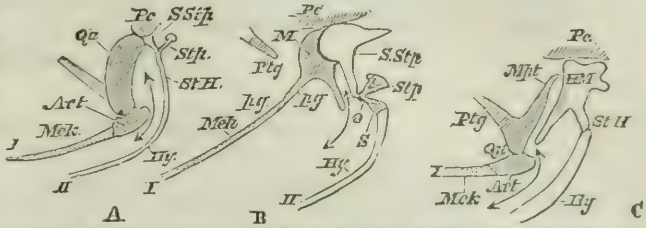
FIG. 13.



Pmx, premaxillary; *Mx*, maxillary; *Pl*, palatine; *Prf*, prefrontal; *SOr*, supraorbital; *HM*, hyomandibular; *Mt*, metapterygoid; *Op*, operculum; *SOp*, suboperculum; *IOp*, interoperculum; *PrOp*, preoperculum; *Brg*, branchiostegal rays; *Sy*, symplectic; *Qu*, quadrate; *An*, angular; *Ar*, articular; *D*, dentary.

ed by a single bone, the *quadrate,* which is the true support of the under jaw. In mammals the articular disappears, while the quadrate is drawn into the ear-chamber as the *malleus* or hammer, leaving the dentary to articulate directly with the skull. The hyoid arch also develops several osseous segments. In fishes these are called (beginning at the cranium) the *hyomandibular,* the *stapedial,* the *stylohyal, ceratohyal,* and as the middle piece below, the *basihyal.* The first-named is a large bone, and supports in part the articulation of the lower jaw through the intervention of the inferior quadrate. In reptiles it is represented by a flat plate, usually cartilaginous, attached to the stapes. In mammals it is drawn into the tympanic chamber of the ear, behind the malleus, and is known as the *incus* or anvil. The next segment is short in fishes, and in reptiles forms a rod, which abuts with an expansion like a lid against the fenestra of the labyrinth of the ear. In mammals it is entirely enclosed in the tympanic chamber, as the *stapes,* and is behind the incus. The *stylohyal* segment is united by suture with the ceratohyal in fishes; in reptiles and mammals it is cartilaginous or ligamentous, the portion next the skull in the latter being called the *styloid process.* In the lampreys, the lowest vertebrates, the palatopterygoid arch comes off from the posterior border of the ethmoid superior arch, the mandibular from the hinder part of the frontal region, and the hyoid from what corresponds with the parietal or occipital arch when ossified. The relations to the upper arches are not so definite in the higher Vertebrata.

FIG. 14.



Diagrams of the skeleton of the first and second visceral arches in lizard (A), mammal (B), and osseous fish (C). First visceral arch (I) shaded, second (II) nearly unshaded. *Mck*, Meckel's cartilage; *Art*, articulare; *Qu*, quadratum; *Mpt*, metapterygoid; M, malleus; *pg*, processus gracilis; HM, hyomandibular; arrow, first visceral cleft; *Pc*, periotic capsule; *Ptg*, pterygoid.

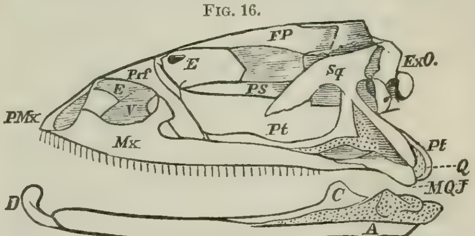
It remains to notice some membrane bones which protect the sides of the cranium, and the muscles attached to them. The maxillary carries on its posterior end a more or less flat rod, the *malar* bone, which protects the orbit below in mammals and many reptiles. On its posterior end it is joined to another piece, the *squamosal.* In mammals this piece lies like a plate on the side of the temple, and unites with the proötic and epiotic bones to form the *temporal.* In reptiles, where the ear-bones project and carry the articulation of the lower jaw away from the skull, the squamosal accompanies them and stands above the end of the quadrate, supported on the projecting rod formed of the proötic, exoccipital, etc., which is now known as the *suspensorium.* In Batrachia it lies over the length of the quadrate, and in fishes occupies a similar position on the outer face of the inferior quadrate and hyomandibular, and is known as the *preoperculum.* Other membrane bones are added; namely, the operculum and suboperculum behind it, and the interoperculum below it. The malar rod may be connected with the end of the quadrate in reptiles and Batrachia by an intervening bone, the quadrato-jugal, and with the postfrontal, completing the orbit behind in many Mammalia and Reptilia. In the latter it is usually done by the intervention of a separate bone, the postorbital, and with the squamosal through a zygomatic bone. In some Batrachia (*Stegocephali*) the space so enclosed with the median bones of the skull is roofed over by a special plate, the supratemporal. Still another bone is formed in reptiles, mammals, etc., which develops in the cartilage near the position occupied by the intercalare in some fishes; namely, the opisthotic. In mammals it unites with the epiotic and proötic to form the *mastoid* and *petrous* portions of the temporal bone. In tortoises and pythonomorphs it forms part of the suspensorium, and is very much elongated in serpents. In lizards it sends a process upward with the squamosal, which forms, with a descending projection of the posterior angle of the parietal, the parieto-quadrate arch. The zygomatic arch is the only one found among the mammals. The ethmoid arch surrounds the olfactory lobes of the brain; the frontal is in front of the optic foramen; the parietal passes before the foramen of exit of the trigeminus (5th) nerve. The otic bones extend to the vagal (10th) foramen, and the occipital to the foramen magnum.

Fig. 15.

Cranium of *Alligator Mississippiensis*, without quadratojugal arch, profile.

Special Osteology.—Attention has already been called (art. Comparative Anatomy) to the prominent peculiarities of the mandibular and hyoid arches, which distinguish the classes of Vertebrata. There are, however, very numerous peculiarities characteristic of natural divisions of these classes, to which only brief allusion can be made here. The vertebræ may be concave at both ends (*amphicœlous*), as in selachians, fishes, and Ichthyosauri, and many tailed batrachians; with ball-and-socket joint, the concavity being in the front of the body (*procœlous*), as in most tailless Batrachia and a majority of reptiles; with the cup behind (*opisthocœlous*), in the bony gar-fishes, some salamanders and frogs, a few Reptilia (?), and in the neck of many ungulate mammals. Finally, the centra are plane at both ends in Mammalia in general, and numerous reptiles, especially the extinct types Rhynchocephalia, Sauropterygia, Dinosauria, and some Crocodilia, where the ends are sometimes somewhat excavated. In Mammalia, and to a lesser degree in other Vertebrata, the vertebræ are distinguished into cervical, dorsal, lumbar, sacral, and caudal. The first are generally seven in number, and are readily distin-

Fig. 16.



Cranium of bullfrog, profile.

guished by the perforation of their transverse processes (= diapophysis + parapophysis) for the conduct of the vertebral artery. The dorsals are distinguished as furnishing the points of attachment for the ribs. These vary in structure as follows: I. A single rib-basis; *a*, exclusively on the vertebral centrum: fishes, batrachians, and some reptiles, viz. tortoises, lizards, Pythonomorpha, and serpents; *aa*, partially standing on the neural arch: Sauropterygia. II. Two separate points of rib attachment; *a*, on the centrum only, Reptilia, Ichthyopterygia; *aa*, the lower (capitular) articulation on the centrum, the upper (tubercular) on the diapophysis, which springs from the neural arch: reptiles (Crocodilia, Dinosauria, "Anomodontia," Pterosauria), birds, and mammals. The lumbar vertebræ succeed the dorsals, and are distinguished by the absence of rib articulations; but the ribs extend to the sacrum in some Crocodilia (Belodon), Dinosauria, Anomodontia, and birds. The sacral vertebræ are usually co-ossified into a single mass, the sacrum, with very massive diapophyses for sutural attachment to the iliac bones or pelvis. They are numerous in the birds, less so in the Dinosauria (Agathaumas has eight), four to six among mammals with well-developed hind limbs. There are three or two in reptiles with hind limbs, while in any of the orders where these members are small or rudimental a single vertebra serves the same purpose. The caudal vertebræ are distinguished among Vertebrata below the mammals by the presence of the chevron-bones (see Fig. 3, *pp*, *hh*) on the inferior surface. They are present in Cetacea (whales), Edentata, some rodents, etc. among Mammalia.

The ribs present a general similarity except in their proximal attachments, as already pointed out. They articulate in the thorax with the median bones of the breast or sternum in all above the fishes, and usually remain separate for the remainder of their length. An exception, however, occurs in the tortoises, where they are so widened as to unite by their borders into a more or less complete shield, which protects the entire visceral cavity, and into which, in many species, the head, tail, and limbs may be withdrawn. In birds, crocodiles, and Rhynchocephalia there are recurved processes on the ribs pointing backwards, the "uncinate processes." The thoracic ribs are united by segments on the middle line below, which, taken together, constitute the sternum. The hæmal element of the ribs is wanting in fishes, serpents, Ichthyopterygia, Sauropterygia, tortoises, and (?) Pythonomorpha; the sternum is absent in the same groups, so far as known. The first appearance of the sternum is in the Batrachia, where a cartilaginous plate behind the shoulder-girdle represents it in the tailed and many of the tailless forms. In some of the latter it becomes an osseous rod, and in some extinct Stegocephali is a bony, shield-like body. In Lacertilia, Pterosauria, and probably Dinosauria, it is a broad plate behind the coracoid bones. In birds it is of similar form in the most reptile-like forms, as the apteryx, ostriches, etc., but is peculiar in the possession of a produced process on each side in front (costal process). This is frequently ossified from a separate centre (protosteon), while the main shield originates from a centre on each side, the pleurosteon, and sometimes from two others behind these, the metostea. In all existing birds besides the ostriches there is a middle centre of ossification, the lophosteon, which when ossified is a prominent keel extending along the length of the sternum. The metostea are frequently produced as separate lateral rods, and in nearly all birds the hinder margin of the sternum is variously incised. In Crocodilia the sternum exists as a small shield in front, and a prolongation from it backwards on the median line. This brings us to the form seen in the Mammalia, where it defends the middle line of the thorax as a series of segments which may number from two (Echidna) to thirteen (two-toed sloth). In the whales it is represented by an oval or cruciform bone, and its posterior segment in other mammals is a spatulate cartilage or bone known as the xiphisternum.

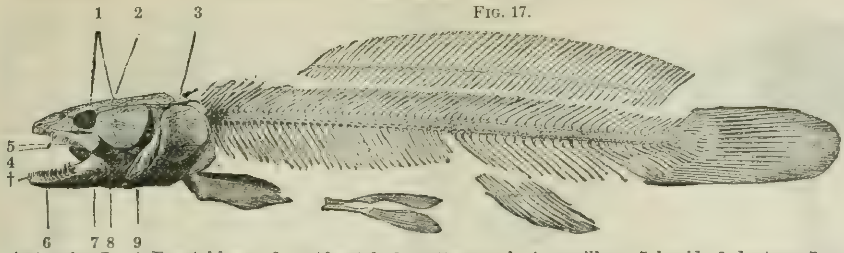
There are various *dermal* ossifications found behind the sternum and hæmapophyses in different Vertebrata. These consist, in many Stegocephali, of osseous rods arranged *en chevron*, with the angle anteriorly directed. Similar pieces, with the addition of lateral ones, exist in ichthyopterygian, sauropterygian, crocodilian, and rhynchocephalian reptiles. In tortoises these extend below the shoulder-girdle in front and the pelvic arch behind, and unite together into the solid inferior plate or plastron. This is connected with the ribs by a series of membrane bones, the marginals, which also extend all round the free margin of the upper shell or carapace. The dermal pieces of the plastron are the two clavicles, the interclavicle between them, the two hyosternals, the two hyposternals, and the two postabdominals.

The scapular arch in vertebrates is composed of both cartilage and membrane bones. Like the pelvic arch, it appears as a cartilaginous rod in the somatopleure of the fœtus, often extending in its fold to near the point of contact above the vertebræ on the median line. If development proceeds, the upper part of this cartilage becomes segmented off, forming the scapula, while the lower portion becomes bifurcated into the coracoid and procoracoid bones. From the junction of the three, the cartilaginous basis of the fore limb appears. Above the scapula another segment is usually present, the suprascapula. The dermal bones relate to the cartilaginous as follows, appearing on their anterior and outer faces, viz.:

Epiclavicle	Suprascapula.
Mesoclavicle and clavicle	Scapula.
Clavicle	Præcoracoid, Coracoid.
Interclavicle	Epicoracoid.

The fishes differ from other vertebrates in having another membrane bone, the post-temporal, connecting the epiclavicle with the cranium at the epiotic bone. This is wanting in sharks, where the arch is cartilaginous and

Fig. 17.



Amia calva, L.: 1, Frontal bone; 2, postfrontal; 3, posttemporal; 4, maxillary; 5, hyoid; 6, dentary; 7, angular; 8, interoperculum; 9, branchiostegal rays.

without laminiform membrane bones. In many fishes there are membrane bones which extend in a bar backwards and downwards from the clavicle; namely, the first, second, and third postclavicles. There may also be a cartilage bone behind the coracoid, the postcoracoid. The following scheme will express the leading characters of the classes and orders in the structure of the scapular arch:

A. Arch suspended to cranium by post-temporal.

1. Scapula, coracoid, and sometimes procoracoid osseous; epiclavicle and clavicle osseous; suprascapula cartilaginous; interclavicle generally double when present: *Pisces.*

A A. Arch not suspended to the cranium; no laminiform dermal bones.

1. Arch cartilaginous: *Selachii.*

2. Coracoid and scapula osseous; suprascapula and procoracoid cartilaginous: *Batrachia Urodela.*

3. Coracoid and scapula, suprascapula and procoracoid osseous: *Batrachia Anura.*

A A A. Arch not suspended; laminiform dermal bones present (except Chamæleo).

1. Scapula and coracoid only ossified: *Lacertilia Rhiptoglossa.*

2. Interclavicle only ossified membrane bone: *Crocodilia.*

3. Clavicle and single interclavicle of membrane, and scapula, procoracoid and coracoid of cartilage, all osseous.

a. Clavicle and interclavicle united with plastron; epicoracoid cartilaginous: *Testudinata.*

a a. Clavicle and interclavicle free; epicoracoid cartilaginous: *Ichthyopterygia, Lacertilia.*

a a a. Clavicle and interclavicle united with a short procoracoid, forming furcula; epicoracoid not osseous; suprascapula co-ossified with scapula: *Aves.*

a a a a. Clavicle and interclavicle distinct; epicoracoid osseous; procoracoid wanting: *Mammalia Monotremata.*

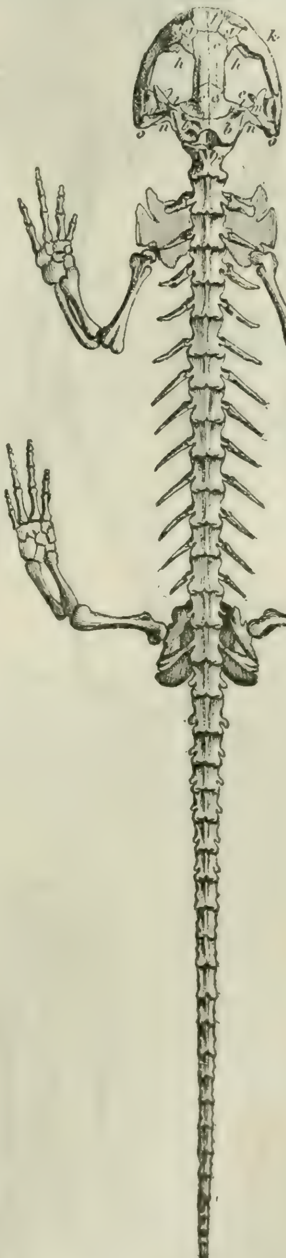
A A A A. Arch not suspended; both membrane and cartilage bones; coracoid rudimental or wanting.

a. Clavicle united with mesoscapula and procoracoid into one bar; epicoracoid and suprascapula rudimental or wanting: *Mammalia.*

The cartilage forming the limb-bones appears early in a fold of the outer skin, and in the Vertebrata above the fishes is soon divided by transverse interruptions into three segments. In Dipnoi or the Lepidosirenidæ this cartilage is broken up into many successive joints. In Ceratodus a branch segment is given off at the end of each of these primary joints, but in sharks and fishes, most of the segments diverge from one side only. The basal and the first and second of the one side are especially enlarged in the sharks, forming the *propterygium*, *mesopterygium*, and *metapterygium*, from which numerous cartilaginous radii arise, forming a triangular fin. The extremital parts of the fins are dermal, and embrace the ends of the cartilaginous rods. In true fishes the propterygium is wanting, and the radii of the first cross-row, either cartilaginous or osseous, enter between them and reach the scapular arch. The upper radial unites with the mesopterygium to form the first ray of the fin, often a strong spine; the remainder usually number four, of which the lower, like the others in shape, nevertheless is the metapterygium. They are subquadrate in the higher fishes, but much elongate in the Pediculati, where the number is reduced to three and two.

In Vertebrata, from the Batrachia up, the limbs, both fore and hind, are early divided into three principal segments. In the anterior, the first presents a single bone, the humerus; the second, two parallel bones, the ulna and radius, and thirdly the foot. This consists of two transverse rows of small bones, the carpals, and from three to five rows of longer bones, the phalanges, arranged in typically five ray-like lines or digits, the basal segments of which are called the metacarpals. Typically, there are three bones in the first transverse row of carpals and five in the second, with a median bone enclosed between the rows, a condition seen in various batrachians and reptiles. In higher classes these bones are variously combined or omitted. The bone next the radius is the scaphoid, the next the lunar, the next the cuneiform; in the second row the first is the trapezium, the second trapezoides, third magnum, while in mammals the fourth and fifth are combined and called the unciform; the centrale is probably united with some of the other carpals. In Ichthyopterygia the bones of the fore and hind limb beyond the humerus and femur are of similar shape, but though undistinguishable as to form are proximally of the usual position and number. In birds there are never more than three digits of

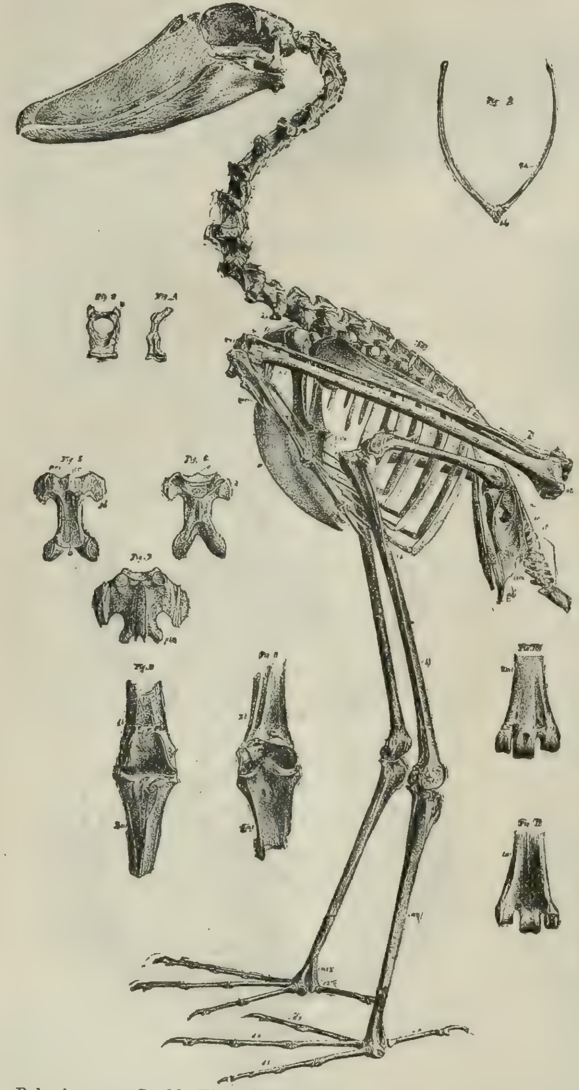
Fig. 18.



Salamandra maculosa, L.: *b*, exoccipital: *c'* parietal; *c*, frontal; *e*, pterygoid; *f*, premaxillary; *g*, nasal; *h*, prefrontal; *k*, maxillary; *l*, prootic; *m*, squamosal; *n*, opisthotic; *o*, quadrate.

the fore foot, in the Apteryx and Casuarius only one. These answer to the first, second, and third of the ordinary foot. The metacarpals are co-ossified in all birds excepting the

Fig. 19.



Balæniceps rex, Gould: Fig. 2, hyoid arch; Fig. 3, atlas from behind; Fig. 4, atlas, profile; Fig. 5, ninth cervical vertebra from below; Fig. 6, same from above; Fig. 7, middle dorsal vertebra from above; Fig. 8, posterior view of tibio-tarsal joint; Fig. 9, anterior view of do.; Fig. 10, distal end of tarso-metatarsus, front view; Fig. 11, same from behind.

extinct Archæopteryx. In Mammalia of the order Cetacea the ulna and radius are immovably fixed in a single plane with the carpus and manus, and not flexibly articulated with the humerus, thus resembling the aquatic reptiles (Sauropterygia). In higher orders the radius possesses greater or less power of rotation on the ulna, which is especially developed in apes and man. In proboscidians the proximal end of the radius is moved outwards above the ulna, so as to cross it obliquely. In Perissodactyla (odd-toed) and Artiodactyla, the ulnar attachment to the carpus is more and more reduced, until the radius, appropriating the larger part, extends almost entirely in front of the ulna. The latter becomes in the horse and ruminants, very slender and co-ossified with the radius. In the carpus a bone develops below the tendon of one of the flexors of the foot, which articulates with the cuneiform, called the *pisiform*. In five-toed orders the carpals are usually distinct, excepting in the Carnivora, where the scaphoid and lunar are generally co-ossified. In the Artiodactyla the number of toes is regularly reduced from four to two, and the number of carpals is reduced correspondingly in the second row, those of the first being narrowed. In the most specialized Ruminantia the trapezium is wanting, and the trapezoides and magnum are confluent. The outer digits become smaller and disappear, while the two middle metacarpals, representing the third and fourth, co-ossify into the single "cannon-bone." In the living types the third metacarpal supports the whole width of the trapezoides and magnum, while in the extinct family of the Anoplotheriidæ it articulated with the magnum only. The last phalange in Carnivora, Insectivora, bats, rodents, etc. is compressed, and with its complete horny sheath forms a claw; in ungulates it is broad, with two posterior faces, the terminal of which support the weight of the animal; the horny covering does not enclose it behind, and forms a hoof. In apes and men the last phalange is flat, and supports a flat horny nail.

Fig. 20.

Tapirus, fore foot: *s*, scaphoid; *l*, lunar; *p*, cuneiform; *t*, trapezoides; *m*, magnum; *u*, unciform.

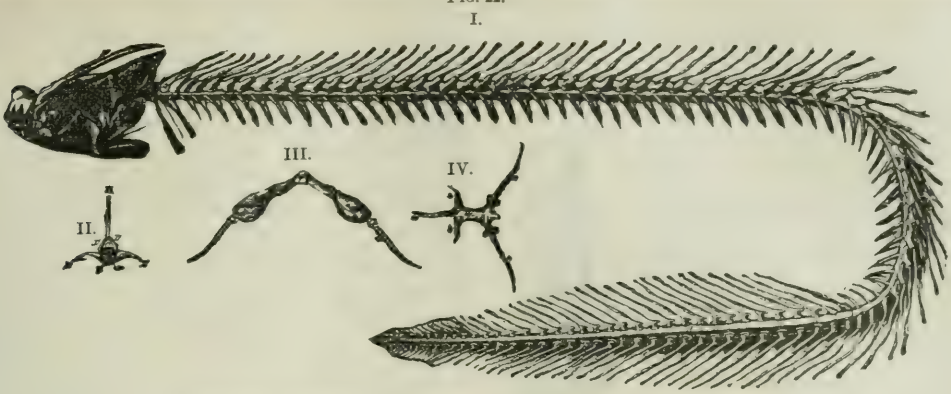
Fig. 21.

Cervus, fore foot: lettering as in Fig. 20.

The *pelvic* arch is composed of the single superior element, the *ilium*, and the two inferior ones arranged as limbs of a fork, the anterior, the *pubis*, the posterior, the *ischium*. The ilium corresponds with the scapula, the pubis with the procoracoid, the ischium with the coracoid, and the osseous bar, that usually connects the latter two, with the epicoracoid. The ilium generally presents a crest forward, from which a strong ligament descends to the end of the pubis, which represents the clavicle. It is the Poupart's ligament of human anatomy. Fishes, however, do not possess a pelvis, with two exceptions, those of the Lepidosirenidæ and of the Holocephali. In the former there is a single median diamond-shaped cartilage, to which the limbs are attached, whose homology is unknown. In the latter there is a flat curved cartilage extending forward from the basis of each fin on each side, which occupies the position of the pubis. Another and serrate cartilage is attached to its anterior margin in the male, which projects into an open pouch, from which it can be protruded. A cartilaginous rod succeeds the pubic bone as the basal element of the posterior limb. In the Dipnoi this is followed by others, forming the segmented ray representing the ventral fin. In Ceratodus each segment is furnished with a short divergent sub-segment on each side; but in the sharks and rays the sub-segments or radii are all on one side. In these animals the axis is much shortened, so that the radii are packed closely together on the basal piece; the first radius also is enlarged, forming an opposite border of the fin. In the rays the latter is much enlarged, and supports radii indistinguishable from the others. In Polypterus the basal element, or femur, is deprived of rays, except at its extremity, and they, as in the sharks, support the dermal fin-rays proper. In sturgeons the radial bones are present in the ventral fins only, but in Lepidosteus and Amia one or two very small rudiments remain, and the dermal fin-rays are attached immediately to the femur, as is the case with all the true fishes. In sharks the axis is developed into some peculiar and complex organs, the claspers, which bear some resemblance to the hinder limbs of terrestrial Vertebrata.

The three pelvic elements are remarkably constant in all the land vertebrates, the most marked variations being seen in the Batrachia Anura and the Dinosauria and Aves. In the former the ilia are much elongate and extended backwards to the acetabula, round which the ischia and pubes are compacted in a solid mass. In Dinosauria Goniopoda, the ischia are slender and unite into a dense osseous rod, which served as a support when in a sitting position (*e. g.* Megadactylus). In those of the order where the pubes are known, they are turned backwards beneath the ischia, are slender, and not united distally. They are similar in position in the birds, except in the ostriches, where they are united distally. The ischia in birds are slender and not distally united, but often co-ossified with the ilia.

Fig. 22.

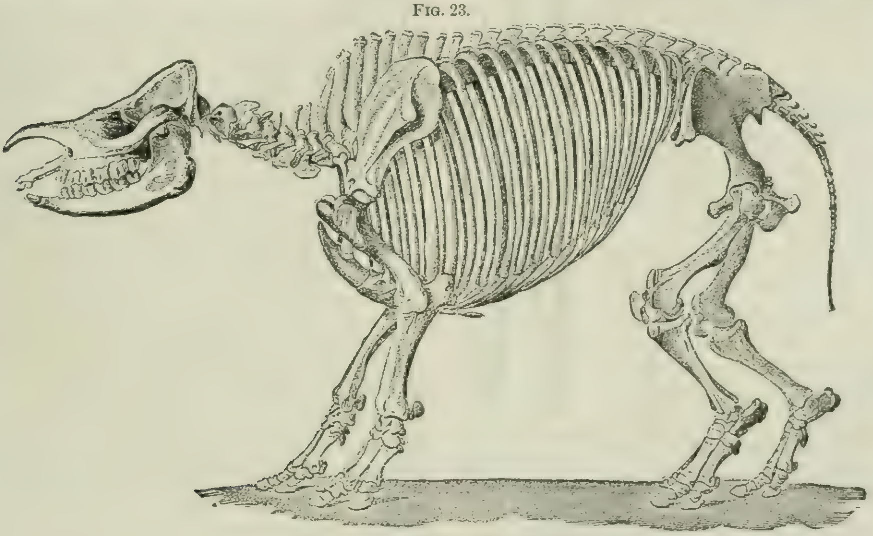


Lepidosiren paradoxa (I.); II. a vertebra; III. pelvis; IV. pectoral arch.

The latter are very much extended fore and aft, embracing many vertebræ as sacrum which belong to the lumbar and caudal series. They frequently meet over the neural spines, completing the pelvic arch above. In Dinosauria the ilium is usually elongate, as much so as in some birds in Agathaumas, but is shorter in others. The acetabulum is perforated and not completed at the fundus in this order and the birds. In Crocodilia the pubes are not united on the middle line below, but are directed forwards. In the marsupial mammals the pubes support a pair of bones directed outwards and forwards, the marsupial bones, which are ossifications of the tendons of the external oblique muscles. In Mammalia the pubes and ischia are in contact on the middle line below, and are sometimes extended posteriorly on the peduncles of the ilia.

The *hinder limbs* are wanting in Leptocardii, Dermopteri, and several orders of true osseous fishes collectively called Apodes or eels. In most other fishes they occupy the usual position on the abdomen, but in the Physoclysti they are placed beneath the pectoral limbs, or nearly so, the femoral bones being more or less united and suspended from the symphysis of the coracoids. In Plectognathi they form a simple rod, which is generally deprived of fins. In Batrachia the hind limbs are constituted like the fore limbs, and therefore embrace one bone in the first segment, *femur;* two in the second, *tibia* and *fibula;* three in the third, *tibiale, mediale,* and *fibulare;* five in the fourth, from which are continued the five metatarsals and series of phalanges. These correspond with the elements of the fore leg as follows: femur to humerus; tibia to radius in front, and fibula to ulna behind. These relations are maintained so long as the limbs extend horizontally without twist, either in paddles, as in Ichthyopterygia, or terrestrial animals, as salamanders. In most vertebrates the first bones are twisted in opposite directions, that is, towards each other, the knee pointing forward, the elbow backward, which causes an apparent reversal of the homologies of the two bones of the second segment. In the hind foot of the higher Vertebrata, especially the mammals, the tibiale and intermedium form the single astragalus, while the fibulare is produced backward, forming the heel-bone or calcaneum. The centrale becomes the navicular, while the fourth and fifth of the second row unite to form the cuboid. In the reptiles these bones are less distinctly constituted, and various modes of combination present themselves. In the Dinosauria the astragalus and calcaneum are often co-ossified, and may be united, by suture or co-ossification, with the tibia. In the birds the latter case always prevails, and the fibula, being much reduced, does not extend to the articulation. In reptiles and birds, then, the ankle joint is between the two rows of tarsals, while in Mammalia it is between the tibia and astragalus. The number of toes is usually four and five in the Batrachia and reptiles; among birds it is usually four, the inner being turned backwards and reduced in size, and sometimes wanting. The metatarsals of the three remaining toes are co-ossified with each other and with the second row of tarsal bones. In Mammalia the normal number of digits is five, but is often reduced to four. Among ungulates the hippopotamus displays four; the lateral ones are reduced in the hog and the Tragulus, till in the Poëbrotherium they are reduced to rudiments, two only remaining. These are united into a solid "cannon-bone" in the Ruminantia, which supports two distinct toes. In the rhinoceros there are but three toes, of which the central is the largest; the laterals are successively reduced in the horse series, composed of such genera as Anchitherium and Protohippus. In ruminants the navicular and cuboid bones are united, and

Fig. 23.



Rhinoceros? Javanicus (from Cuvier).

Fig. 24.

Posterior foot of *Rhinoceros*: *a*, calcaneum; *b*, astragalus; c, cuboid; *d*, navicular; *e*, mesocuneiform; *f*, ectocuneiform; *g*, fourth; *h*, third; *i*, second toe.

often the second and third of the second row or cuneiforms with each other and the naviculo-cuboid.

It remains to notice the peripheral ossifications of fishes and a few appendages of other Vertebrata. In the archetypal fin each neural spine and each hæmal behind the abdominal cavity, supports an additional bone called an interneural, and the latter another bone, the basal radial. This is the case in a large portion of the unpaired or peripheral fins of the Dipnoi. These radial bones support the fin-rays, which are developed in the dermal fold that represents the fins in the early stages. The vertebræ in the Dipnoi and a number of other fishes gradually diminish in size to the end of the tail, forming a type called the protocercal. In other fishes the hæmal spines of the last vertebræ are largely developed, forming the principal part of the basis of the caudal fin. In these the vertebral axis turns upward to the end, forming the type called heterocercal, which is seen in sharks, sturgeons, and some bony fishes. In the majority of osseous fishes the terminal vertebræ are wanting, and the greatly expanded hæmal spines extend round its end, forming a fan. This is the homocercal tail. In the bony fishes the radial bones are usually wanting, but in some cases rudimentary; they are long in the anal fin of Amia. In Polypterus they are very elongate, and each supports a number of cartilaginous rays, the posterior from the end, but the more anterior from the posterior side, forming the vertical pinnules of that genus. In higher fishes the interneurals, which support the dorsal, and the interhæmals, that support the anal fin, are more numerous than the vertebræ they are opposite to. In many fishes there are interneurals between the cranium and dorsal fin which support no fin.

Fig. 25.

Diplopus, hind foot (from Kowalevsky): *Cal*, calcaneum; *As*, astragalus; *nav C*, navicular; *Cb*, cuboid; C^3, ectocuneiform.

Horn cores are developed on the crania of various species of Mammalia, especially the Eobasiliidæ among Proboscidia, *Titanotherium* among Perissodactyla, and the Ruminantia among Artiodactyla. They are permanent except in the Cervidæ among ruminants, where they grow and are shed annually, leaving a basal portion, the burr, attached to the frontal bones. They are often of large size and grow with incredible rapidity.

List of authorities in general departments: Cope, *On Osteology of Fishes, Batrachia, and Reptilia, especially Lacertilia;* Cuvier, *Ossemens Fossiles;* Flower, *Osteology of Mammalia;* Gegenbaur, *On Limbs and the Shoulder and Pelvic Girdles;* Huxley, *Elements of Comparative Anatomy*, and *Anatomy of Vertebrated Animals;* Kölliker, *The Development of the Vertebral Column;* Owen, *Anatomy of Vertebrate Animals; Homologies of the Vertebrate Skeleton;* Parker, *Anatomy of the Shoulder Girdle; Development of the Skull in the Ostrich Tribe, the Pig, Frog, Eel, and Salmon;* Vrolik, *On the Ossification and Bones of the Skull of the Teleostei.*

E. D. Cope.

Os′terhaus (Peter J.), b. in Prussia; formerly an officer in the Prussian service, he emigrated to America and settled in St. Louis, Mo. On the outbreak of the civil war he accepted a major's commission in the 2d Missouri Vols., of which regiment he became colonel, participating in the battle of Wilson's Creek and Pea Ridge; promoted to be brigadier-general of volunteers June, 1862, he commanded a brigade in the 13th Corps at capture of Arkansas Post, siege and capture of Vicksburg, and in the 15th Corps at Chattanooga, Missionary Ridge, and operations resulting in capture of Atlanta, having been promoted to be major-general in July. In Sherman's "march to the sea" he commanded the 15th Corps from Atlanta to Savannah; subsequently, as chief of staff to Gen. Canby, he received the surrender of Kirby Smith May 26, 1865; mustered out Feb., 1866.

Os′terode, town of Prussia, in Hanover, on the Sose, at the foot of the Hartz Mountains, has breweries, distilleries, and manufactures of white-lead, linen and cotton-goods, and metallic wares. Pop. 5090.

Os′tia, an old Roman town, situated on the left side of the mouth of the Tiber, about 18 miles from the city of Rome. Ancient writers agree in stating that it was founded by Ancus Martius as a maritime station for his capital, but it was not until the wars with Carthage that it became important as a port for the introduction of foreign grain. From that time it grew rapidly, and was soon the principal commercial and naval station of the Romans. The harbor, however, was never a really good one, and in the reign of Claudius it was already so shoaled up by deposits from the Tiber as to necessitate the construction of an artificial basin about two miles to the N. This was called *Portus Augusti*, afterwards *Portus Trajani;* but the new town which grew up around it (*Portus* or *Portus Urbis*) never equalled the old one in size and opulence. Ostia began to decline with the declining empire, and early in the ninth century was a heap of ruins. Gregory IV. then tried to rebuild it, but without success; and later popes have made similar fruitless attempts. Fine statues and other works of art are often disinterred here, and recent excavations have disclosed extensive warehouses and other commercial and public structures, whose foundations and lower stories remain to witness to the former greatness of this ancient city. These ruins and the crumbling old mediæval walls and fortress offer a picturesque aspect to the visitor, and a few scores of men and women engaged in the manufacture of salt, like the first colonists of Ancus Martius, still linger about this desolate and pestilential spot. Ostia was an episcopal see at the beginning of the fifth century, and the title bishop of Ostia and Velletri is now given only to the dean of the Sacred College, resident in Rome.

Osti′glia [anc. *Hostilia*], town of Italy, province of Mantua, on the left bank of the Po. It is a place of much industry, and great quantities of silk are produced here, but the terrible inundations from the Po to which it is subject greatly interfere with its prosperity. Ostiglia appears in history before the Christian era, and is supposed by some to be the birthplace of Cornelius Nepos. Pop. 6829.

Ostraciont′idæ [from ὄστρακον, a "shell"], a family of teleost fishes of the order Plectognathi and sub-order Ostracodermi, distinguished by the trunk-like case in which the body is enclosed. This case is more or less angulated along the back and sides, and is formed by the coalescence of hexagonal osseous plates; the head is continuous with the body and encased in the same armature, being only separated externally by the small branchial apertures; the opercula are thus concealed from view; the mouth is small, the upper jaw formed by the intermaxillary and supramaxillary bones, which are coalescent with each other; the teeth slender and in a single row on each jaw; branchial apertures narrow slits in front of the pectoral fins; branchiostegal rays concealed within the case; the dorsal and anal fins are small and posterior, the latter farther behind than the former; caudal fin well developed; pectorals normal; ventrals entirely wanting. The family includes a number of species, which are popularly known under the name of trunk and box fishes, and which are all closely related to each other, although by some authors they have been differentiated into several genera. They are mostly confined to the tropics, although sometimes they wander beyond. One species, *Ostracion* (*Lactophrys*) *trigonus*, occasionally visits our own coasts. Theo. Gill.

Os′tracism [Gr. ὀστρακισμός, from ὄστρακον, a "shell, potsherd, or tile"], a form of temporary banishment which once prevailed in ancient Athens and some other Greek cities (Argos, Megara, Miletus). The Athenian senate and ecclesia having decided that ostracism was necessary in the case of any citizen, the ten tribes voted upon the question in the agora. Each voter in favor of the ostracism presented a tablet or shard of burnt clay, on which was written the name of the person to be banished. If there were 6000 votes for it, the person ostracised was obliged to leave the state within ten days and not return for ten years unless recalled. Ostracism was not a penalty for crime, but was employed against persons supposed to possess dangerous power. The exile retained his property and social position. In Syracuse the olive leaf was used instead of the clay tablet, and the act of exile was called *petalism.*

Ostræ′idæ [from *Ostræa*, the ancient name of the oyster], a family of the class Conchifera and order Monomyaria, typified by the common oyster. The animal has a mantle, with its opposite lobes separate; the margins finely fringed; no ocelli; the gills double, nearly of a size, posteriorly united together with each other and with the mantle lobes, thus forming a complete gill-chamber; the palpi triangular and connected round the mouth by a plain membrane; the foot is obsolete, the sexes distinct. The shell is quite irregular, variable in form, and more or

less inequivalve as well as equilateral, with the beaks greatly varying, being in some straight and very small and in others in one valve greatly produced, and even subspiral; the hinge is toothless; the ligament internal; the muscular impression central or subcentral (*i. e.* somewhat behind the centre); the pallial line simple and indistinct. The family thus distinguished include the famed oysters of Europe and America and many related species in other seas. Representatives early appeared on the surface of the globe, species being preserved in rocks as early as the Carboniferous period. Three genera are generally recognized as members of the family: (1) *Ostræa*, which has survived from the Carboniferous to the present time; (2) *Gryphæa*, which existed during the Triassic and Cretaceous epochs; and (3) *Exogyra*, which is characteristic of the later Oolitic and Cretaceous epochs. (See, also, OYSTER.) The so-called pearl-oysters have no near relationship with the true oysters, but belong to the family PTERIIDÆ (which see). THEODORE GILL.

Os'trich, the *Struthio camelus*, the largest of living birds, belonging to the order Ratitæ, and a native of South-western Asia and of Africa. It is represented in South America and Australia by several similar but smaller birds. (See CASSOWARY, EMU, NANDU.) The male ostrich is sometimes 8 feet high and may weigh 300 pounds. It is an extremely swift runner, but has no power of flight. It strikes severe blows with the foot. It is gregarious and polygamous, the wives of one male laying their eggs together in one nest; by day they are exposed to the sun's heat, but at night incubation is kept up until the greater part of the eggs are hatched. Ostriches are now domesticated and bred in considerable numbers in the Cape Colony for the feathers, oil, and eggs, and to some extent for the flesh, which is palatable if the bird is young, and have lately been introduced into California for the same purpose, but more especially for their plumes. These are assorted with great care, and bring various prices, according to shape, size, and quality. The coarse plumes used for feather-dusters are largely those of the nandu, or American ostrich. The ostrich has a remarkable habit of swallowing stones, iron, bits of leather, and the like—a habit shared by many other birds. These hard substances assist in the trituration of food in the gizzard. The ordinary food of the ostrich is grass, leaves, grain, and seeds, but it does not altogether reject animal food. According to general acceptation, it is a stupid animal, and the Arabs even have a proverb, "Stupid as an ostrich." As evidence of its stupidity, it is related that when hunted it thrusts its head into a bush, and imagines that the hunter cannot see it because it cannot see the hunter; and Dr. Shaw in his *Travels* relates as an instance of want of sagacity in the bird that he "saw one swallow several leaden bullets scorching hot from the mould." Other travellers, however, give quite another account of the character of the bird. In the Old Testament the ostrich is spoken of as being cruel, because it leaves its eggs to "the earth" and forgets "that the foot may crush them." The ostrich of Syria, Palestine, Egypt, and other regions not belonging to the tropical zone does not leave its eggs to be hatched by the sun, and is generally remarkable for the care it takes of them and the fondness it shows for its young ones. The Old Testament probably refers to the peculiar habit of the bird of laying a few eggs outside of the nest, that they may serve as food for the young ones.

Os'tritz, a small town of the kingdom of Saxony, on the Neisse, has some cotton-spinning and linen-weaving factories, and about 2000 inhabitants. In its vicinity is the Cistercian monastery for nuns, Marienthal, founded in 1374, and containing a richly-ornamented church.

Ostrog', town of European Russia, government of Volhynia. Here the first Slavonic Bible was printed. Pop. 9353.

Ostrogoths. See GOTHS.

Ostrok', a convent of Montenegro, near the border of Herzegovina, is remarkable on account of its situation in a spacious cavern on the side of a steep cliff, which rises 400 feet above it. It has sometimes been transformed into a stronghold by the Montenegrins and used as a powder-magazine.

Ostrolen'ka [Polish, *Ostrolęka*], town of Russian Poland, government of Lomza, on the Narew, has 3466 inhabitants (1867). An encounter took place here Feb. 16, 1807, between the French under Savary and the Russians under Essen, in which the former were victorious. The place became still more famous by the battle which was fought here May 26, 1831, between the Poles under Skrzynecki and the Russians under Diebitsch. The struggle was bloody, protracted, and by itself undecided. The Poles retreated to Warsaw, but the Russians were unable to follow them on account of their own losses.

Ostrow'ski, the name of a celebrated family of Polish nobility, originally descending from the palatinate of Lublin. Among its most remarkable members was TOMASZ ADAM RAWICZ, COUNT OSTROWSKI, b. at Ostrow Dec. 21, 1739. He took a very active part in the establishment of the constitution of May 3, 1791, and was appointed minister of finance, but resigned when the king shortly after joined the confederacy of Targowicza, and lived after the third division of Poland (1795) in retirement on his estates in the Ukraine, occupied with making improvements in agriculture and public education. On the establishment of the duchy of Warsaw, he was made grand marshal of the diet Mar. 9, 1809, and president of the senate Dec. 6, 1811. The emperor Alexander I. also showed great confidence in him, and the Poles received their new constitution of 1815 from his hands. D. Feb. 5, 1817.—His son, ANTONI JOANNES, COUNT OSTROWSKI, b. at Warsaw May 27, 1782, studied at the University of Leipsic; entered in 1806 the French body-guard; was made a member of the provisional government of the duchy of Warsaw; followed Napoleon to Dresden in 1812, and fought in the battle of Leipsic; entered the Polish senate after the death of his father, and offered a firm and steady opposition to the arbitrary measures of the grand duke Constantine. Unable to continue his struggle against the Russian despotism, he went abroad, and travelled much in Germany, France, and England, but hastened back to Warsaw in 1830 on the first report of the insurrection. In the revolution he took a very active and very noble part, fighting at last in the ranks on the walls of Warsaw, and wrote the manifesto which the last remnant of the Polish army issued (Oct. 4, 1831) to the kings and nations of Europe after crossing the Prussian frontier and laying down their arms. He afterward lived in France, and published *Le Panslavisme moscovite* (1842).

Ostrowsky Mountains, The, form part of the central Carpathian range, and extend between the rivers Gran, Eipel, and Sajo. They show remarkable volcanic features. Their highest peak, Sitna, rises 3498 feet.

Ostu'ni (*Ostunium*), a town of S. Italy, in the province of Lecce, situated in a district rich in vines, olives, almonds, and grain. It lies about 20 miles N. W. of Brindisi, on the railway to Bari. The churches and convents are very numerous, but of no special interest. Pop. 16,295.

Osu'na is an old, substantially but irregularly built town of Spain, in the province of Sevilla, standing in a very fertile plain rich in wine, almonds, figs, and olives. The palace of the duke of Osuna is a large and magnificent building. Pop. 15,130.

Osuna (PEDRO TELLEZ **Giron**), DUKE OF, b. at Valladolid, Spain, in 1579; spent his childhood at Naples, where his grandfather was viceroy; was educated at Salamanca; assumed the title of duke of Osuna on his marriage with a daughter of the duke of Alcala; aided in the escape of Antonio Perez from Saragossa; was at first unpopular at the courts both of Philip II. and Philip III.; was twice exiled and once tried by the Inquisition on a charge of infidelity; gained military distinction in Flanders, where the twelve years' truce of 1609 was advised by him; became viceroy of Sicily 1611; was transferred to Naples 1616; incurred the hostility of the clergy by resisting the establishment of the Inquisition at Naples; was an active enemy of the maritime supremacy of Venice; was subsequently suspected of conspiring with foreign princes to make himself independent in Southern Italy; was recalled 1620; subjected to a long and secret trial for high treason, and though not convicted was retained a prisoner in the castle of Almeidas, where he d. in 1624, either by suicide or poisoned by his wife.

Os'wald (SAINT), king of Northumbria, b. in 604; son of Ethelfrid, who was killed in 617 by Redwald, king of East Anglia; resided some years thereafter an exile in Scotland (or Ireland), where he was converted to Christianity; came to the throne 634; made war upon Cadwalla, king of Wales, whom he killed in battle; introduced Christianity into Wales; married Cyneburg, daughter of the West Saxon king Cynegil, on condition of her embracing Christianity, and was killed at Maserfield Aug. 5, 642, by the heathen king Penda of Mercia. The events of his life as given by Bede and Alcuin are overgrown with miraculous legends, which were long popular, especially in Germany. Canonized by the Roman Church.

Oswald (Col. ELEAZER), b. in England about 1755, a relative of Richard Oswald of Auchencruive; came to New York shortly before the Revolution; served under Arnold at Ticonderoga and Quebec, where he commanded the forlorn hope after Arnold was wounded, and displayed great bravery; became secretary to Arnold; was lieutenant-colonel of Lamb's artillery regiment 1777; rendered good ser-

vice at the battle of Monmouth; became public printer at Philadelphia; was a strenuous opponent of Hamilton upon constitutional questions; took service in the French army 1792, commanding a regiment of artillery at the battle of Jemappes. D. at New York of yellow fever Oct. 1, 1795.

Oswald (RICHARD), b. at Auchencruive, Scotland, in 1705; was a merchant of London; married, late in life, Mary Ramsay, famous in the poems of Robert Burns, and was a plenipotentiary on the part of England in framing the treaty of peace with the U. S. D. Nov. 6, 1784.

Osway'o, post-v. and tp., Potter co., Pa. Pop. 629.

Oswegatch'ie, tp. of St. Lawrence co., N. Y., on the St. Lawrence at the mouth of the Oswegatchie River; enjoys a favorable position for manufactures and commerce. Pop. 3018.

Oswe'go, county of New York, bounded N. W. by Lake Ontario. Area, 1038 square miles. It is uneven and mostly fertile, being especially adapted to grazing and the dairy. Cattle, grain, wool, dairy products, hay, tobacco, etc. are the leading agricultural staples. The manufactures are important, and include lumber, cooperage, carriages, cheese, flour, clothing, leather, harnesses, furniture, metallic wares, shipping, wooden wares, starch, etc. The county is traversed by numerous railroads, and has important commercial interests, centring chiefly at Oswego. Building stone, clay, peat, marl, glass, sand, and some iron ore are found. Caps. Oswego and Pulaski. Pop. 77,941.

Oswego, post-v. and tp., Kendall co., Ill., on Fox River and Chicago Burlington and Quincy R. R.; has 1 weekly newspaper. Pop. 1756.

Oswego, post-v. of Plain tp., Kosciusko co., Ind. P. 116.

Oswego, post-v. and tp., cap. of Labette co., Kan., on the Neosho River and the Missouri Kansas and Texas R. R., 13 miles from Parsons; has 2 weekly newspapers and excellent water-power, utilized for saw-mills and factories. Pop. 1196; of tp. 1836.

Oswego, city and port of entry, cap. of Oswego co., N. Y., situated near the eastern end of Lake Ontario, 328 miles N. E. of New York City; is the principal port upon the American side of Lake Ontario, and possesses considerable commercial importance, being seventh in the list of the entry ports in the U. S. for duties collected, the importations consisting mainly of Canada grain and lumber. It has also a coastwise trade. Oswego has a daily line of steamers, during the navigable season, to Chicago and the other important places on the lake. It is the Lake Ontario terminus of the Delaware Lackawanna and Western R. R., of the New York and Oswego Midland R. R., also that of the Oswego branch of the Rome Watertown and Ogdensburg R. R. and of the Lake Ontario Shore R. R. Among its manufactories may be mentioned Kingsford's starch-works, probably the largest in the world, producing 35 tons of starch daily, with an annual consumption of 1,000,000 bushels of corn, 15 flouring-mills, with an aggregate of 76 runs of stone, capable of manufacturing 6080 barrels of flour daily, the Vulcan, Ames, and Kingsford iron-works, Conde's knitting-works, the Oswego shade cloth factory, 1 sash and door factory, and the car-works and repair-shops of the Delaware Lackawanna and Western, the Midland, and the Rome Watertown and Ogdensburg R. Rs., and Herick's car-works. Oswego has 10 grain-elevating establishments with a storing capacity of over 2,000,000 bushels, 2 extensive malt-houses, several barrel-factories, and numerous other industries. The city is supplied with fine water-power by the Oswego River, which drains an area of many square miles, including a cluster of 11 beautiful lakes, for which Central New York is so noted. The streets of the city are 100 feet wide, crossing each other at right angles. There are 2 parks, beautifully shaded, a public library, containing 20,000 volumes, a State normal and training school and an excellent public school system, 15 churches, an opera-house, 2 daily and 2 weekly newspapers, a fire-department, 6 national and 2 saving banks, and water-works of ample capacity. Its public buildings include the county court-house and jail, a city hall, State armory, a government building, containing the post-office, the custom-house, and a U. S. court-house. Fort Ontario, one of the three original fortifications that defended the city, has been rebuilt by the U. S. government, and is now a casemated structure overlooking the lake and harbor, and is garrisoned by a company of the U. S. army. The harbor, situated at the mouth of the Oswego River, is protected from the action of the lake water by extensive piers. The U. S. government is now constructing a new harbor outside the present one, which, when completed, will have a depth of 20 feet and be one of the safest and most commodious harbors upon the chain of great lakes. Pop. of city 20,910; of tp. 3043. JOHN A. PLACE, ED. "OSWEGO TIMES."

Oswego Falls, post-v. of Granby tp., Oswego co., N. Y., on the Oswego River opposite Fulton, and on the Oswego and Syracuse R. R. Pop. 1119.

Oswich'ee, post-v. and tp., Russell co., Ala. P. 1920.

Osyka, post-v. of Pike co., Miss., on the New Orleans Jackson and Great Northern R. R.; has 1 newspaper and is a trade centre of some importance.

Ota'go, province of New Zealand, consists of the southern part of Middle Island. The first settlement was made here in 1847, and in 1851 the number of settlers had increased to 1740; but in 1861 gold was discovered in several districts, and in two years the population swelled to 48,907, of whom only 500 were natives. Although the gold-production has declined, the province has made great progress; it is now extensively cultivated, and its natural riches are rapidly developing. Cap. Dunedin.

Otari'idæ [from *Otaria*—ὠταρός, "distinctly eared"—the principal genus], a family of mammals of the order Pinnipedia, containing the sea-lions and fur-seals. The form is more like that of ordinary quadrupeds than in any other members of the order; the fore-limbs are flippers, the hind limbs flexible forwards; the head is bear-like; small linear ears are developed; the 34 or 36 teeth are present (M. $\frac{5-6}{5-5}$, C. $\frac{1}{1}$, I. $\frac{3}{2}\times 2$), and the incisors of the upper jaw are notched; the skull is strong and has salient mastoid processes, which stand aloof from the auditory bullæ; well-developed post-orbital processes and alisphenoid canals are developed; the anterior limbs are about as large as the posterior; their digits decrease in a curved line and are destitute of claws; the posterior feet have all their digits nearly coterminal, and are furnished with long linguiform flaps extending beyond the tips; the three middle toes are alone provided with claws. The family has been variously subdivided, but by American naturalists is regarded as being represented by five genera, viz.: (1) *Zalophus*, (2) *Eumetopias*, (3) *Otaria*, (4) *Arctocephalus*, and (5) *Callorhinus*. The first is represented on the coast of California as well as Japan and Australia; the second is restricted to the North Pacific, *E. stelleri* descending, however, as far as California; the third and fourth belong to the southern seas; and the fifth to the North Pacific. The first three are "hair-seals" and the last two "fur-seals." *Arctocephalus* is hunted for its fur at widely distant places; *Callorhinus*, however, is only sought for, to any extent, on the Prybilov Islands, Alaska, and Commander Islands, Kamtchatka. THEODORE GILL.

Ote'go, tp. of Fayette co., Ill. Pop. 903.

Otego, post-v. and tp., Otsego co., N. Y., on the Albany and Susquehanna R. R.; has 2 newspapers and a large trade in grain, hops, and other agricultural products. P. 2052.

O'tey (Rt. Rev. JAMES HERVEY), D. D., b. at Liberty, Va., Jan. 27, 1800; graduated in 1820 at the University of North Carolina; took orders in 1825, and was the first Protestant Episcopal clergyman in Tennessee; was consecrated bishop of Tennessee in 1834, and engaged in laborious missionary labors in the S. W. D. at Memphis, Tenn., Apr. 23, 1863. Author of *Unity of the Church* (1852), and many *Charges* and *Sermons*.

Ot'fried, a Frank by birth, studied at Fulda till 848, and was afterward monk in a Benedictine monastery at Weissenburg, Alsace; wrote a paraphrase in German verses of the Gospels, which he sent in 868 to King Louis the German. The aim of this poem was to wean the newly-converted Germans from their heathenish ballads and draw them to Christianity. How well it accomplished its purpose is not known. Its poetical merits are very small, but for the study of German language it is invaluable. It has been edited by Graff (Königsberg, 1831) and by Kelle (Regensburg, 1856); the latter has also translated it into modern High-German in 1870. (For the character, esthetical and generally historical, of this poem and the poetry of the whole period, see Rechenberg, *Otfried's Evangelienbuch und die übrige althochdeutsche Poesie karolingischer Zeit*, 1862.)

Oth'man, or **Osman** (AL GHAZI), the founder of the empire of Turkey (called from this the Ottoman empire), b. at Sergut, Bithynia, in 1259; was the son of Orthogrul, a Turkish soldier, whom in 1280 he succeeded as commander in Armenia under the sultan of Iconium. In 1299 he was made ruler of Bithynia, and the remainder of his life was occupied with almost ceaseless wars with the Byzantines, against whom he gradually made headway. D. Aug. 10, 1326. The title of sultan was assumed by Orkhân, his son and successor.—OTHMAN II., sultan of Turkey, b. Nov. 4, 1604; succeeded Mustapha I. in 1618, and was killed by his janizaries May 19, 1622.—OTHMAN III., b. 1696, succeeded Mahmood I., his brother, 1754, and d. Oct. 28, 1757.

Othman Ibn Affan, the third caliph of the Moslems, b. about 574, a relative of Mohammed; one of the earliest

converts to Islam; subsequently son-in-law and secretary to the prophet; succeeded Omar in 644, and ruled to 655. He proved unequal to the position. Insurrections took place in Egypt, Persia, etc., and were quelled only by making concessions. His internal government was characterized by weakness and despotism, by cowardice and arrogance; and when he ordered Mohammed, the son of Abubekr, to be put to death, the latter marched to Medina, entered the city without opposition, and stabbed the caliph. Under Othman, the first authentic copy of the Koran was composed and the first naval expedition by the Arabs undertaken, a pillaging campaign against Cyprus and Rhodes, in 649.

O'tho, post-v. and tp., Webster co., Ia. Pop. 596.

O'tho (Otto) I., THE GREAT, emperor of Germany, b. Nov. 22, 912; succeeded his father, Henry the Fowler, in 936, as king of Germany, but was not crowned emperor of the Romans until 962. His thirty-six years' reign was a series of bloody wars with Czechs, Italians, Hungarians, Northern Slavi, Danes, Greeks, and malcontent nobles at home; but the emperor was everywhere triumphant, and greatly enlarged the German territories on the E. and S. E., besides subduing a large part of Italy. D. in 973 at Memleben, Thuringia.—OTHO II., son and successor of Otho I., b. 955, was crowned king of Lorraine 961; of Italy 962; emperor 967; succeeded his father 973; repressed the civil wars of Germany and Italy; drove out Lothaire, king of France, who had invaded Germany, designing to make good his claim upon Lorraine; ravaged Champagne and compelled Lothaire to give up his claim 977–980; carried on a war in Calabria with the Greeks and Arabians, by whom he was utterly defeated at Basantello July 13, 982. D. at Rome Dec. 7, 983. He was a warlike and able but rash prince.—OTHO III., son and successor of Otho II., b. in 980, was chosen and crowned king of Germany in 983, but not crowned emperor until 996. His reign was a turbulent one. D. at Paterno in Campania, Jan. 23, 1002, very probably poisoned by his enemies.—OTHO IV. (Otho of Brunswick), son of Henry the Lion, b. 1175; took refuge in England after his father's death, and was made count of Poitou by Richard Lion-heart, his uncle, 1195; in 1198 he claimed the empire, and was elected by the Guelphic faction; proclaimed emperor by the papal legate 1201, and crowned by Innocent III. 1209, his rival, the Ghibelline co-emperor Philip of Suabia, having died in 1208. Having violated his pledge to support the papal claims in regard to benefices, he was excommunicated and was compelled to resign the government 1212, but several times attempted to resume power. In 1214 his forces were badly beaten by Philip Augustus at Bovines; in 1215 he was formally deposed by the fourth Lateran Council; in 1217 his last military insurrection was repelled by Frederick II. D. at Harzberg May 15, 1218.

Otho, king of Greece. See OTTO.

Otid'idæ [from *Otis*, the generic name of the European bustard], a family containing carinate birds, which are mostly of large size and distantly resembling the ostriches, to which formerly they have been approximated by some naturalists; the body is longer, however; the neck moderately elongated; the head small and oblong; the bill more or less elongated, compressed, with the culmen straight above the nasal groove, and thence vaulted to the strongly emarginated tip; the nostrils at the base of the bill lateral, in a large membranous groove, and with large and oval apertures; the wings well developed and somewhat pointed; the tail moderately broad and rounded; feet stout; the tarsi long and covered with small scales; the toes short and covered above with small narrow scales; claws short, broad, and blunt. This family is peculiar to the Old World; and by G. R. Gray the species are arranged under two genera: (1) *Otis*, with two species, and (2) *Eupodotis*, with twenty-four species, arranged under nine groups. The species of *Otis*, or true bustards, are limited to Europe and Northern Africa; those of *Eupodotis* are found mostly in Africa, but several species occur in India and one in Australia. They are mostly large shy birds, inhabiting the plains and open countries of the old continents, and are generally solitary or combine in small parties of three or four. They feed mostly upon grains and seeds, but also, to some extent, on insects, worms, and even small animals. The females lay from one to five eggs, according to the species, on the bare ground; the young, when hatched, are able to follow their parents at once. THEODORE GILL.

O'tis, post-v. and tp., Hancock co., Me. Pop. 246.

Otis, post-v. and tp., Berkshire co., Mass., on Farmington River. Pop. 960.

Otis (FESSENDEN NOTT), A. M., M. D., b. at Ballston Spa, N. Y., May 6, 1825: graduated at the New York Medical College 1852; resident assistant physician at Blackwell's Island Hospital 1852–53; surgeon to the U. S. M. Steamship Co. 1853–60; surgeon of the New York police department 1861; lecturer on genito-urinary diseases at the New York College of Physicians and Surgeons 1862–71; superintending surgeon to Pacific Mail Steamship Co. 1869–73; president of New York board of police surgeons 1870–72; surgeon to the Strangers' Hospital and president of its medical board 1871–73; clinical professor at the College of Physicians and Surgeons 1871; advisory physician to the Artists' Fund Society and member of the medical board of the New York Charity Hospital 1873. Author of *Landscape Perspective and Animal Drawing* (1849), *History of the Panama R. R. and the Pacific Mail S. S. Co.* (1861), and numerous monographs on urethral and syphilitic diseases.

Otis (GEORGE ALEXANDER), M. D., b. at Boston, Mass., Nov. 12, 1830; graduated at Princeton 1849, and at the medical department of the University of Pennsylvania 1851; studied surgery two years in London and Paris; established the *Virginia Medical Journal* 1853; entered the army 1861 as surgeon; was assigned to duty July, 1864, in the office of the surgeon-general at Washington; published monographs on *Amputation of the Hip Joint* (1867) and *Excisions of the Head of the Femur for Injury* (1869); prepared in 1871 a *Report of Surgical Cases treated in the Army of the U. S. from 1867 to 1871*, forming a quarto volume, and in 1872 edited the surgical volume of the first part of the *Medical and Surgical History of the War*. He is now (1876) curator of the Army Medical Museum at Washington, engaged in preparing the remaining portion of the surgical history of the war.

Otis (HARRISON GRAY), son of Samuel A. and nephew of James Otis, was b. in Boston, Mass., Oct. 8, 1765; graduated at Harvard in 1783; was admitted to the bar in 1786; a Federalist leader in Congress 1797–1801; U. S. district attorney, Boston, 1801; Speaker in the Massachusetts legislature 1803–05; president of the Massachusetts senate 1805–11; judge of common pleas 1814–18; was in the U. S. senate 1817–22; was mayor of Boston, Mass., 1829–32. D. in Boston Oct. 28, 1848. He published speeches, etc.

Otis (JAMES), b. at Barnstable, Mass., June 14, 1702; was the son of Judge John Otis (1657–1727), and became one of the leaders in the patriotic opposition to the tyranny of the home government and the crown officers of Massachusetts. He was a provincial colonel, a judge in the provincial court, and held other important positions. D. Nov. 9, 1778. Was the father of James Otis and S. A. Otis.

Otis (JAMES), b. in West Barnstable, Mass., Feb. 5, 1725; graduated at Harvard College 1743; studied law with Mr. Gridley, and began practice at Plymouth 1746; removed to Boston 1750; published in 1760 *Rudiments of Latin Prosody*; in 1761, when advocate-general of the admiralty, refused to argue in favor of the writs of assistance, and resigned his office to plead the people's cause; in 1762 was elected to the State legislature, and in 1765, on his motion, the Stamp Act congress met in New York, to which he was a delegate; his speeches and pamphlets placed him at the head of the patriotic party in Massachusetts; in 1769 denounced in print the commissioners of customs, and on Sept. 9, meeting one of the commissioners in a coffee-house, he was attacked, and received a cut on his head which led to derangement; retired to Andover, where he was killed by lightning May 23, 1783; published *Vindication of the Conduct of the House of Representatives* (1762), *Rights of the British Colonies asserted* (1765), *Consideration on Behalf of the Colonists* (1765).

Otis (Col. JOHN), b. at Hingham, Mass., in 1657; settled at Barnstable on Cape Cod; represented that town twenty years in the general court; commanded the county militia; was chief-justice of common pleas, first judge of probate of Barnstable co., and councillor from 1706 to his death Sept. 23, 1727. He was father of Judge James Otis.

Otis (SAMUEL ALLEYNE), b. at Barnstable, Mass., Nov. 24, 1740; graduated at Harvard 1759; became a merchant in Boston; held many important public positions; was in Congress 1787–88; secretary of the U. S. Senate 1789–1814. D. at Washington, D. C., Apr. 22, 1814.

Otis'co, post-v. and tp., Waseca co., Minn. Pop. 531.

Otisco, post-v. and tp., Ionia co., Mich. Pop. 1578.

Otisco, post-v. and tp., Onondaga co., N. Y. P. 1602.

Otisco Lake, a shallow body of water in Onondaga co., N. Y., 4 miles long, half a mile wide, and 772½ feet above sea-level. It is bordered by high hills. Its waters flow through Nine Mile Creek into Onondaga Lake.

O'tisfield, post-v. and tp., Cumberland co., Me. Pop. 1099.

Otisville, post-v. of Mount Hope tp., Orange co., N. Y., on the Erie R. R.

Ot'ley, post-v. of Summit tp., Marion co., Ia., on the Keokuk and Des Moines R. R. Pop. 176.

O'toe, county of S. E. Nebraska, bounded E. by the Missouri River. Area, 570 square miles. It is one of the most fertile counties in the State, its soil being a deep silicious loess. Coal and peat are found to some extent; grain-culture is a leading industry. The county is traversed by the Midland Pacific R. R. Cap. Nebraska City. Pop. 12,345.

Otoe, tp. of Otoe co., Neb. Pop. 1044.

Otoe Agency, post-v. of Gage co., Neb. Pop. 13.

Otoe Indians, a tribe of Dakota stock, formerly inhabiting both sides of the Missouri. Their remnant is now united with the Missourias, a kindred tribe. (See Missouria Indians.)

Otomis, or **Othomis,** a tribe of Indians inhabiting the mountain-regions of the states of Querétaro, Hidalgo, and Guanajuato, with scattered bands in several other states of Mexico. They have been established in their present seats from time immemorial, and occupied the valley of Mexico before the Toltecs and Aztecs. At present they maintain no tribal organization, are Mexican citizens, and usually speak Spanish in addition to their own language, which is one of the harshest and most guttural of all Indian dialects. It consists in a great measure of words of one or two syllables only, whence it has erroneously been supposed to belong to a different linguistic family from the neighboring tribes, and unsuccessful efforts have been made to connect it with the Chinese. Several catechisms and devotional works have been printed in Otomi, the best-known grammar being that of Neve y Molina (Mexico, 1767).

Otran'to, post-v. and tp., Mitchell co., Ia. Pop. 596.

Otranto, duke of. See Fouché.

Otranto, Terra di, a province of Italy consisting of the south-eastern peninsula, the heel of the boot, and comprising an area of 3293 square miles, with 493,594 inhabitants. The coasts are generally marshy and unhealthy, but the high, mountainous inland, covered with branches of the Apennines, is beautiful, healthful, and exceedingly fertile. Wine, figs, almonds, oranges and melons, wheat, and olive oil are produced, and the best tobacco in Italy is grown. Cap. Lecce.

Ot'sego, county of Michigan. Area, 540 square miles. It is densely timbered and almost uninhabited. It is traversed by the Jackson Lansing and Saginaw R. R.

Otsego, county of Central New York. Area, 1038 square miles. It is hilly, with broad, fertile valleys, and is well adapted to grazing. Cattle, wool, grain, fruit, hops, and dairy products are the chief agricultural staples. The manufactures include flour, furniture, cheese, lumber, carriages, harnesses, metallic wares, castings, clothing, cooperage, brick, etc. Limestone is extensively quarried. Water-power is abundant, but not well developed. The county has at present good railroad facilities, and is increasing in wealth and prosperity. Cap. Cooperstown. Pop. 48,967.

Otsego, tp. of Steuben co., Ind. Pop. 1318.

Otsego, post-v. and tp., Allegan co., Mich., on the Kalamazoo division of Lake Shore and Michigan Southern R. R. Pop. of v. 994; of tp. 2396.

Otsego, post-v. and tp., Wright co., Minn. Pop. 595.

Otsego, tp. of Otsego co., N. Y., on the W. bank of Otsego Lake; is traversed by the Cooperstown and Susquehanna Valley R. R. Pop. 4590.

Otsego, post-v. of Monroe tp., Muskingum co., O. Pop. 111.

Otsego, post-v. and tp., Columbia co., Wis., on the Chicago Milwaukee and St. Paul R. R. Pop. 1715.

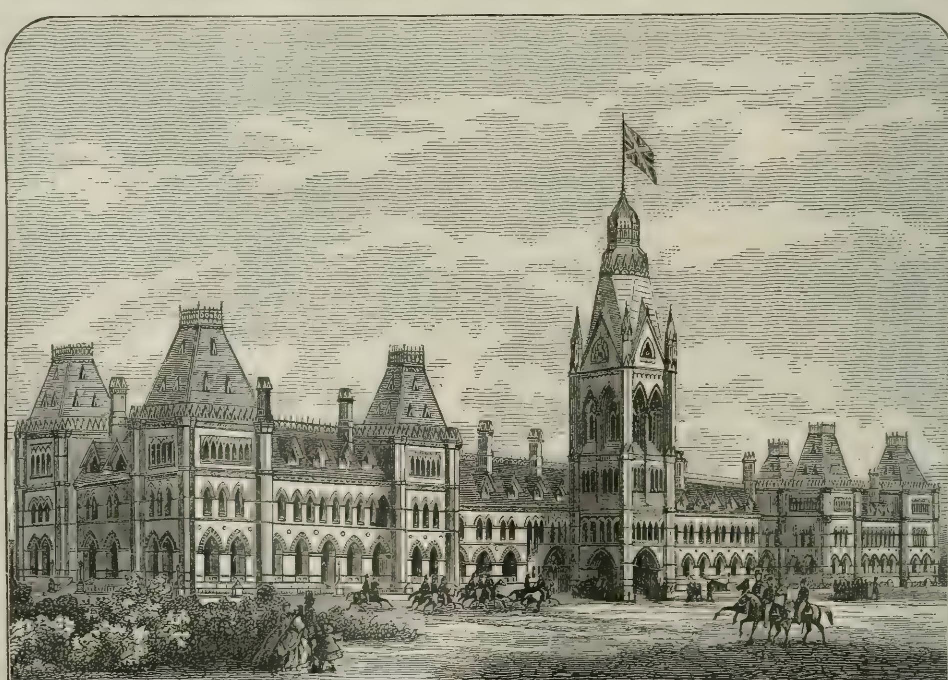
Otsego Lake, a fine lake of Otsego co., N. Y., 7½ miles long, 1½ broad, 1193 feet above tide. Its clear waters abound in fish, and its high and picturesque shores were the scene of many memorable incidents in Cooper's *Leather-stocking.* Cooperstown stands at its outlet. The lake is the source of the main fork of the Susquehanna River.

Otse'lic, post-v. and tp., Chenango co., N. Y., on Otselic Creek and the Auburn branch of the Midland R. R. Pop. of tp. 1733.

Ottaia'no (*Octavianum*), town of Southern Italy, province of Naples, lying at the foot and on the N. E. slope of Vesuvius. The neighboring country is extremely fertile, but the town itself is in perpetual danger from the eruptions of Vesuvius. Pop. of the commune 17,776.

Ot'tawa, a large county of Quebec, Canada, lying N. of the Ottawa River. It is heavily timbered and rocky, but the valley is very fertile and well watered. It has been rapidly settled of late. Cap. Aylmer. Pop. 38,635.

Ottawa, city, capital of the Dominion of Canada, on the S. bank of the river of the same name, occupies a central position, being almost equidistant from Toronto and Montreal, the chief commercial cities and by far the largest in Canada. From Prescott, opposite Ogdensburg, N. Y., it is 54 miles distant due N.; from Montreal it is 126 miles W.; from Kingston, the old capital of Upper Canada, at the foot or eastern end of Lake Ontario, it is 95 miles E. by N. Its position has peculiar importance independently of its political significance because of the great Canadian lumber trade, of which it is the central mart, and this trade is mainly in the hands of the native Americans. Indeed, it was to the Americans that the Canadians owed the development of their vast, if not unlimited, forest wealth lying to the N. W. of Ottawa City, and it is to this trade that the city of Ottawa owes nearly all that it has of com-



Capitol of Canada.

mercial importance. Ottawa was founded in 1827 at the instance of the British government under the administration of Col. By, of the Royal Engineers, who was sent out from England for the express purpose of forming an interior line of defence against possible American attacks. The Rideau Canal, connecting the Ottawa River with Lake Ontario at Kingston, was the grand conception as an inland line of communication between Montreal and the then province of Upper Canada. That line, formed by the Ottawa River from the Island of Montreal to the city of Ottawa, and thence by the canal to Kingston, has now no political or strategical significance, and never had, nor will have, much commercial importance. But it may be taken for granted that the records of the imperial colonial office, which led to the building of the canal half a century ago, also led to the selection of Ottawa as the capital of Canada some thirty years later. As such it is admirably situated. On the confines of the two most important provinces of Canada, by the side of one of the largest rivers in America, on the borders of one of the greatest lumbering regions in the world, surrounded by rich agricultural and mineral lands, the seat of government for half the North American continent, its future is full of promise. In compliment to its founder it was originally called Bytown, which name it retained until 1854, when it was incorporated as a city under its present designation. In 1856 it was selected by Her Majesty the queen as the capital of Canada, and ten years later was occupied by the government after the building of very costly and admittedly elegant departmental and parliamentary edifices. Improvements and additions are still going on, one of the latest being the completion of the library attached to the main building occupied by Parliament, and the other an extension of the western departmental block to make room for the Canadian Pacific Railway and other offices.

The progress of Ottawa has been very constant, though not at any time particularly rapid. The development of the lumber interest, chiefly due, as we have stated, to the enterprise of a number of American gentlemen, one of whom, Mr. J. M. Currier, at present represents the city in the House of Commons, has led to the establishment of a flourishing import trade for provisions and general merchandise, while the establishment here of the seat of government, with its 1200 or 1300 employés of all grades, has given a regularity to its retail cash business not enjoyed by any other city in Canada. The principal industries of the city are connected with the lumber business; but the mineral wealth of the neighboring country, chiefly in iron and plumbago, promises to add to their variety. In the development of these American capital is also largely embarked. The progress of Ottawa may fairly be judged by the increase of its population. In 1851 it was under 10,000; in 1861 it had risen to about 15,000; in 1871 it was over 21,000. These numbers are from the census returns, and are, as far as can be ascertained, reliable. An estimate from the city assessment for the present year (1875) gives the population as 24,262, though the cursory enumeration would doubtless be put at 25,000 or 30,000. Another means of estimating the progress of the city, less reliable than that of the population, is the assessment of the value of city property. In 1869 this was placed at $5,081,679, in 1875 at $11,254,635, or an increase of more than double inside of six years. Readers will, however, place their own value upon local assessments; but it cannot be denied that Ottawa has made very steady and substantial progress. The population of the city is, as nearly as may be, divided equally between Roman Catholic and Protestant, the former having a slight preponderance. The greater portion of the Roman Catholics are French Canadians, the remainder mainly Irish or of Irish descent. The Protestants are English, Scotch, Irish, and Americans; the last have the control of the leading business establishments, both financial and manufacturing, throughout the city. The church edifices are numerous and, as a rule, of superior architectural design. There are two bishops in Ottawa, the Episcopal or Church of England, who is called "bishop of Ontario," and the Roman Catholic, who takes his title from the city. The former is Dr. J. T. Lewis, the latter Dr. Duhamel, and both are gentlemen of cultivation, enjoying the esteem of all classes. Dr. Duhamel is a native of Ottawa and Dr. Lewis an Irish gentleman of good family. Prominent among the religious establishments is the new Reformed Episcopal church, built about a year ago, and having a select congregation, numbering among it some of the leading business men of the city. Ottawa is especially distinguished for its educational establishments. Chief among them are the Ottawa College, a Roman Catholic institution with a university charter; the Protestant Ladies' College, and the two convents under the charge of nuns, which command a very large support. In addition to these, the government has established in the city a normal school for Central Canada, and also a collegiate institute. These institutions are only opening for the first time this year, but they give a character to the neighborhood and have done much towards inspiring literary aspirations among the people.

The city occupies a most advantageous position, especially favorable for drainage. Parliament Hill (or Barrack Hill), on which the public buildings are situated, is a commanding bluff on the banks of the Ottawa, unsurpassed for beauty of natural scenery. Major's Hill, on the E. side of the Rideau Canal, has been laid out as a public park, for which it is delightfully situated. The Lower Town stretches about a mile eastward, and is a level plain with very wide streets, having no architectural adornment save the Roman Catholic cathedral. Sandy Hill, to the S. of Lower Town and E. of the canal, is mainly occupied with private residences, many of which are of an elegant design. In this neighborhood the ministers of the crown and many of the most prominent members of the civil service reside. Westward, and crossing the canal, is the busy hum of active commercial life, the large hotels, the banks, the law-offices, the city hall, the principal churches, etc. Farther on is the suburb of Rochesterville, and to the N. of it the great lumber manufacturing section of the Chaudiere, at which the traveller crosses the river to the neighboring city of Hull in the province of Quebec, where, as at the Chaudiere (or the "flats"), lumbering is extensively carried on, and which may fairly be considered a suburb of the Canadian capital, though it is a recently incorporated city of some 8000 or 10,000 inhabitants. At the E. end of the city is the village of New Edinburgh, where the residence of the governor-general—"Rideau Hall"—is situated. Rideau Hall, though commodious, is not imposing in appearance. It is merely an enlargement of the private residence of a local magnate, and was bought by the government at a very handsome price. The grounds surrounding the hall are spacious, and the conservatory, under the admirable taste of Earl Dufferin, the present governor-general of Canada, may be said to have become a source of national pride to the Canadians.

Ottawa is reached by two railways, one connecting at Prescott and the other at Brockville with the Grand Trunk railway running E. and W. In summer a line of steamers runs between the city and Montreal, and another between Britannia, hard by, and the Upper Ottawa. The Quebec Montreal Ottawa and Occidental railway, running from Quebec on the N. side to connect with the future Canadian Pacific railway, now under construction, will open a new means of communication with the outside world. Since the establishment of the supreme court of the Dominion in October last, the judges of that court, six in number, reside in Ottawa, and the sittings of the court will always be held here. Hon. W. B. Richards, an eminent jurist, has been appointed the first chief-justice of the Dominion. Hon. Alexander Mackenzie is the present prime minister of Canada, and, with his twelve colleagues, resides in Ottawa. Ottawa possesses 3 daily newspapers and many excellent hotels, of which the Russell House is the best.

Alexander Robertson.

Ottawa, county of Central Kansas. Area, 720 square miles. It is traversed by Solomon and Saline rivers, is undulating, fertile, and well adapted to stock and grain raising. The county has good and constant water-power. Good lignite is found. Cap. Minneapolis. Pop. 2127.

Ottawa, county of Michigan, bounded W. by Lake Michigan. Area, 540 square miles. It is traversed by Grand River and by various railroads. It is well timbered, level, and generally fertile. It is in the great fruit belt of Michigan. Live-stock, wool, grain, fruit, and lumber are leading products. Cap. Grand Haven. Pop. 26,651.

Ottawa, county of N. W. Ohio. Area, 250 square miles. It is bounded N. E. by Lake Erie, and includes some of the Wine Islands, in that lake. It is undulating and fertile. Live-stock, grain, fruit, wool, and lumber are leading products. The county is traversed by the Lake Shore R. R. Cap. Port Clinton. Pop. 13,364.

Ottawa, city and tp., cap. of La Salle co., Ill., at the junction of the Chicago Rock Island and Pacific and the Chicago Burlington and Quincy R. Rs., contains extensive manufactures of starch and glass, and its shipping facilities are fine. The great mineral springs located upon the S. bank of the Illinois River are surrounded by a handsome park. The city has 4 newspapers, several fine hotels, and stores. Pop. of city 7736; of tp. 463.

R. J. Bliss, Ed. "Free Trader."

Ottawa, city and tp., cap. of Franklin co., Kan., 53 miles S. W. of Kansas City, Mo., has 1 university, 1 large union school, 8 churches, 3 banks, 3 newspapers, 2 large flouring-mills, a foundry, 1 soap manufactory, railroad

repair and machine shops, a castor and linseed oil establishment, and stores. Pop. of city 2941; of tp. 877.
JOHN T. HEWITT, ED. "JOURNAL."

Ottawa, tp. of Ottawa co., Kan. Pop. 359.

Ottawa, post-v. and tp., Le Sueur co., Minn., on the St. Paul and Sioux City R. R. Pop. 613.

Ottawa, tp. of Allen co., O., on the Ottawa River, at the intersection of the Dayton and Michigan with the Pittsburg Fort Wayne and Chicago R. R.; includes village of Lima, cap. of the county. Pop. 4662.

Ottawa, post-v. and tp., cap. of Putnam co., O., on the Dayton and Michigan R. R., 50 miles S. W. of Toledo, has a union school, 2 banks, 1 newspaper, 4 churches, several mills and factories, and stores. Principal employment, farming. Pop. of v. 1129; of tp. 2837.

Ottawa, post-v. and tp., Waukesha co., Wis., on the Milwaukee and Mississippi R. R. Pop. of tp. 922.

Ottawa Indians, a tribe of Algonkins formerly found on both sides of Lake Erie. In 1728, and again in 1764, they could muster 200 warriors. They were in 1831 removed to Kansas, and in 1867 obtained a reservation of 24,960 acres in Franklin co. In 1870 they removed to the Indian Territory. They maintain a tribal organization, but are U. S. citizens, and are generally prosperous. There is also a considerable number of Ottawas with the Chippewas of Michigan. They are self-supporting and well advanced in civilization. There are others in Canada. Pontiac was the most famous warrior of this tribe.

Ottawa River, in Canada, is the boundary between the provinces of Ontario and Quebec (except in the very lowest parts of its course). It rises on the divide between the basin of the St. Lawrence and Hudson's Bay, and flows S. E. and E., communicating with the St. Lawrence at the W. end of Montreal Island. It sends off the Rivière des Prairies, between Montreal Island and the Isle Jésus, N. of which the Ottawa flows, finally joining the St. Lawrence below the Island of Montreal. It has numerous rapids, some of which are flooded out by dams and others surmounted by canals. It is a noble stream, and has a heavy trade in lumber. Its cataracts afford very great and well-utilized water-power. It is navigated by steamboats and canal-boats. It is connected with Lake Ontario by the Rideau Canal. Its valley contains much fertile land and is rapidly filling with settlers. Length 791 miles.

Ot'tendorfer (OSWALD), b. at Zwittau, Moravia, Feb. 26, 1826; studied law at Prague and Vienna; settled at New York 1850; became an editor of the *New Yorker Staats-Zeitung*, and subsequently its manager and proprietor, having in 1859 married the widow of the former proprietor (Mr. Uhl). Under his auspices it became one of the leading German-American papers and a prominent advocate of the interests of the Democratic party. As president of the German Reform Association Mr. Ottendorfer took a leading part in the exposure of dishonesty in the city government 1871, at which time his paper assumed an independent attitude in politics; was alderman 1872–74, and was an independent candidate for mayor 1874.

Ot'ter, tp. of Warren co., Ia., on South River. P. 929.

Otter, tp. of Bedford co., Va., on Otter River and at the base of the celebrated "Peaks of Otter," a portion of the Blue Ridge, near the Virginia and Tennessee R. R. Pop. 4004.

Otter [Lat. *lutra;* Fr. *loutre;* Ger. *Otter*], a name applied to several species of carnivorous fur-bearing animals of the family Mustelidæ, and sub-families (1) Lutrinæ and (2) Enhydrinæ, and which have been differentiated in the genera (1) *Lutra, Aonyx, Pteronura*, and (2) *Enhydris*, and by some still further. The typical species is the European otter (*Lutra vulgaris*), which, from the fishy character of its flesh, is, with the scoter duck, permitted to be eaten during Lent. The permission is, however, very rarely taken advantage of, and its fur is far more valuable than its flesh. It feeds upon fish, and is very hard to shoot. It is hunted by a peculiar race of dogs called otter-hounds. The N. American otter (*Lutra Canadensis*) is much larger than the foregoing, attaining the total length of 4½ feet. The true otters have a singular fondness for sliding down hill upon mud and snow. Brazil, India, China, S. Africa, and other countries have peculiar species of otter, some of which are without nails or with only rudimentary ones (*Aonyx, Barangia*). India furnishes to commerce the skins of a small, short-haired otter. One of the aberrant genera of otters is the *Enhydris* or sea-otter. The *Enhydris marina* of the N. Pacific coasts furnishes the sea-otter fur of commerce, which is highly prized in Russia and China. It is the largest of the living otters, and is found often in the open sea far from land. Its body attains a length of nearly four feet. The tail is a foot long. It is stupid, timid, and harmless. Its fur is thick, soft, woolly, and quite handsome.
THEODORE GILL.

Ot'terbein (PHILIP WILLIAM), founder and bishop of the United Brethren in Christ, b. at Dillenburg, Germany, June 4, 1726; entered the Reformed ministry in 1749; came in 1752 to America as a missionary; labored especially in Pennsylvania and Maryland; founded his new church at Lancaster, Pa., in 1775; with Martin Boehm was chosen bishop; toiled for many years with great earnestness and success. D. at Baltimore Nov. 17, 1813. He was a man of learning and piety. (See UNITED BRETHREN IN CHRIST.)

Otterbein University, located at Westerville, O., on the Cleveland Columbus and Mt. Vernon R. R., about 11 miles from the city of Columbus; is under the control of the United Brethren in Christ; was organized in 1847, chartered with university privileges, has a commodious building, 170 feet in length and 109 feet in depth, with an endowment of $70,000. There is a regular classical course covering four years of study, after two years of preparatory instruction; scientific, with four years of study and one of preparatory; ladies', similar to scientific, but with less of science, and English course, omitting ancient and modern languages, and covering three years of study. In 1872 Rev. Henry A. Thompson, A. M., became president.

Otter Creek, tp. of La Salle co., Ill., near Vermilion River, covers rich coal-fields. Pop. 1009.

Otter Creek, tp. of Ripley co., Ind., on the Ohio and Mississippi River R. R. Pop. 1637.

Otter Creek, tp. of Vigo co., Ind., on the Wabash River; intersected by three railroads. Pop. 1269.

Otter Creek, post-v. and tp., Jackson co., Ia. Pop. 902.

Otter Creek, tp. of Linn co., Ia., on E. bank of Cedar River. Pop. 1600.

Otter Creek, tp. of Lucas co., Ia., near Burlington and Missouri R. R. Pop. 711.

Otter Creek, tp. of Tama co., Ia., on Iowa River. P. 2046.

Otter Creek, post-v. and tp., Mercer co., Pa. Pop. 560.

Otter Creek rises near the S. border of Rutland co., Vt.; flows through Rutland and Addison cos., and reaches Lake Champlain at the town of Ferrisburg. It is 90 miles long, affords good water-power, and is navigable 8 miles to Vergennes.

Otter Creek, post-v. and tp., Eau Claire co., Wis., on the West Wisconsin R. R. Pop. 920.

Otter River, post-v. of Worcester co., Mass., near the Vermont and Massachusetts R. R.

Otter's Creek, tp. of Edgecombe co., N. C. Pop. 651.

Otter Tail, county of W. Minnesota. Area, 2016 square miles. It is somewhat uneven, abounds in lakes, is well timbered, and adapted to grain-culture. The county is traversed by the Northern Pacific R. R. Cap. Fergus Falls. Pop. 1968.

Otter Tail City, post-v. and tp., Otter Tail co., Minn., on Otter Tail Lake. Pop. 52.

Ot'terville, post-v. of Cooper co., Mo., on the Atlantic and Pacific R. R.

Ott'ley (WILLIAM YOUNG), F. R. S., b. in England in 1771; studied art in Italy; published *The Italian School of Design* (3 vols. 1808–23), a magnificent collection of facsimiles of drawings by the best Italian masters; *An Inquiry into the Origin and Early History of Engraving upon Copper and in Wood* (2 vols. 1816); *Notices of Engravers and their Works* (1831), and several other elegant and costly art publications. He became keeper of the prints in the British Museum 1833, and d. at London May 26, 1836.

Ot'to, tp. of Kankakee co., Ill., on the Iroquois River and Chicago branch of Illinois Central R. R. Pop. 1356.

Otto, tp. of Oceana co., Mich. Pop. 135.

Otto, tp. of McKean co., Pa., near the Alleghany River. Pop. 298.

Otto, post-v. and tp., Cattaraugus co., N. Y., on the Cattaraugus Creek and Erie R. R. Pop. 1028.

Otto I., king of Greece from Oct. 5, 1832, to Oct. 27, 1862; b. at Salzburg June 1, 1815, the second son of King Louis of Bavaria; was established on the throne of Greece by the election of the Greek people and the guaranty of Russia, England, and France. His government was a failure, and the fault was to some extent his own. On his accession he confided the whole power to German officials, and German was used as the official language. This manner of proceeding, naturally very offensive to the Greek people, was stopped by the revolution of Feb. 14, 1837, but still the despotic and unnational measures of the king con-

tinued to alienate him more and more from the people. By a new revolution of 1843 he was compelled to convoke a national assembly and accept a liberal constitution Mar. 30, 1844, but under this form the intrigues of the Russian, English, and French diplomats made his government almost impossible. One ministry followed the other, keeping the popular parties in perpetual excitement and dragging the country along, now in the track of Russia, now in that of England. When the Crimean war broke out, the king and the people united for a short time in the same sympathy; both felt that Greece was the natural adversary of the Turks. But a French-English fleet was stationed at Piræus and neutrality was imposed on the country in a humiliating manner. Immediately after the peace of Paris the embroilments between the people and the king recommenced, and after several local insurrections, which were put down, the whole country rose in rebellion in Oct., 1862. A provisional government was established at Athens, declaring the Greek throne vacant, and King Otto left the country. He afterwards lived at Munich, and d. there July 26, 1867.

Otto (Friedrich Julius), b. at Grossenhain, Saxony, Jan. 8, 1809; studied natural science and chemistry at Jena, and afterwards at Giessen under Liebig, and was appointed professor in practical chemistry in 1836 at the Carolinum of Brunswick, where he d. Jan. 13, 1870. His *Lehrbuch der landwirthschaftlichen Gewerbe*, often reprinted, and his books on the manufacture of vinegar, beer, liqueurs, etc., are of great practical value.

Otto (Louis William), count of Mosloy, b. in Baden in 1754; educated at the University of Strasbourg; entered the diplomatic service; accompanied the chevalier Luzerne in his mission to the U. S. 1779, acting as secretary and afterwards as *chargé d'affaires* until 1792; married an American lady of the Livingston family; was employed in the public service in Paris by the Committee of Public Safety 1793; was thrown into the Luxembourg prison on the fall of the Girondists, remaining there until the revolution of the 9th Thermidor; was employed in diplomatic posts at Berlin, London, and Vienna; negotiated the marriage of Napoleon with Maria Louisa; was a minister of state 1813, and during the Hundred Days. D. at Paris Nov. 9, 1817.

Ot'tocar II., king of Bohemia from 1253 to 1278, b. about 1230, a son of Wenceslas I.; revolted against his father, but was defeated, and even imprisoned for some time; acquired Austria and Styria by marriage; made a crusade, after succeeding to the throne of Bohemia on the death of his father, against the heathen Prussians; conquered their country and founded Königsberg; defeated the Hungarians on the Marchfield in 1260, and took possession of parts of Hungary; inherited Carniola and Carinthia in 1269, and ruled with vigor and intelligence his vast empire, stretching from the Baltic to the Adriatic and from the Inn, Bavaria, to the Raab, Hungary. But in 1273 he opposed the election of Rudolph of Hapsburg as emperor of Germany, and refused to acknowledge him; the consequence was a war, in which Ottocar was defeated and compelled to cede Austria, Styria, Carniola, and Carinthia. Once more he tried his fortune against Rudolph, but was again defeated, and fell in the battle of Jedenspeng, Aug. 26, 1278. In his internal government he strove to break the power of the feudal lords and supported agriculture, industry, and commerce.

Ottoman Empire. See Turkey.

Otto of Roses. See Attar of Roses.

Ot'tumwa, city of Centre tp., cap. of Wapello co., Ia., on the Des Moines River, 75 miles N. W. of Burlington. It is the most important railroad centre in the State. The city contains 2 seminaries, 2 fine public-school buildings, 9 churches, 2 foundries, 2 pork-packing establishments, a furniture-factory, a sewing-machine attachment factory, 3 banks, 2 extensive wagon and carriage factories, a steam plough manufactory, 1 daily and 4 weekly newspapers, and a number of stores and mechanical shops. The Burlington and Missouri River R. R. has its feeding-yards here, where large numbers of cattle and hogs are rested and fed. Pop. 5214.

Hamilton & Warden, Eds. "Ottumwa Courier."

***Ottumwa,** post-v. and tp., Coffey co., Kan., on the Neosho River, near the Missouri Kansas and Texas R. R. Pop. of v. 263; of tp. 833.

Ot'way (Thomas), b. at Trotton, Sussex, England, Mar. 3, 1651; was educated at Winchester and Christ Church, Oxford; became an unsuccessful actor; served for a time as cornet in the Low Countries; memorable as the author of many dramatic pieces, some of which, in power, eloquence, and the portrayal of the passions, are of very high rank, though nearly all are needlessly coarse and indecent. His most successful pieces were *Don Carlos*, 1676; *The Orphans*, 1680; *Caius Marius*, 1680; *The Soldier's Fortune*, 1681; *The Atheists*, 1684; and especially *Venice Preserved*, 1681, which last is still occasionally played. Most of his works are tragedies of a high order. Otway's last years were spent in poverty; and according to the traditional account he starved to death in London Apr. 14, 1685.

Ouachita', county of S. W. Arkansas. Area, 730 square miles. It is traversed by the navigable Washita River, has a diversified and very fertile soil, with abundance of timber and good lignite. Live-stock, cotton, and corn are leading products. Cap. Camden. Pop. 12,975.

Ouachita, parish of N. Louisiana, traversed by the navigable Washita River and the Texas and Northern Louisiana R. R. Area, 575 square miles. It is somewhat hilly, well timbered, and fertile. Cotton and corn are leading products. Cap. Monroe. Pop. 11,582.

Ouachita, tp. of Bradley co., Ark. Pop. 718.

Ouachita, tp. of Hot Springs co., Ark. Pop. 542.

Ouachita, tp. of Polk co., Ark. Pop. 237.

Oude, a province of British India, bounded S. by the Ganges and N. by Nepaul, consists of a large plain watered by the Goggra, Goomty, Sye, and other tributaries of the Ganges. Area, 23,973 square miles; pop. 11,220,747, mostly Hindoos; a few are Mohammedans. The soil is extremely fertile and well cultivated; all the choicest products of India grow in abundance. The inhabitants are very warlike; they serve in all Indian armies, and formed the famous Sepoy regiments in 1857. Cap. Lucknow.

Oudenarde. See Audenarde.

Ou'dendorp, van (Franz), b. in Leyden July 31, 1696; educated in the University of Leyden as a pupil of J. Gronovius and P. Burmann; was made rector of the school at Nymwegen in 1724; rector at Haarlem in 1726, and called as professor of eloquence and history, along with Hemsterhuys, to Leyden 1740; published valuable editions of classic authors—*Julius Obsequens* (Leyden, 1720), *Lucan* (1728), *Frontinus* (1731), *Cæsar* (1737), *Suetonius* (1751), and began an edition of *Appuleius* (continued by Ruhnken and Bosscha), which appeared at Leyden (1786–1823, 3 vols. 4to). D. at Leyden in 1761. (See *Saxii Onom. Lit.*, vol. vi. pp. 336, 337.) Henry Drisler.

Oudinot' (Charles Nicolas), duke of Reggio, marshal of France, b. Apr. 26, 1767, at Bar-le-Duc, in the department of Meuse, France; was commander of a battalion in 1792, brigadier-general in 1794, general of division in 1799, and distinguished himself especially in the battles of Friedland and Wagram, when he was made a marshal and created duke. His greatest feat was his manœuvre in order to protect the crossing of the Beresina in 1812. In the battle of Leipsic he was wounded, but recovered soon, and remained faithful to Napoleon to the very last. During the Hundred Days he stayed on his estates. After the restoration he was made a peer of France and commander of the national guard. In 1823 he led the first corps during the invasion of Spain. He d. at Paris Sept. 13, 1847. —His son, Nicolas Charles Victor, b. Nov. 3, 1791, general in 1835, commanded in 1849 the expedition against the Roman republic, and compelled the city of Rome to unconditional surrender July 2. Protesting in the chamber of peers against the *coup d'état*, he was imprisoned, but shortly after restored to liberty. D. July 7, 1863.

Ougrée', town of Belgium, province of Liege, on the Meuse, has iron-works and cannon-foundries. Pop. 5759.

Oulachan, Eulachon, or **Candle-fish,** the *Thaleichthys pacificus*, a fish of the smelt family (Microstomidæ) and resembling the smelt and the capelin. In the spring it enters in great shoals the harbors and fiords of British Columbia and Washington Territory to spawn. The Indians take the fish in immense quantities for food and oil. The fish consist almost entirely of fat. A fish with a strip of bark drawn through it serves as a candle. Many oulachans are preserved for food by drying and smoking.

Ounce [Lat. *uncia*, the twelfth part of a pound], in troy weight, one-twelfth of a pound, or 480 grains; in avoirdupois weight, one-sixteenth of a pound, or $437\frac{1}{2}$ grains troy. In the U. S. the apothecaries' ounce is the troy ounce; in Great Britain it is now the avoirdupois. In the U. S. the fluid ounce is one-twelfth of a wine-pint, in Great Britain the twelfth of an Imperial pint.

Ounce, the *Felis uncia*, a large cat of India resembling the leopard and panther, but lower, rougher, paler, and with a longer and more hairy tail and a thicker fur. The spots are also more irregular than those of the leopard. In parts of S. America the jaguar is called the ounce.

Ourebi [Dutch *bleek-boc*, or "pale buck"], *Scopophorus ourebi*, an antelope of S. Africa, is nearly three feet high, and found in great numbers in open plains. It is of a pale brown-yellow tint, white beneath. It has sharp straight

horns. It gallops rapidly, and its progress is effected by numerous graceful leaps. Its flesh is dry, but very good, and the animal is much hunted; for it does not attempt to flee from the neighborhood of towns and farms.

Ou'ro Pre'to, town of Brazil, cap. of the province of Minas Geraes, was originally founded as a settlement of miners, and reached a high degree of prosperity, but has now declined since its gold-mines became exhausted, or nearly so. It carries on an active trade with Rio Janeiro by means of mules. Pop. 8500.

Ouse, a river of England, flows into the Trent and forms the estuary of the Humber. Its entire length is 60 miles; it is navigable from York, 45 miles from its junction with the Trent.

Ou'sel [Fr. *oisel, oiseau*, a "bird"], a name applied in England to several birds. Thus the "ousel-cock" of Shakspeare was the European blackbird (*Turdus merula*); the ring ousel of the present day is a very similar bird, the *Turdus torquatus*. More frequently the name is applied to those remarkable birds, the water-ousels. (See WATER-OUSEL.) Still other birds receive this name; but nearly all are thrushes, or their allies.

Ouse'ley (Sir FREDERICK ARTHUR GORE), Bart., only son of Sir Gore Ouseley, ambassador to Persia, b. in London, England, Aug. 12, 1825; graduated at Christ Church, Oxford, 1846; was curate of a London church 1849–51; became precentor of Hereford Cathedral 1855, and incumbent of St. Michael's, Tenbury, Worcestershire, 1856; distinguished for his attainments in music as a science; took an active part in establishing St. Michael's College, Tenbury, of which institution he is warden; became professor of music in Oxford University 1855; author of several esteemed anthems, a *Treatise on Harmony* (1869), and a *Treatise on Counterpoint and Fugue* (1869), and editor of several collections of ancient and modern cathedral music.

Ouseley (Sir WILLIAM), LL.D., b. in Monmouthshire, Wales, in 1771; became cornet of dragoons 1788; left the army 1794; engaged in the study of Oriental languages at Leyden; published *Persian Miscellanies* (1795), *Oriental Collections* (3 vols., 1797), numerous other works on similar subjects, and translations from Oriental writers; was secretary to his brother, Sir Gore Ouseley, in his embassy to Persia 1810–12; published *Travels in Persia* (3 vols., 1819–23); brought to England valuable collections of Oriental literature. D. in England in 1842.—His brother, Sir GORE OUSELEY (b. about 1768; d. 1844), long a prominent member of the diplomatic corps, was a distinguished Oriental scholar and collector of manuscripts; author of a posthumous work, *Biographical Notices of Persian Poets* (1846).

Ouseley (Sir WILLIAM GORE), K. C. B., D. C. L., eldest son of Sir William, b. in London, England, July 26, 1797; entered the diplomatic service at an early age; was connected with the British legation at Washington in 1825, when he married a daughter of Gov. Cornelius P. Van Ness of Vermont; filled difficult and responsible diplomatic posts in Rio Janeiro, Buenos Ayres, Montevideo, and Asuncion during the wars originated by the dictator Rosas 1832–51; was employed on special missions in Central America and in the U. S. 1857–58; was author of *Remarks on the Statistics and Political Institutions of the U. S.* (1832); *Notes on the Slave Trade* (1850); *Views in South America, from Original Drawings* (1852), and many miscellaneous, political, and geographical writings. D. in London Mar. 6, 1866.

Oust'er denotes, in law, the dispossession or ejection of one who is entitled to the possession of real property by another who enters into occupation of the premises. Ouster may be either of the freehold or of chattels real, the former being the dispossession of an owner in fee or a tenant for life, the latter of a tenant for years. (See FEE, ESTATE, CHATTEL.) At common law there were five different methods by which ouster of the freehold might be effected: abatement, intrusion, disseisin, discontinuance, and deforcement. Abatement was the wrongful entry of a stranger upon land after the death of the owner, being an estate of inheritance, to the exclusion of the heir or devisee. Intrusion was a similar wrongful entry after the death of a tenant for life, to the exclusion of the remainder-man or reversioner. Disseisin denoted the unlawful ejection of the owner, who was actually or constructively in occupation of the premises, by depriving him of the possession. Discontinuance and deforcement were peculiar modes of ouster, where the entry of the tenant was at first lawful, but the wrong consisted in retaining possession after his rightful interest had terminated. Thus, it was a deforcement for a lessee for years to hold over after the expiration of his term, refusing to deliver possession to the owner of the reversion. But at the present day the terms "ouster," "disseisin," and "adverse possession" are commonly used interchangeably to denote the dispossession of an owner of a freehold, without reference to the particular circumstances under which it is effected, and these ancient names, designating particular methods of ouster, have fallen into disuse. The remedy usually employed to recover the possession of lands of which the owner has been wrongfully divested is the action of ejectment. (See EJECTMENT.) There were formerly, however, various other forms of action which might be resorted to for this purpose, but these have been generally superseded in modern times by ejectment. If the wrongful possession be continued for a sufficient length of time, usually twenty years, under an adverse claim of title, and be open, notorious, and uninterrupted, it is generally provided by statutes of limitation in England and in this country that the rightful owner shall be divested of his title, and the adverse claimant thus becomes the owner of the property. (See the rules on this subject stated in the article LIMITATION, STATUTES OF.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Outagamie', county of N. E. Wisconsin. Area, 648 square miles. It is somewhat level, is fertile, well timbered, and produces live-stock, grain, wool, and much lumber. The county is traversed by the Wolf, Fox, and other rivers, and has good railroad facilities. Cap. Appleton. Pop. 18,430.

Outagamies. See FOX INDIANS.

Out'law, Outlawry [Ang.-Sax. *ûtlaga, ûtlagian*]. An outlaw, in English law, is one who has been placed *out* of the protection of the *law* on account of wilfully avoiding the execution of legal process. In ancient times the process of outlawry took place both in civil and in criminal proceedings. In civil cases a person might be outlawed who was liable to arrest in an action which had been instituted against him, but who avoided the service of process and could not be found. The only forms of action in which a person was originally subject to outlawry were actions of trespass *vi et armis* (see TRESPASS), since in these alone was a defendant then liable to arrest; but subsequently outlawry and the process of arrest were extended by statute to other civil actions. The mode of proceeding to outlaw a person was as follows: If the sheriff were unable to find the defendant and apprehend him upon the regular writs of arrest, a special writ was issued, which required him to cause proclamation to be made in five county courts successively that the defendant should render himself up. If the defendant then failed to appear, he was declared an outlaw. If afterwards he appeared publicly, he might be arrested and committed until the outlawry were reversed. A reversal might readily be obtained upon any plausible cause, however slight, since the only object of the outlawry was to compel an appearance. The process of outlawry in civil actions was abolished in 1852 by statute, except in cases where the defendant was liable to arrest in the execution of a judgment rendered against him; and it was provided that if personal service of the writ could not be effected by reasonable diligence, the plaintiff might make affidavit that the writ had come to the defendant's knowledge or that he had wilfully evaded service, and might obtain an order authorizing him to proceed as if personal service had been made. In criminal proceedings outlawry existed at an earlier period than in civil actions, since no one was subject to be outlawed except for felony until some time after the Norman Conquest. It was extended from cases of felony to misdemeanors, and has continued, until the present, applicable in criminal proceedings of every kind. The mode of procedure in outlawing a defendant who absconds or evades arrest is substantially the same as in civil cases. Outlawry in prosecution for crime has not been abolished. A sentence of outlawry may be reversed by application to the court or by proceedings in error.

The effect of outlawry is to place a person beyond the protection of the law. The maxim applicable to outlaws is, "Let them be answerable to all, and none to them." They cannot, therefore, maintain actions for redress of injuries, nor are they deemed to have any legal rights which can be enforced by suit at law, while they are nevertheless liable upon all causes of action existing against them. Before outlawry in civil cases was abolished it was attended by a forfeiture of goods and chattels to the crown. The same penalty is incurred in cases of misdemeanor, but an outlawry in treason or felony is deemed equivalent to a conviction and attainder for the offence charged, and is attended by the same consequences, viz., in treason, a forfeiture of all his property, both real and personal, and in felony a forfeiture of chattels and the profits of his freehold estates in land during life. (See FORFEITURE.) Anciently, an outlawed felon was said to have a "wolf's head" (*caput lupinum*), so that any one might kill him as he would a wolf. But at an early period a different rule was

established, and the life of an outlaw was held to be under the protection of the law. Process of outlawry has fallen almost entirely into disuse in England, even where permissible. In some of the U. S. it has been retained as applicable in certain criminal cases, as in prosecutions for treason; but occasion for a resort to this practice seldom occurs, so that it may be said to be wholly disused.

George Chase. Revised by T. W. Dwight.

Ou'tram (Sir James), G. C. B., b. in Derbyshire, England, Jan. 29, 1803; educated at Marischal College, Aberdeen; entered the military service of the East India Company 1819; distinguished himself in campaigns in Candeish and against the wild Bheel tribes, from whom, after the peace, he formed an irregular military corps; pursued a similar policy respecting some rebel chiefs in Guzerat; was aide-de-camp of Sir John Keane in the Afghan war; took part in the capture of the Beloochee stronghold of Kelat, and, disguised as a native devotee, rode through the Belan Pass, then held by the enemy, and conveyed the news to Kurrachee; appointed political agent in Lower Scinde, with the brevet rank of major, and subsequently commissioner at Hyderabad; opposed Sir Charles Napier's aggressive policy, but had to defend the Residency from attack by the populace; became resident at Sattara 1845, at Baroda 1847, and at Lucknow 1854; was commander-in-chief of the British forces in the Persian war of 1856–57; arrived in India in the midst of the Sepoy rebellion; relieved Havelock at Cawnpoor Sept. 15, then waived the command in favor of Havelock, whom he accompanied to the relief of Lucknow Sept. 25 in his capacity of chief commissioner of Oude; defended the Residency and held the Alumbagh (Lucknow) during the subsequent siege by the rebels; aided Sir Colin Campbell in the final recapture of Lucknow Mar., 1858; was knighted and made lieutenant-general 1858; received the thanks of Parliament 1860; became a member of the supreme council of India; retired in broken health 1861. D. at Paris Mar. 11, 1863.

Ova'da, town of Italy, province of Alessandria, containing fine public and private buildings and having considerable trade and manufactures. During the mediæval wars, Ovada was fiercely contended for and suffered severely. Its old wall and castle are in ruins. Pop. 7053.

O'val [Lat. *ovum*], an egg-shaped curve; a curve resembling an ellipse. A semi-oval formed by arcs of circles of different radii and tangent to each other is sometimes used by engineers in the construction of arches. Such curves are often called basket-handled curves or basket-handled arches.

Cartesian Oval.—This name is given to a class of curves characterized by the property that the simultaneous increments of two lines drawn from the generating point to two fixed points have a constant ratio. If this ratio is -1 (that is, if one of these lines increases as fast as the other diminishes), we have the ellipse as a particular case of the Cartesian oval. If the ratio is $+1$ (that is, if the simultaneous increments are equal), we have the hyperbola as another particular case of the Cartesian oval. Let the fixed points lie on a horizontal line, and let one on the left be taken as a pole, the line joining them being the initial line; then will the equation of the oval be,

$$(m^2-1)r^2+4(a-m^2c\cos\phi)r+4(m^2c^2-a^2)=o,$$

in which c is half the distance between the fixed points, m the ratio of the simultaneous increments of the lines drawn from these points to the generating point, and a an arbitrary constant. This equation is of the *fourth* degree, except for the particular cases in which $m=\pm 1$. In these cases the equation of the oval reduces to the form,

$$r=\frac{a^2-c^2}{a-c\cos\phi}=\frac{a(1-e^2)}{1-e\cos\phi}$$

the well-known polar equation of the ellipse and hyperbola, when the pole is taken at one focus. The scientific interest attached to the Cartesian oval arises from the fact that the surface generated by revolving it about the line that joins the two fixed points is a surface of *accurate convergence* (that is, a surface which must divide two media of different refracting power, in order that rays of light coming from one point may be so deviated as to pass accurately through another point). W. G. Peck.

Ovam'pos, a tribe or nation of Africans resembling both the true negro and the S. African tribes. They inhabit the Atlantic coast region S. of Cuanene River, and near Walfisch Bay. Except near the coast the soil is fertile, but water is not abundant. The surface is elevated and healthful. The people are warlike and strong, but remarkably ugly and filthy. They are, however, industrious, ingenious, and unusually honest, and have made some progress towards civilization. They keep large herds of cattle and swine and raise much grain and poultry. Their country abounds in elephants and other large game.

Ovar', town of Portugal, province of Beira, on a river of the same name, has valuable fisheries and considerable trade. Pop. 10,000.

O'varies [Lat. *ovum*, "egg;" Fr. *ovaire*], the two organs in oviparous animals in which the *ova*—the generative product of the female—are formed. They are termed by Galen *testes muliebres*, since they are in woman the analogues of the testes of the male, which originate the male generative element—spermatozoids. The ovaries in adult women are situated on either side of the uterus, in the iliac fossæ; they are included in the two pelvic duplicatures of the peritoneum, which are called the broad liga-

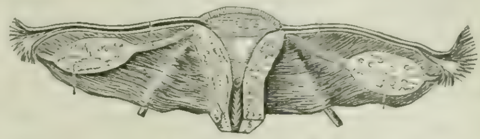
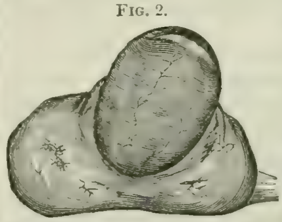


Fig. 1. Relation of uterus, Fallopian tubes, and ovaries.

ments. Each ovary is also attached by a round fibrous cord, the ovarian ligament, to the side of the uterus, and by a lesser fibrous cord to the fringed edge of the Fallopian oviduct. These three ligaments support and retain the ovary in its proper position. The ovary is an oblong, ovoid, flattened body, of whitish color and uneven surface. It is one-third to half an inch thick, three-quarters of an inch wide, 1 to $1\frac{1}{2}$ inches long; it weighs from 1 to 2 drachms. (For elaborate description of the minute structure of the ovaries and of the development of the ova see Histology.) The physiological function of the ovary is the formation of ova, their maturation, and their final discharge at periodic menstrual epochs. The distended follicle at the time of rupture may equal in size one-third of the ovary, and many scars exist where former ruptures have taken place. As a rule, the fringed end of the Fallopian tube clasps this distended follicle and receives the escaping ovum, which by the oviduct is carried to the interior of the uterus. It may here be impregnated and detained, or pass from the body with the menstrual flow; the blood of menstruation escapes from the mucous lining of the uterus. The activity of the ovary develops at puberty—usually the fifteenth or sixteenth year—and ceases with the climacteric—forty-fifth to fifty-second year. The remarkable functional activity of the ovary, including periodic congestions, ruptures, and cicatrization, renders it peculiarly liable to disease. Neuralgia, congestion, and inflammation of the ovary are frequent diseases in women—often temporary and slight, at times chronic, depressing strength and health, and causing hysteria and dementia. Solid tumors, fibrous and cancerous, affect the ovary less often than the uterus. Ovarian dropsy originates in the dropsical distension of one or more Graafian follicles by albuminoid serum. This may arise when the follicles are too deeply situated to rupture and discharge the contained ovum, or prevented by thickening of the surface from previous inflammation; it may also begin by accumulation in the cavity of the corpus luteum. A cyst may be *unilocular*, having but one cavity and arising originally from one follicle; or *multilocular*, having several compartments corresponding to several follicles. The ovarian cyst may contain many quarts of transparent, albuminoid serum.

Fig. 2.



Graafian vesicle about to rupture: scars of former ruptures.

Ovariotomy, the surgical operation of evacuating ovarian dropsy and eradicating the cyst, was first performed in America by Dr. Ephraim McDowell of Kentucky; this first case resulted in recovery. Dr. McDowell operated thirteen times—eight successfully. Originating in America, it is now accepted and extensively performed in all countries. Spencer Wells of England has operated in over 500 cases; second to him in number of cases stand Atlee, Peaslee, Kimball, Sims, and Thomas of this country. It is a formidable operation, but the ratio of recovery and cure steadily increases as the result of improved methods and instruments. Simple unilocular cysts quite generally recover; multiple cysts and those adherent to adjacent organs result less favorably. E. Darwin Hudson, Jr.

Ov'en Bird, or **Golden-crowned Thrush,** the *Seiurus aurocapillus*, a N. American bird of the family Sylvicolidæ, remarkable for its nest, which it builds upon

the ground and roofs over with a dome-shaped covering. It is a shy, retiring bird, of an olive-brown color, six inches long, and is often seen running along the ground. The name oven bird is also given to certain S. American birds of the genera *Furnarius* and *Cinclodes*, belonging to the family Certhiadæ. They are remarkably bold little birds, and build a fine dome-shaped nest which is divided by a partition into two rooms, the innermost of which contains the eggs.

O'verbeck (FREDERICK), b. at Lubeck July 3, 1789; studied painting in Vienna from 1806 to 1809; settled in 1810 at Rome; embraced Roman Catholicism in 1814; was an apostle of the sentimental religious school in art; held beauty subordinate to piety; attempted to revive the devotional art of a former ascetic period, and founded a school which was numerously attended and celebrated in its day. His works expressed deep religious feeling, but are thin and artificial. Discarding as heresy the ideas of the moderns, he earned the title "Nazarene," which was bestowed on the men of his school. He chose sacred subjects: *The Entrance of Christ into Jerusalem* (Lubeck), *Christ on the Mount of Olives* (Hamburg), *The Entombment* (Lubeck), *The Triumph of Religion* (Frankfort). These are his best pieces. The great frescoes on the Monte Pincio and in the Villa Massimi were executed by Overbeck in conjunction with other artists of the same persuasion. D. in Rome Nov. 12, 1869. O. B. FROTHINGHAM.

O'verbrook, post-v. of Montgomery co., Pa., on the Pennsylvania Central R. R.

O'verbury (Sir THOMAS), b. at Ilmington, Warwickshire, England, in 1581; graduated at Queen's College, Oxford, 1598; travelled on the Continent; became a resident of Edinburgh 1601, where he was an intimate friend of Robert Carr, afterwards Viscount Rochester and earl of Somerset; was knighted 1608; travelled on the Continent 1609; wrote *Observations upon the State of the Seventeen United Provinces;* incurred the enmity of his former friend, Lord Rochester, and of the countess of Essex, by his opposition to their criminal intrigues; refused a foreign mission offered him as a means of removing him from the country, and was thereupon thrown into the Tower, where he was cruelly treated, and d. Sept. 15, 1613. Three years later Lord Rochester, then earl of Somerset, and his countess were convicted of having poisoned Overbury.

Overdar'wen, town of England, in Lancashire, has large paper manufactures, iron-works, and coal-mines. Pop. 14,327.

O'verfield, tp. of Wyoming co., Pa. Pop. 433.

O'verisel, post-v. and tp., Allegan co., Mich. P. 1060.

Overland Route, The, from Great Britain to India, is most rapidly traversed by way of Dover, Calais, Lyons, Mt. Cenis, Turin, Bologna, and Ancona or Brindisi, thence by steamer to Alexandria, and by rail to Suez; or by the French Messageries steamers to Port Said direct, thence to Suez by canal, and thence by the Red Sea to Aden and Bombay. The trip may be made in twenty-three days, and will cost from about £170 (second class) to £300 (first-class fare).

O'verstone (SAMUEL JONES **Loyd**), BARON, only son of Lewis Loyd of Overstone Park, Northamptonshire, b. Sept. 25, 1796; was educated at Eton and at Trinity College, Cambridge; was high sheriff of Warwickshire 1838; member of Parliament for Hythe in the Liberal interest 1819–26; member of a powerful banking-firm in Lothbury, London; became a recognized authority upon financial and fiscal questions, on which he published a number of treatises; was a munificent patron of art; took an active interest in promoting the introduction of decimal coinage into England, and was raised to the peerage Mar. 5, 1850.

Overt Act. See TREASON.

O'verton, county of Tennessee, bounded N. by Kentucky. Area, 450 square miles. It is uneven and in parts mountainous, occupying a place on the N. W. slope of the Cumberland Mountains. It contains detached coal-beds, has a good soil, and produces corn, tobacco, wool, and live-stock. Its area has been much diminished since the last census. Cap. Livingston. Pop. 11,297.

Overton, tp. of Lincoln co., Nev. Pop. 149.

Overton, post-v. and tp., Bradford co., Pa. Pop. 550.

O'verture [Fr. *ouverture*], the name given to the introductory movement, symphony, or elaborate prelude occurring in oratorios, operas, cantatas, and similar compositions. The overture, though complete in itself, is generally so framed as to bring the mind of the hearer into a correspondence of tone and sympathy with the leading traits of the work to which it is prefixed. To effect this it is sometimes sufficient to exhibit in the overture the prevailing sentiment or coloring of the earlier movements (at least) of the work it announces. In other cases the composer ingeniously weaves into the overture some of the leading ideas of the work itself by brief anticipations of its melodies, or anything striking in its modulations, harmonies, or rhythmical forms, thereby predisposing the mind of the hearer to enjoy the recurrence of those points in the after-part of the performance. The introduction of the overture as a distinct and highly-wrought species of composition is ascribed to Scarlatti, a Neapolitan of the latter part of the seventeenth century, before whose time its place was occupied by meagre preludes or prefatory symphonies, of little account beyond that of an ordinary opening strain. WILLIAM STAUNTON.

O'verweg (ADOLF), b. at Hamburg July 24, 1822; studied natural science, especially geology, at Bonn and Berlin; joined Barth and Richardson on their explorations of Central Africa in 1850, and d. near Lake Tchad Sept. 27, 1852. His observations, among which was the discovery that the desert of Sahara is an elevated plateau, and not, as had hitherto been supposed, a depressed plain, were communicated in *Monatsberichte der Gesellschaft für Erdkunde,* Berlin, vols. viii. and ix., and Petermann's *Zeitschrift für allgemeine Erdkunde,* Gotha, vol. i.

O'veryssel, a province of the Netherlands, lies between the Zuyder Zee in W., and Hanover and Westphalia in E. Area, 1312 square miles; pop. 260,543. The surface is level, the soil mostly light, in many places sandy and covered with heath, in others affording good pasture-grounds. Rye, barley, oats, hemp, potatoes, and buckwheat are raised. Cattle-rearing, digging of turf, and linen manufactures are extensively carried on.

O'vibos [Lat.], a genus of the *Bovidæ* or ox family, but more probably belonging to the *Ovidæ* or sheep family. The only known living species, *Ovibos moschatus,* the musk-ox, so called from the strong musky flavor of the meat of the bulls and lean cows, is an animal about the size of the smallest breed of oxen, or of a two-year old heifer, its carcass, without the entrails, weighing upwards of three hundredweight. This animal is at present confined to the extreme northern parts of the N. American continent, where it ranges over the barren grounds to the N. of lat. 60°, roaming in summer to the islands within the Arctic circle, though never reaching Greenland. During the glacial period its range must have been far more extensive, as its bones have been found in drift-gravel in the valley of the Avon at Bath, and elsewhere in England; whilst the remains of species allied, termed *Bootherium* by Leidy, have been found in the U. S. EDWARD C. H. DAY.

Ov'id, tp. of Branch co., Mich., near the Michigan Southern R. R. Pop. 1230.

Ovid, post-v. and tp., Clinton co., Mich., about 20 miles N. of Lansing, on the Detroit and Milwaukee R. R., has 1 union school, 3 churches, 1 bank, a newspaper, 2 "shook" factories, 2 good hotels, 1 flour and 2 saw mills, an iron foundry, 1 organ-factory, 1 planing-mill, and stores. Pop. 2420. REEVES & CARRIER, EDS. "REGISTER."

Ovid, post-v. and tp., cap of Seneca co., N. Y., 20 miles from Ithaca; has a union graded school, 4 churches, a court-house and jail, a steam flouring and saw mill, 1 bank, 1 newspaper and job-printing office, the county clerk's office, and a number of stores. Pop. of v. 724; of tp. 2403. OLIVER C. COOPER, ED. "INDEPENDENT."

Ovid (PUBLIUS OVIDIUS NASO), b. Mar. 20, 43 B. C., at Sulmo in the country of the Peligni, about 90 miles from Rome, of a rich equestrian family; received an elegant education in the schools of the rhetoricians; studied afterwards at Athens; travelled in Asia Minor and Sicily, and lived then for many years in Rome, idle, frivolous, but brilliant; intimately connected with Macer and Propertius; acquainted with Horace, moving with freedom and ease in the court circles; admired by all for his wit and his verses, and enjoying, as it seems, to the very dregs, all that could be enjoyed at Rome, until, in the latter part of the year 8 A. D., Augustus suddenly banished him to Tomi. The reason is not known with certainty. The edict mentions the obscenity and frivolity of the *Ars Amandi,* but the book had been in free circulation for ten years before this time, and cannot have been more than a pretext. It is more probable that the cause was the intrigue in which the poet, during the period between his second and third marriages, indulged with Julia, the daughter of Augustus. At Tomi, a small Getic town on the frontier of the empire, at the delta of the Danube, the fastidious libertine of the metropolis found life intolerable, and month after month sent the most humble supplications to Augustus, but the emperor was immovable, and the poet d. in exile 18 A. D. His works comprise *Heroides,* twenty-one letters from heroines to their lovers; *Amores,* love-elegies; *Ars Amandi; Remedia Amoris; Metamorphoses; Fasti,* a poetical

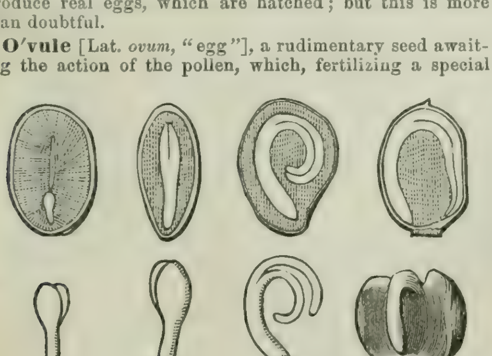
commentary on the Roman calendar; *Tristia; Epistolæ ex Ponto:* the tragedy *Medea* is lost. The most remarkable editions of his collected works are the *editio princeps,* Rome, 1471, that by Heinsius, Leyden, 1629, and that by Burmann, Amsterdam, 1727; separate editions, especially of *Metamorphoses* and *Ars Amandi,* are very numerous. Among the translations, likewise very numerous in all modern languages, is one of the *Metamorphoses* by Dryden, Addison, Congreve, and others, edited by Garth. Of all Latin poets Ovid stands nearest to modern civilization, partly on account of his fresh and vivid sense of the beauties of nature—a point in which the Latin literature is generally deficient—partly because his subject is love. His representations of this feeling are often sensuous, but they are graceful and strikingly true. He also excels other Latin poets in the perfect elegance of his form, especially in the character and rhythm of his verses. CLEMENS PETERSEN.

Ovie'do, town of Spain, capital of the province of the same name, is finely laid out, with a large and elegant public square in the centre, from which the four main streets lead in opposite directions. It has a beautiful cathedral from the eighth century, a splendid aqueduct, which provides eleven fountains with abundance of good water, a well-attended university with a large public library, and manufactures of arms, hats, linen, and leather. In the vicinity are hot springs, which are much used for bathing. Pop. 14,156.

Oviedo y Valdés, de (GONZALO FERNANDEZ), b. at Madrid, Spain, in 1478; was made inspector of mines in the West Indies 1514; held offices at Hispaniola; visited Darien and Nicaragua; made several voyages to Spain; was appointed historiographer of the Indies; published a *Sumario* or brief history in 1526, and *Historia General y Natural de las Indias Occidentales,* in 50 books, of which twenty-one were printed at Seville in 1535, and reprinted at Salamanca in 1547; but no complete edition was published until that edited by the Royal Academy (4 vols., 1850), though it was consulted in manuscript by most subsequent Spanish writers upon America. He was also author of *Las Quinquagenas,* treating upon the genealogies of the Spanish nobility, chronicles of Ferdinand and Isabella, of Charles V., and of Cardinal Ximenes, none of which have been published, and of *Historia de Nicaragua,* first published in French in the collection of Ternaux-Compans (vol. xv.). Translations of the printed portion of the *Historia General* appeared in Latin (Bâle, 1555), in German (1579), and Italian, the latter forming part of vol. iii. of the great work of Ramusio (Venice, 1559). D. at Valladolid, Spain, in 1557.

Ovip'arous Animals [Lat. *ovum,* "egg," and *pario,* to "produce"] are those which do not bring forth their offspring in a well-developed or even a fœtal state, but in the condition of an *egg. Ovoviviparous* are those which develop the ovum into a perfect egg, which, however, hatches before birth, so that living young are brought forth. All mammals are *viviparous,* that is, bring forth living young which has never been contained within a complete egg, though all have been through the *ovum* stage. But the non-placental mammals (marsupials and monotremes) have been called *semi-oviparous* because their reproduction is highly analogous to that by means of the complete egg; and, indeed, some observers have declared that the monotremes (duck-bill echidna) do indeed produce real eggs, which are hatched; but this is more than doubtful.

O'vule [Lat. *ovum,* "egg"], a rudimentary seed awaiting the action of the pollen, which, fertilizing a special



cell or its contents, incites the formation of the germ or embryo. Ovules are borne on the placenta, either singly or in numbers, and are often raised on a *funiculus,* or seed-stalk. The point of attachment is called the *hilum,* and in the seed forms a scar. The ovule consists of a *nucleus* and usually one or two coats, through which there is an orifice at the top known as the *foramen* or *micropyle.* The part where the coats, nucleus, etc. are united together is called *chalaza.* Ovules have four principal forms—the *orthotropous,* or straight; the *campylotropous,* or curved; the *amphitropous,* or half-inverted; and the *anatropous,* or inverted. The latter is the most common form: here the ovule coheres down one side with its funiculus, and its apex points to the placenta. The coherent support thus forms a ridge called the *rhaphe.* When the pollen reaches the stigma—which it does either by falling directly upon it, or through the agency of wind or insects—it absorbs moisture from the glutinous or naked tissue, and protrudes a tube. This insinuates itself between the loose cells and penetrates the style until it reaches the embryo sac. It contains the fluid contents of the original pollen-grain. What the action is which results upon contact is not definitely known, but it seems probable that the fluid of the pollen-tube is absorbed into the embryo sac by *endosmosis.* The actual body awaiting fertilization is a globule of protoplasm, and is called the *germinal vesicle.* It grows by cell-multiplication; the manner in which it is developed is treated under VEGETABLE PHYSIOLOGY.
W. W. BAILEY.

Ovum. See HISTOLOGY, by COL. J. J. WOODWARD, M. D.

Owas'co, post-v. and tp., Cayuga co., N. Y., on Owasco Creek and Lake. Pop. 1261.

Owasco Lake, a picturesque lake of Cayuga co., N. Y., 11 miles long, 1½ miles wide, and 758 feet above the sea. It is in a fertile region, and is a favorite summer resort. Its waters flow into Seneca River.

Owas'so, city and tp., Shiawassee co., Mich., 25 miles N. E. of Lansing, on the Detroit and Milwaukee and the Jackson Lansing and Saginaw R. Rs., contains a fine high school and 4 branch schools, 7 churches, 2 banks, fine water-power, 1 tannery, 2 flouring, 1 woollen, 1 plaster, and 2 planing mills, a brewery, 1 boot and shoe factory, 2 newspapers, a marble-mill, a fire-clay mine, 7 hotels, and stores. Pop. of city 2065; of tp. 3123.
J. H. CHAMPION, ED. "WEEKLY PRESS."

Owaton'na, post-v. and tp., cap. of Steele co., Minn., on Straight River, at the intersection of the Milwaukee and St. Paul with the Winona and St. Peter R. R., 90 miles W. of Winona, has 1 newspaper, important manufactures, and a brisk shipping trade. Pop. 2070; of tp. 2572.

Owe'go, tp. of Livingston co., Ill. Pop. 800.

Owego, post-v. and tp., cap. of Tioga co., N. Y., situated on the Susquehanna River, 236 miles from New York City, has a public library, an academy, 4 schools, 3 banks, 6 churches, 3 weekly newspapers, several good hotels, 2 flouring and 3 planing mills, 2 foundries and machine-shops, and other minor manufacturing interests. The village is situated in the heart of a fine agricultural section, and its streets are regularly laid out with rows of maple trees on either side. Owego is quite a resort for tourists during the summer months. Pop. of v. 4756; of tp. 9442. BEEBE & KINGMAN, EDS. "OWEGO GAZETTE."

O'wen, county in Central Indiana. Area, 400 square miles. It is somewhat uneven, fertile, well wooded, and abounds in valuable block coal. Cattle, wool, and grain are leading products. The manufactures include lumber, carriages, etc. The county is traversed by White River and by the Louisville New Albany and Chicago and the Indianapolis and Vincennes R. Rs. Cap. Spencer. Pop. 16,137.

Owen, county of Northern Kentucky, bounded W. by Kentucky River. Area, 300 square miles. It is rolling, fertile, and produces live-stock, corn, tobacco, and wool. Limestone abounds. Cap. Owenton. Pop. 14,309.

Owen, tp. of Pulaski co., Ark. Pop. 505.

Owen, tp. of Saline co., Ark. Pop. 283.

Owen, tp., Winnebago co., Ill., on Rock River. P. 929.

Owen, tp. of Clarke co., Ind. Pop. 679.

Owen, tp. of Clinton co., Ind. Pop. 1118.

Owen, tp. of Jackson co., Ind. Pop. 1589.

Owen, tp. of Warrick co., Ind. Pop. 1440.

Owen, tp. of Cerro Gordo co., Ia., on Shell Rock River, near the Central Iowa R. R. Pop. 211.

Owen (DAVID DALE), son of Robert Owen, the socialist, b. at New Lanark, Scotland, June 24, 1807; d. in New Harmony, Ind., Nov. 13, 1860; was educated at Hofwyl, Switzerland, and came to the U. S. with his father in 1823 to assist him in his social experiment at New Harmony; subsequently studied geology and other natural sciences. In 1835 received the degree of M. D. from the Medical College of Ohio, and in 1837, by appointment of the legislature, he made a geological reconnoissance of the State of

Indiana. Under instructions from the U. S. Land Office, he subsequently made an examination of the mineral lands of Iowa, and in 1848 was employed by the government to take charge of a geological survey of Wisconsin, Iowa, and Minnesota. The results of this survey, extending over a period of three years, were published in a quarto volume by Congress in 1852. From 1852 to 1857 he was employed in a geological survey of Kentucky, the results of which were published in four volumes. In 1857 he was appointed State geologist of Arkansas, and the report of his survey was subsequently published in one volume.

OLIVER JOHNSON.

Owen (ELIAS K.), U. S. N., b. in Illinois Nov. 21, 1834; entered the navy in 1848, and rose to be a commander in 1866; commanded the Louisville in most of the various hard-fought battles on the Western waters in 1863 and 1864. FOXHALL A. PARKER.

Owen (JOHN), D. D., "the great dissenter" and the "prince of divines," was b. at Stadham, Oxfordshire, in 1616; was educated at Queen's College, Oxford, 1628–37; was an early advocate of the parliamentary cause, and an adversary of Laud's measures; received the living of Fordham, Essex, which he exchanged for a Presbyterian pastorate at Coggeshall, where he introduced independent church government. In 1649 he became private chaplain to Oliver Cromwell; in 1651 dean of Christ Church, Oxford; was vice-chancellor of the university 1652–57, when he was deprived by the Presbyterian party; in 1673 he removed to London. D. at Ealing, Middlesex, Aug. 24, 1683. He was a man of great piety, learning, and magnanimity, the author of more than eighty theological works, doctrinal, practical, and polemical. His *Exposition of the Epistle to the Hebrews* (1668–84) is his greatest work. Though a zealous opponent of Arminianism, Presbyterianism, Episcopacy, and papacy, all parties held him in high esteem. His works, in Goold's edition (1850), occupy 24 vols. 8vo.

Owen (JOHN), b. in Bladen co., N. C., in Aug., 1787; was educated at the State University; was governor of North Carolina 1828–30; president of the Harrison convention at Harrisburg, Pa., in 1840, and held other public positions. D. at Pittsborough, N. C., Oct., 1841.

Owen (JOHN JASON), D. D., LL.D., b. at Colebrook, Conn., Aug. 13, 1803; graduated at Middlebury College, Vt., in 1829, and at the theological seminary, Andover, Mass., in 1831; entered the Presbyterian ministry in 1832; became in 1836 president of Cornelius Institute, New York; professor of Latin and Greek in the New York Free Academy 1848, and its vice-principal in 1853; vice-president of the College of the City of New York 1866; prepared editions, with notes, of Xenophon's *Anabasis*, 1843; Homer's *Odyssey*, 1844; of the *Cyropædia*, 1846; of *Thucydides*, 1848; of the *Iliad*, 1851; the text of the Acts of the Apostles, with notes, 1850; a Greek reader, 1852; a *Commentary on the Gospels*, 3 vols., 1857, *seq.* D. in New York City Apr. 18, 1869.

Owen (LEWIS), D. D., LL.D., b. at Maltraeth, Anglesea co., Wales, in 1533; educated at Winchester School and New College, Oxford, where he obtained a fellowship; was professor of canon law during the reign of Mary, and having remained attached to Catholicism retired in the reign of Elizabeth to Flanders; became professor at Douay, which he founded in union with Cardinal Allen, as also an English college at Rome, where he obtained high ecclesiastical dignities. D. Oct. 14, 1594.

Owen (RICHARD), C. B., F. R. S., LL.D., D. C. L., b. at Lancaster, England, in 1804; served for a time in the British navy; studied medicine at Edinburgh and St. Bartholomew's, London; succeeded Sir Charles Bell as Hunterian professor in the Royal College of Surgeons in 1836; became superintendent of the natural history department of the British Museum in 1855; has attained world-wide renown as a comparative anatomist, palæontologist, and of later years as a student of sanitary science; is a member of many learned societies and the recipient of many honors. Owen's most important works are *Lectures on the Comparative Anatomy and Physiology of Invertebrate Animals* (1843); *Lectures on the Comparative Anatomy and Physiology of Vertebrate Animals* (1846); *Odontography* (1840–45); *On the Archetypes and Homologies of the Vertebrate System* (1848); *On the Nature of Limbs* (1849), besides numerous other works of scarcely less importance, including a number of valuable catalogues of the museum, compiled with very great labor. In 1873 he was made a Companion of the Bath.

Owen (RICHARD), M. D., son of Robert Owen, b. at New Lanark, Scotland, Jan., 1810; was educated at Hofwyl and Glasgow; came in 1827 to the U. S.; served as an officer in the Mexican war, and afterwards assisted his brother, D. D. Owen, in geological labors; held professorships of natural science in the Military Institute and University of Nashville, Tenn., 1849–58; removed in 1858 to New Harmony, Ind. Author of *A Key to the Geology of the Globe* (1850–57), in which the doctrine of evolution is enunciated; and numerous scientific and other papers.

Owen (ROBERT), social reformer, b. in Newtown, Montgomeryshire, North Wales, Mar. 14, 1771, where he d. Nov. 19, 1858; entered upon a commercial life at an early age, and subsequently engaged in the cotton manufacture at New Lanark, Scotland, where he introduced important reforms having for their object the improvement of the condition of the laborers in his employ; then directed his attention to social questions on a broader scale, publishing in 1812 *New Views of Society, or Essays upon the Formation of the Human Character*, and subsequently *Book of the New Moral World*, in which he advocated doctrines of human equality and the abolition of class distinctions. Having won a large fortune in his business, he was able to give these works and various tracts embodying his views a wide circulation. The duke of Kent became his patron, and his followers were numerous. His religious views exposed him to much obloquy and a bitter opposition, and after the death of his patron he came to the U. S. in 1823, and founded at his own expense a communist society at New Harmony, Ind. The scheme proving a failure, he returned to England, where he tried several similar experiments with the same result. He also failed in an attempt to establish a "labor exchange" in London. In 1828, by invitation of the government of Mexico, he went to that country in the hope of carrying out his socialistic schemes, but was disappointed. In spite of his failures he was universally esteemed for his integrity and benevolence. His later years were spent in efforts to promote a religion of reason and to improve the condition of the working-classes. His followers bore the name of "Owenites," and from them sprang the English Chartist movement.

OLIVER JOHNSON.

Owen (ROBERT DALE), eldest son of Robert Owen, the social reformer, b. in Glasgow, Scotland, Nov. 7, 1801; was educated at Fellenberg's college, near Berne, Switzerland; came to the U. S. with his father in 1823, and assisted him in his efforts to found the colony of New Harmony, Ind. On the failure of that experiment he visited France and England, but returned to the U. S. in 1827 and became a citizen. In 1828, in partnership with Miss Frances Wright, he founded *The Free Enquirer*, a weekly journal devoted to socialistic ideas and to opposition to the supernatural origin and claims of Christianity. The paper was discontinued after an existence of three years. In 1832 he married Mary Jane Robinson of New York, who died in 1871. He settled in New Harmony, Ind., where for three successive years (1835–38) he was elected a member of the legislature. It was through his influence that one-half of the surplus revenue of the U. S. appropriated to the State of Indiana was devoted to the support of public schools. From 1843 to 1847 he represented the first district of Indiana in Congress, acting with the Democratic party; took an active part in the settlement of the north-western boundary question, serving as a member of the committee of conference on that subject; introduced the bill organizing the Smithsonian Institution, and served for a time as one of the regents; in 1850 was a member of the Indiana Constitutional Convention, in which he took a prominent part. It was through his efforts that Indiana conferred independent property rights upon women. In 1853 he went to Naples as U. S. chargé d'affaires, and in 1855 was appointed minister, and held the place until 1858. In 1860 he discussed the subject of divorce with Horace Greeley in the *Tribune*. The discussion, in pamphlet form, obtained a wide circulation. After the breaking out of the rebellion, Mr. Owen was a warm champion of the policy of emancipation, and the letters which he addressed to members of the cabinet and the President on that subject were widely disseminated. When the proposition was made by certain influential politicians to reconstruct the Union with New England "left out in the cold," Mr. Owen addressed a letter to the people of Indiana, exposing the dangerous character of the scheme, which the "Union Leagues" of New York and Philadelphia published and circulated extensively. In 1862 he served as a member of the commission on ordnance stores, and in 1863 was chairman of the American freedmen's commission, which rendered valuable service to the country. Mr. Owen has published *Outlines of the System of Education at New Lanark* (Glasgow, 1824), *Moral Physiology* (New York, 1831), *Discussion with Origen Bachelor on the Personality of God and the Authenticity of the Bible* (New York, 1832), *Pocahontas*, a historical drama (New York, 1837), *Hints on Public Architecture*, illustrated (New York, 1849), *Footfalls on the Boundary of Another World* (Philadelphia, 1860), *The Wrong of Slavery and the Right of Freedom* (Philadelphia, 1864), *Beyond the Breakers*,

a novel (Philadelphia, 1870), *The Debatable Land between this World and the Next* (New York, 1872), *Threading my Way*, an autobiography (New York, 1874). Mr. Owen received the degree of LL.D. from the Univ. of Ind. in 1872. D. at L. George, N. Y., June 24, 1877. OLIVER JOHNSON.

O'wens, tp. of Dallas co., Ark. Pop. 690.

Owens (JOHN E.), b. at Liverpool, England, in 1823; was brought to the U. S. in infancy; made his début on the Philadelphia stage 1846, and has since appeared in comedy in the principal cities of the U. S. and England, his most successful part being *Solon Shingle.*

Owens (Rev. THOMAS), b. in South Carolina Jan. 8, 1787; entered the itinerant ministry in Mississippi in 1813; his ministry was unique, attractive, and successful; was a member of the Mississippi conference of the M. E. Church, South, at the time of his death, July 1, 1868.
T. O. SUMMERS.

O'wensboro', city, cap. of Daviess co., Ky., on the S. bank of the Ohio River, 160 miles from Louisville; contains an excellent system of public schools, churches representing all creeds, 18 tobacco stemmeries, with a capital sufficient to handle the entire tobacco crop of the Green River country, 3 weekly newspapers, and several manufactories. Rich deposits of coal exist throughout the county, and large quantities of corn, hay, wheat, and rye are raised annually. Pop. of city, 3437. J. G. FORD, ED. "SHIELD."

Owen Sound, port of entry, cap. of Grey co., Ontario, Canada, at the head of Owen Sound (a part of Lake Huron), 45 miles W. N. W. of Collingwood. It has a good water-power, several lumber-mills, foundries, and other manufactories, and 2 weekly newspapers. There is a good trade in lumber and grain. Pop. of sub-district, 3369.

Owens River rises in Mono co., Cal., E. of the Sierra Nevada, and flows S. into Owens Lake in Inyo co. The lake is saline and alkaline, and has no outlet. There is a narrow area of arable bottom-lands near the river.

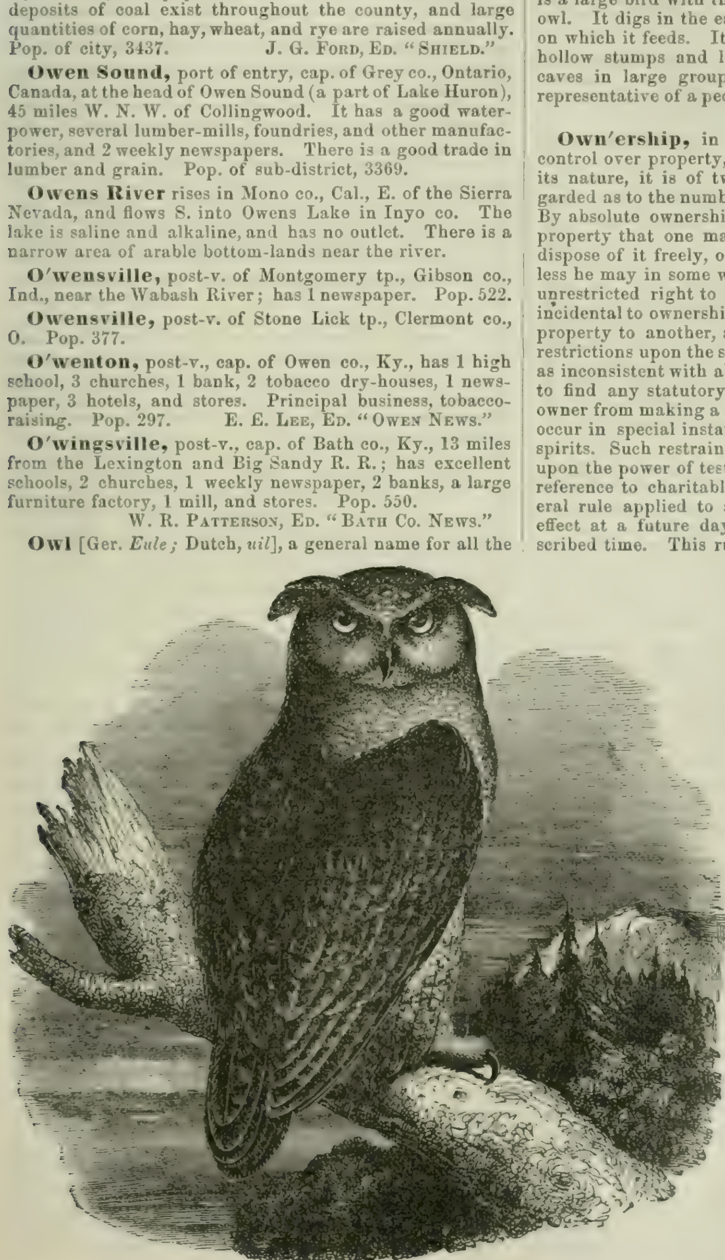
O'wensville, post-v. of Montgomery tp., Gibson co., Ind., near the Wabash River; has 1 newspaper. Pop. 522.

Owensville, post-v. of Stone Lick tp., Clermont co., O. Pop. 377.

O'wenton, post-v., cap. of Owen co., Ky., has 1 high school, 3 churches, 1 bank, 2 tobacco dry-houses, 1 newspaper, 3 hotels, and stores. Principal business, tobacco-raising. Pop. 297. E. E. LEE, ED. "OWEN NEWS."

O'wingsville, post-v., cap. of Bath co., Ky., 13 miles from the Lexington and Big Sandy R. R.; has excellent schools, 2 churches, 1 weekly newspaper, 2 banks, a large furniture factory, 1 mill, and stores. Pop. 550.
W. R. PATTERSON, ED. "BATH CO. NEWS."

Owl [Ger. *Eule;* Dutch, *uil*], a general name for all the nocturnal birds of prey. They are all short and heavy, with large head and eyes, the latter of which are in almost every instance fitted for night-vision and surrounded by radiating feathers. Nearly all have a singularly noiseless flight and a quick sense of hearing. By G. R. Gray 206 species are recognized as inhabitants of all regions. In N. America, N. of Mexico, 80 species are found, according to Baird, Brewer, and Ridgway. *Glaucidium gnoma*, the pygmy owl of the Pacific States, is the smallest North American owl, and is but seven inches long. *Nyctea nivea*, the snowy owl, and *Surnia ulula*, the hawk-owl, are diurnal in their habits. Owls have in all ages and countries been regarded as of ill omen by the superstitious. Their strange appearance, their harsh cries, their noiseless flight, and their nocturnal habits have all tended to confirm this popular opinion. The Greeks made the owl sacred to Athena, the goddess of wisdom.
THEODORE GILL.



The Eagle Owl.

Owl Creek, post-v. and tp., Woodson co., Kan., near the Neosho River and Missouri Kansas and Texas R. R. Pop. 1096.

Owl-Parrot, the *Strigops habroptilus*, a bird of the South Pacific Islands, and especially of New Zealand. It is a large bird with the aspect and nocturnal habits of the owl. It digs in the earth with its hooked beak after roots on which it feeds. It seldom flies, and generally rests in hollow stumps and logs. It is reputed to hibernate in caves in large groups. It is the type and only known representative of a peculiar group of the family Psittacidæ.
THEODORE GILL.

Own'ership, in law. This consists in dominion or control over property, real or personal. Considered as to its nature, it is of two sorts, absolute and qualified; regarded as to the number of owners, it is individual or joint. By absolute ownership is meant such a full control over property that one may do with it as he pleases. He may dispose of it freely, or even destroy it without action, unless he may in some way injure the rights of others. The unrestricted right to sell must be regarded as in general incidental to ownership. Accordingly, if one should convey property to another, and at the same time impose general restrictions upon the sale of it, the restrictions would be void as inconsistent with absolute ownership. It is not common to find any statutory restrictions preventing an absolute owner from making a sale of his property, though this may occur in special instances, as in the case of sale of ardent spirits. Such restraints are to a considerable extent placed upon the power of testamentary disposition, particularly in reference to charitable institutions. There is also a general rule applied to all dispositions of property, to take effect at a future day, that they must vest within a prescribed time. This rule is one of public policy to prevent the undue postponement of absolute ownership, and is known as the doctrine of "perpetuities" or "remoteness." (See PERPETUITIES and REMOTENESS.) When ownership has once been acquired, it cannot in general be lost, except by the consent of the owner. This consent is implied in some cases, as where property is taken under the exercise by the state of the right of eminent domain (see EMINENT DOMAIN), or by way of taxation, or on grounds of public necessity, as, *e. g.*, to check a conflagration or to prevent the incursions of an enemy in time of war. Under the general notion of the inviolability of property, it is well settled that a thief can transfer no title to the goods stolen, even if they be sold to a purchaser acting in good faith, though there is a single exception to this rule, based on public policy, in the case of commercial paper and current money. (See NEGOTIABLE PAPER.) Ownership is qualified in the case of wild animals and of bailment. (See BAILMENT.) The qualification in the case of wild animals is, that the animal may recur to its state of original wildness, and ownership thus be wholly lost. In the case of bailment, the qualification consists in the fact that the ultimate owner has parted with it for a special purpose, as, for example, to have it repaired, or to

raise money on it by way of pledge. The bailee may in such a case be regarded as a temporary or "special owner," while the bailor may be deemed the "general owner." The interests of the two, when combined, constitute complete ownership. Ownership is said to be several when it exists in one person, joint when it is vested in more than one. The subdivisions of JOINT OWNERSHIP are PARTNERSHIP, JOINT TENANCY, TENANCY IN COMMON, and the case of PART OWNERS OF SHIPS. (See these titles respectively.) Ownership may be lost or materially qualified by abandonment. This topic is peculiarly applicable to personal property. One may purposely cast away a chattel. If it be sunk in the sea, he may wholly abandon all effort to recover it. In this last case the property is called derelict. Any one may then interfere and save it, and have a claim upon the property saved for services, termed salvage. (See SALVAGE; see, also, PERSONAL PROPERTY.)

T. W. DWIGHT.

Owosso. See OWASSO.

Ows'ley, county of E. Kentucky, traversed by the South Fork of Kentucky River. Area, 460 square miles. It is mountainous, with fertile valleys, and contains beds of coal and iron of great prospective value. Live-stock, corn, and wheat are leading products. Cap. Booneville. Pop. 3889.

Owsley (WILLIAM), b. in Virginia in 1782; removed in 1783 to Lincoln co., Ky., with his father; became a teacher and lawyer of Garrard co., whence he removed to Boyle co. in 1843; was a judge of the Kentucky supreme court 1812–28, and governor of Kentucky 1844–48. D. at Danville, Ky., Dec., 1862.

Owy'hee, county of S. W. Idaho. It is mountainous, with fertile valleys adapted to farming and stock-raising. Rich lodes of silver ore abound. Mining is the principal industry. Cap. Silver City. Pop. 1713.

Ox. See CATTLE.

Ox'alates, compounds of OXALIC ACID (which see) with bases. The salt of sorrel has already been referred to as potassic dioxalate, and the first known source of oxalic acid. Oxalate of ammonia is largely in use in chemical laboratories as a reagent for lime. Oxalate of lime, as already stated, occurs largely in the vegetable kingdom, being found in different tissues and cells in the form of square prismatic crystals, which have the composition

$$CaO.C_2O_3.3H_2O.$$

Braconnot found that certain lichens growing on limestone rocks were half calcic oxalate. Liebig identified an incrustation found on the marble of the Parthenon at Athens as calcic oxalate, without making, however, a complete analysis. He called it thierschite, but Dana deems it identical with the mineral whewellite, already referred to. Oxalate of ferrous oxide, as humboldtine, has already been mentioned. There appear to be no other oxalates of general interest.

HENRY WURTZ.

Oxal'ic Acid [Gr. ὀξαλίς, a name for a kind of sorrel, whence the botanical name of the genus *Oxalis*, which contains this acid; Fr. *acide oxalique;* Ger. *Kleesäure, Oxalsäure*]. Salt of sorrel, which is an acid oxalate, dioxalate, or binoxalate of potash, has for a period unknown been procured in Germany from certain species of oxalis and rumex. Savary first obtained oxalic acid from it in 1773 by sublimation. Scheele afterwards obtained it from the same source by precipitation as oxalate of lead and subsequent decomposition of this. This latter chemist also first proved that the acid previously known as prepared by the action of nitric acid on sugar is oxalic acid. Besides the plants above mentioned, there are sea-shore plants, *Salsola* and *Salicornia*, which contain it as oxalate of soda. It is found as insoluble oxalate of lime in a great number and variety of plants, and in certain morbid conditions this latter salt is formed largely in the animal body, passing off by the urine, and forming what is called the "mulberry calculus" in the bladder. In the mineral kingdom calcic oxalate forms the species whewellite, which is but little known; but another mineral oxalate, humboldtine, which is the trihydrate of diferrous oxalate, is much more common, being found in brown coal in some European localities, and at one American locality discovered by Sterry Hunt, at Kettle Point, near Bosanquet, in Canada, as a sulphur-yellow incrustation in black shales.

All the oxalic acid of commerce is prepared by artificial processes, of which two are in common use: 1. By the action of nitric acid on sugar, starch, or molasses. A violent action occurs, with production of copious red fumes, which may be partly condensed and converted back again into nitric acid. It is advisable to use an excess of nitric acid, as otherwise intermediate products are formed, which embarrass the crystallization of the oxalic acid from the product. Also, the nitric acid should be of a special density, being at least 1.2, but no higher than 1.27, or the oxalic acid is itself partly oxidized and destroyed by it. 2. By fusing a hydrate of an alkali with starch or cellulose. Sawdust is generally used. Potassic hydrate gives more than sodic, and two of potassic to one of sodic hydrate gives still more. In the latter case, when the product is treated with a strong solution of carbonate of soda, carbonate of potash dissolves and oxalate of soda, by virtue of its low solubility, remains behind. From this oxalic acid is readily prepared. When required *pure* for chemical purposes it is sublimed. Great care must be taken in this case not to inhale the vapor, which is highly dangerous. Oxalic anhydride (or anhydrate, as we prefer to call it), C_2O_3, is unknown. The commercial crystallized acid, in correct chemical nomenclature, is dihydrate of monohydric oxalate, $H_2O.C_2O_3.2H_2O$. When subjected to a dehydrating agent, instead of obtaining C_2O_3, we find that it breaks up into carbonic acid and carbonic oxide, $C_2O_3 = CO_2 + CO$. Permanganate of potash, chromic acid, moist chlorine, and other powerful oxidating agents convert it readily into carbonic acid, but nitric acid acts upon it with difficulty. It dissolves in about nine parts of cold and one part of boiling water. When to its solution or that of an oxalate a lime-solution is added, there is thrown down oxalate of lime, an exceedingly insoluble substance, and for lime in solution it is the most delicate test. Except in very weak solutions, it is an exceedingly dangerous, fatal, and rapid poison, and its universal sale in shops and common use in households is greatly to be reprehended. It has been known to produce death in ten minutes, preceded by horrible agonies. It is used in the arts for cleaning leather, for discharging colors in calico-printing, and in scouring metals. For the latter purpose, cleaning brass and copper, it is now much used in households, as well as for removing ink-stains from fabrics. The greatest care should be exercised that it be not mistaken for Epsom salt (which it almost exactly resembles in appearance), a fatal and not infrequent accident.

HENRY WURTZ.

Ox'alis [Gr. ὀξαλίς], wood-sorrel, the principal genus of the sub-order of Geraniaceæ, from which it has been separated by some authors, but apparently without sufficient reason. The plants composing the family are popularly known as wood-sorrels. They possess five sepals, sometimes slightly coherent at the base, with five hypogynous petals convolute in the bud, and with no glands alternating with them. Stamens ten, often monadelphous, those opposite the petals longer than the others. Fruit a 5-celled pod or berry. The leaves are alternate, compound, and closing at night or sometimes to the touch, like those of Mimosa. *Oxalis sensitiva*, a native of India, has pinnate foliage exhibiting this irritability in a marked degree. All the Oxalideæ possess a sour juice, due to the presence of potassic binoxalate. *Oxalis acetosella* has been said to yield, from 500 pounds of the fresh plant, 4 pounds of this salt, which, under the name of "salts of sorrel" and "salts of lemon," is used to remove the stains of iron-rust from linen and other articles. The commercial article is obtained from other sources, and should never be marked "salts of lemon," as it is a dangerous poison. In the plants it exists only in sufficient degree to render them pleasantly acid, and in France they are sometimes used for culinary purposes. The berry of Averrhoa is intensely acid, and used in the East Indies as a pickle. The *Oxalis crenata* of Peru and Chili is used as an article of food, the tuberous roots forming a substitute for potatoes. They abound in starch, and are insipid to the taste. The plant increases with wonderful rapidity. Some of the species of the sub-order are astringent and have been used in cases of blood-spitting and in the prevention of malignant fevers. There are a considerable number of species in most countries, but they are most abundant in S. America and at the Cape of Good Hope. The flowers are often handsome, as in the well-known *Oxalis acetosella*, where they are white veined with red. This plant is common in the woods of both continents, blossoming in June. It is particularly abundant in Lapland. It is supposed by some to be the true shamrock, the national flower of Ireland, instead of the clover, which is generally so considered. The handsome species cultivated in conservatories mostly come from the Cape of Good Hope. *Oxalis versicolor* has white petals edged with rose-red. The outside of the petals is bright pink. *Oxalis stricta* is a common weed with small yellow flowers. According to Gray, "several species of *Oxalis* produce small peculiar flowers, which are precociously fertilized in the bud and are particularly fruitful, and the ordinary flowers are often dimorphous, or even trimorphous, in the relative length of the stamens and styles." There are upwards of 300 known species of this sub-order.

W. W. BAILEY.

Oxalu'ria [Lat., "oxalic urine"], a morbid condition of the general system which favors the constant excretion of oxalic acid by the kidneys. It is also known as the *oxalic acid diathesis.* At the present time the members of the medical profession are divided in regard to their opinions on this subject, some believing in such a condition constituting in itself a disease, others regarding it merely as a result of malassimilation; that is, "a derangement in the act by which living bodies appropriate and transform into their own substance matters with which they may be placed in contact." (*Dunglison.*) The latter view is perhaps the correct one, for we generally find those persons who have a constant and large deposit of oxalate of lime in the urine suffering more or less from dyspepsia. They are restless and uncomfortable during the digestion and assimilation of their meals, are troubled with flatulence and eructations, and, as a rule, they are more or less hypochondriacal. The advocates of the belief that the oxalic acid diathesis constitutes in itself a disease give the following symptoms as accompanying the excretion of oxalate of lime: Emaciation, nervousness, painful susceptibility to external impressions, and hypochondriasis. The patients are incapable of exerting themselves in the least without suffering from fatigue; they are irritable and easily excitable; and there is more or less impotence. A prominent symptom is a severe and constant pain or sense of weight across the loins. The above train of symptoms undoubtedly very frequently co-exist with the presence in the urine of oxalate of lime; the majority of them are the symptoms of dyspepsia, and may be present without the occurrence of oxalate of lime, and, conversely, oxalate of lime may be produced in immense quantities without any of these symptoms being present. Thus, we may have calculi of the salt repeatedly formed both in the pelvis of the kidney and in the bladder. We also repeatedly find oxaluria occurring in phthisis, heart disease, bronchitis, rheumatism, anæmia, cirrhosis, cancerous diseases, and even in a state of perfect health. Especially is this the case if we do not examine the urine for twenty-four hours after it has been passed, as during that time the mucus in the urine putrefies and communicates its alterations to the rest of the fluid, and lactic and oxalic acids are produced from some of the undetermined animal matters contained in the excretion. As fast as the oxalic acid is formed it unites with the lime which is in solution in the urine, and thus oxalate of lime is produced. This oxalate of lime is entirely insoluble in water and in the urine, even when heated to the boiling-point, so that it is difficult to understand how it could have been held in solution previously, and it surely could not have been excreted by the kidneys in any other condition. Oxalate of lime occurs in the urine in the form of minute octohedral or dumb-bell-shaped crystals, varying in size from a ten-thousandth to a thousandth of an inch in diameter. The formation of oxalic acid in the blood is occasioned by the malassimilation of certain articles of diet, especially those containing sugar, but in exactly what manner has not yet been determined by physiologists. Hence, sugar and all saccharine matters should be avoided as much as possible. Attention should be paid to the general health, and particularly to the digestive organs. As medicines, the mineral acids, given either alone or combined with tonics, seem to be the favorite remedies.

EDWARD J. BERMINGHAM.

Ox'enbridge (JOHN), b. at Daventry, England, Jan. 30, 1609; studied at Oxford and Cambridge; took his degree at the latter university 1631; took orders in the Church of England; made several voyages to the West Indies; was chosen fellow of Eton College; became incumbent of a parish at Beverley, England, 1644; was settled at Berwick-on-Tweed, where he was silenced for nonconformity 1662; went to Surinam, Guiana, as a missionary; was at Barbadoes 1667; came to Boston, Mass., 1669, and was ordained Apr. 10, 1670, colleague with Rev. Mr. Allen over the First church; was a popular and effective preacher, and published a number of sermons. D. at Boston Dec. 28, 1674.

Ox'enden (ASHTON), D. D., b. at Broome Parke, near Canterbury, England, in 1808; educated at University College, London; many years rector of Pluckly-with-Pevington, Kent; became honorary canon of Canterbury Cathedral 1864, and bishop of Montreal, primate, and metropolitan of Canada 1869.

Ox'enford (JOHN), b. at Camberwell, near London, England, in 1812; was called to the bar 1833; was many years theatrical critic for the London press; wrote several dramas and songs, and translated a number of German poems and prose works. D. at London Feb. 22, 1877.

Ox'enstjerna (AXEL), COUNT, b. at Fånö, Upland, Sweden, June 16, 1583; studied theology and jurisprudence at Rostock, Jena, and Wittenberg, and was employed, after his return to Sweden in 1603, by Charles IX. in several important diplomatic negotiations, which he carried through with great sagacity and dignity. On the accession of Gustavus Adolphus in 1611 he was made chancellor of Sweden, and as such he negotiated the Peace of Kmered with Denmark in 1613 and of Stolbowa with Russia in 1617, and the armistice with Poland in 1629, and accompanied Gustavus Adolphus during his campaigns in Germany, taking charge of all diplomatic affairs. After the fall of Gustavus Adolphus at Lützen in 1632 he was empowered by the Swedish representatives to continue the war, and at the congress of Heilbron the Protestant princes chose him head of the league against the emperor. He concluded an alliance with Holland and France, and returned in 1636 to Sweden as chief of the government during the minority of Gustavus Adolphus's daughter Christina. When she became of age in 1644 his influence decreased, and when she abdicated he retired altogether into private life, and d. at Stockholm Aug. 28, 1654. The second part of *Historia Belli Sueco-Germanici*, of which Chemnitz wrote the first part, is generally ascribed to Oxenstjerna, who was an accomplished scholar.

Ox'ford, an old and famous city of England, the capital of Oxfordshire, is situated 55 miles N. W. of London, on the Isis, near its junction with the Cherwell, among rich and beautiful surroundings, and contains a great number of splendid edifices. Its trade and manufactures are comparatively insignificant; it is as a seat of learning it has acquired its fame, its university being the oldest and most celebrated institution of the kind in the United Kingdom. It is attended by about 6000 students, and has an annual revenue of between £400,000 and £500,000. It consists of 19 colleges and 5 halls, of which University College is the oldest and Christ Church College the largest. University College is said to have been founded by Alfred in 872, but it did not receive anything like its present form until 1249. Christ Church College was founded by Cardinal Wolsey in 1525, and comprises the most extensive grounds and the most magnificent buildings. Besides the edifices and institutions belonging to each college, there are some belonging to the university; as, for instance, the Bodleian Library, containing 220,000 volumes and 20,000 manuscripts, the theatre, the observatory, the botanical garden, etc. Besides the Bodleian there are 23 other libraries, of which that belonging to All Souls' College consists of 50,000 volumes, a fine picture gallery, and many collections for science and art. Pop. 31,554.

Oxford, a fertile county of Canada, in Ontario, has 2 ridings. Area, 710 square miles. It is intersected by the Great Western Railway. Cap. Woodstock. Pop. 48,237.

Oxford, county of W. Maine. Area, 1600 square miles. It is bounded W. by New Hampshire and N. in part by Canada. It is hilly and well timbered, containing much fertile soil. It is traversed by Androscoggin River and by the Grand Trunk and the Portland and Oxford Central R. Rs. Cattle, wool, potatoes, oats, and corn are leading products. The manufactures include lumber, leather, starch, carriages, wooden wares, furniture, flour, woollen goods, etc. Cap. Paris. Pop. 33,488.

Oxford, post-v. and tp., Calhoun co., Ala., on Selma Rome and Dalton R. R., 15 miles S. W. of Jacksonville. It contains Oxford College, 3 churches, 2 steam flouring-mills, iron-works, 1 newspaper, several hotels, a saw-mill, and a number of stores. Large quantities of cotton are shipped from this place. Pop. 1147.

W. J. BORDEN, ED. "INTELLIGENCER."

Oxford, post-v. and tp., New Haven co., Conn., on the Naugatuck River and R. R. Pop. 1338.

Oxford, post-v. of Newton co., Ga., on the Georgia R. R., is the seat of EMORY COLLEGE (which see). Pop. 665.

Oxford, post-v. and tp., Henry co., Ill., on the Rockford Rock Island and St. Louis and the Chicago Burlington and Quincy R. Rs. Pop. 1327.

Oxford, post-v. of Oak Grove township, Benton co., Ind., 90 miles N. W. of Indianapolis. It has an academy, 1 bank, an elevator, 1 newspaper, a flouring-mill, a carriage and wagon manufactory, 3 hotels, and stores. Pop. 519. A. COWGILL, ED. "OXFORD WEEKLY TRIBUNE."

Oxford, post-v. and tp., Johnson co., Ia., on Iowa River and Chicago Rock Island and Pacific R. R. Pop. 1043.

Oxford, tp. of Jones co., Ia., on the Wapsipinicon River and Davenport and St. Paul R. R. Pop. 1121.

Oxford, tp. of Johnson co., Kan. Pop. 1926.

Oxford, post-v. and tp., Oxford co., Me., on the Grand Trunk R. R. Pop. 1631.

Oxford, post-v. of Trappe tp., Talbot co., Md., on Eastern Shore of Chesapeake Bay, S. W. terminus of Maryland and Delaware R. R. (unfinished). Pop. 227.

Oxford, post-v. and tp., Worcester co., Mass., on the Norwich and Worcester division of the Boston Hartford and Erie R. R., traversed by French River (so called from a Huguenot colony which settled the town 1684), has 6 churches, a national bank, 12 schools, a new town-hall, free public library, 4 cotton, 4 woollen, and 5 saw-mills, and 5 shoe factories. Pop. 2669.

Oxford, post-v. and tp., Oakland co., Mich., on the Detroit and Bay City R. R. Pop. 1367.

Oxford, post-v. and tp., cap. of Isanti co., Minn., near the Lake Superior and Mississippi R. R.

Oxford, post-v., cap. of Lafayette co., Miss., on the Mississippi Central R. R., contains the University of Mississippi, the Union Female College, Oxford Institute, the Oxford Male Academy, and a primary school, the county court-house, jail, and city hall, 5 churches, 1 bank, 2 furniture establishments, 2 newspapers, and stores. Pop. about 1422. S. M. Thompson, Ed. "Falcon."

Oxford, post-v. and tp., Warren co., N. J., on Delaware River and the Delaware Lackawanna and Western R. R., includes Belvidere, the county-seat. Pop. 2952.

Oxford, post-v. and tp., cap. of Chenango co., N. Y., on the New York and Oswego Midland and the Utica and Binghamton branch of the Delaware Lackawanna and Western R. Rs., 8 miles S. of Norwich, has an academy, 6 churches, 1 bank, 1 newspaper and printing-office, 3 hotels, and stores. Pop. of v. 1278; of tp. 3278.
J. B. Galpin, Ed. "Oxford Times."

Oxford, post-v. and tp., cap. of Granville co., N. C., 46 miles N. of Raleigh, the centre of a tobacco-growing section, and contains 6 churches, 2 tobacco warehouses, 7 tobacco manufactories, and 3 newspapers. Pop. of v. 916; of tp. 2724. Robert Blow, Ed. "Leader."

Oxford, post-v. and tp., Butler co., O., on the Cincinnati Hamilton and Indianapolis R. R., 39 miles N. W. of Cincinnati, contains the Oxford Female Seminary, Miami University, several churches, 1 newspaper, and stores. Pop. of v. 1738; of tp. 3959. F. D. Davis, Ed. "Citizen."

Oxford, tp. of Coshocton co., O., on the Pittsburg Cincinnati and St. Louis R. R. Pop. 1140.

Oxford, tp. of Delaware co., O., on the Cleveland Columbus Cincinnati and Indianapolis R. R. Pop. 1250.

Oxford, tp. of Erie co., O., on the Sandusky Mansfield and Newark R. R. Pop. 1238.

Oxford, tp. of Guernsey co., O. Pop. 1709.

Oxford, a v. of Killbuck tp., Holmes co., O. Pop. 116.

Oxford, tp. of Tuscarawas co., O., on the Tuscarawas River, Ohio Canal, and Pittsburg Cincinnati and St. Louis R. R. Pop. 1667.

Oxford, a v. and tp., Adams co., Pa., on the Susquehanna and Gettysburg R. R. Pop. 1322.

Oxford, post-b. and tp., Chester co., Pa., on the Philadelphia and Baltimore Central R. R., 55 miles from Baltimore, has excellent public and private schools, several churches, a library, 3 banks, extensive car-works, manufactories of carriages, furniture, and other commodities, 2 newspapers, and stores. The borough is supplied with water. Lincoln University, established for the instruction of colored persons, is located about 4 miles from this town. Pop. 1151. Geo. D. Hayes, Ed. "Oxford Press."

Oxford, post-v. of Cache co., Ut. Pop. 149.

Oxford, post-v. and tp., Marquette co., Wis. Pop. 608.

Oxford (Robert **Harley**), Earl of, b. in London, England, Dec. 5, 1661; raised a cavalry regiment for the service of the prince of Orange 1688; entered Parliament 1690 as an extreme Whig, but gradually changed his political views until they reached the opposite extreme of Toryism; was chosen speaker Feb., 1701; re-elected in the two succeeding Parliaments; was made chief secretary of state 1704, chiefly through the influence of Miss Abigail Hill (afterwards Lady Masham) with Queen Anne; acquired great power at court, and incurred the enmity of Marlborough and Godolphin; was dismissed from office 1708 through the prevalence of a popular belief that he was in correspondence with the French court; was made chancellor of the exchequer Aug., 1710; was stabbed at the council-board by the marquis of Guiscard, a Frenchman, Mar. 12, 1711, to which event he owed a new lease of public and royal favor; was created earl of Oxford and Mortimer May 24, and lord high treasurer May 29 of the same year; enjoyed from this time very great power, having completely supplanted Marlborough in the queen's favor, and consolidated his own popularity by the Peace of Utrecht, April, 1713, but was in turn supplanted by Bolingbroke and dismissed July 27, 1714. Regarded with distrust by George I., he was impeached of high treason by Parliament Aug., 1715; committed to the Tower; acquitted June, 1717; lived thenceforth in retirement; accumulated immense collections of books and manuscripts, of which the latter, numbering 8000, are now in the British Museum, and was author of some pamphlets of little merit. D. at London May 21, 1724.

Oxford Clay. The Oxford clay, so called from its extensive development in Oxfordshire, England, is a deposit widely extended over Europe, and constituting the argillaceous member of the middle Oolite series of rocks. It consists of a stiff, grayish-blue to dark-blue clay, containing more or less lime, and varying in different localities from 200 feet to 600 feet in thickness. It abounds in fossils, chiefly ammonites and belemnites. (See Jurassic.)
Edward C. H. Day.

Ox'fordshire, an inland county of England, bordering S. on the Thames, comprises an area of 735 square miles, with a population of 177,956. The surface is mostly level, but undulating in the southern part, where the Chiltern Hills rise to the height of 820 feet. The soil is a mixture of gravel and loam, and very fertile. Agriculture and dairy-farming are in an advanced state. Wheat, barley, turnips, butter, and cheese are produced in large quantities and of excellent qualities. Principal town, Oxford.

Oxford University. Although modern inquiry has long since disposed of the legend which carried back the foundership of Oxford University to Saxon Alfred, yet even the most skeptical of inquirers have left to the university an antiquity of which it may be justly proud. The first fairly authenticated notice of Oxford as a seat of learning dates from the time of Edward the Confessor. In the reign of Stephen we find Vacarius, a Lombard, giving lectures on Roman law at Oxford. The first charter was granted to the university by John; in 1201, according to Anthony Wood, the university numbered within its walls 3000 students. Later on, in the time of Henry III., Wood states that there were 30,000 students at Oxford; "but among these a company of varlets, who pretended to be scholars, shuffled themselves in, and did act much villainy by thieving, whoring, quarrelling, etc." Even after making allowance for the "varlets," the statement is of course a gross exaggeration; but it is plain that the university was beginning to attract great numbers. From Henry III.'s time date the foundations of three colleges, University (1253), erected on the site of a much earlier foundation, Baliol (1263), Merton (1264). In a little more than half a century from this date two other colleges were established, Exeter (1315) and Oriel (1326); Queen's followed in 1340, and New College in 1373. In the time of Richard II. many members of the university warmly espoused the doctrines of Wyckliff, and in the persecutions that followed on this avowal many of the colleges were thinned, some, indeed, being quite deserted. But the desertion was only for a short time; for in the reign of Henry VI. we find three new colleges established, Lincoln College (1427), All Souls' (1437), Magdalen (1456). The university found a generous patron in Richard III., who, among other bounties, granted the privilege to the university of importing or exporting books at will. In Henry VIII.'s time three new colleges were founded, Brasenose (1509), Corpus Christi (1516), Christchurch (1525); the last mentioned of these was founded by Wolsey, on a scale of great magnificence. Wolsey also endowed seven professorships for theology, civil law, physic, philosophy, mathematics, Greek, and rhetoric; especially the study of Greek was largely encouraged by the learned prelate. During the reign of Edward VI. royal commissioners were appointed, with full powers to examine the affairs of the university. In consequence, a new set of statutes was drawn up and the form of government in the university completely altered; but in the next reign the old order of things was re-established. The religious controversies about this time did much to hinder the advancement of learning; in Mary's reign the university appears to have been in a state of great stagnation. Endowments, however, were not wanting; for in 1554 Trinity College was founded, and St. John's followed three years later. Queen Elizabeth's reign is remarkable in the history of Oxford University for the foundation by Sir Thomas Bodley of the Bodleian Library, and for the passing of the act which confirmed the university as a corporate body; also, Jesus College was established in this reign. Shortly after the succession of James I. the two universities had the privilege granted of sending each two members to Parliament. In 1612 Wadham College was founded, and twelve years later Pembroke. During the troublous times of Charles I. the university sided throughout with the king, and suffered severely in consequence. In 1650, Cromwell was elected chancellor of the university, when several of the more obnoxious among the royalists were removed, to be reinstated at the Restoration. Under the tyranny of James II. the university came violently into collision with the crown;

on the refusal of Magdalen College to receive a president forced upon them by the king all the members of that college, with the exception of two, were expelled. However, at the approach of William of Orange they were reinstated by the tyrant. From this period the university has proceeded on an even and unruffled course. In 1714, Worcester College was founded; Hertford College followed in 1740, but for lack of endowments did not flourish, and in 1818 was turned into Magdalen Hall, from which, in 1874, it was metamorphosed again into Hertford College, receiving at the time fresh endowments. Three years before, in 1871, a new college, Keble, had been founded. In addition to these colleges, there are a few halls attached to certain of the colleges; as, St. Alban's Hall, attached to Merton College, St. Edmund's Hall to Queen's College, etc.

The highest officer in the university is the chancellor; the election is determined by the members in convocation, and the office is held for life. For the last two hundred years it has been the custom to elect some distinguished nobleman who has been educated at Oxford; the marquis of Salisbury is the present chancellor. There is no stipend attached to this office. The chancellor's deputy, the vice-chancellor, is nominated by the chancellor from among the heads of colleges: the office is held for four years, and is endowed with a salary of £600 a year. To assist the chancellor and vice-chancellor two other officers are appointed, the high steward and deputy steward; the appointments are at the disposal of the chancellor, subject to the approval of convocation. The business of the university is transacted in two separate assemblies, the house of congregation and the house of convocation. In the former the business is confined to granting ordinary degrees and confirming the nomination of examiners made by the vice-chancellor and the proctors. All other business is conducted in the house of convocation. To facilitate the ordinary legislation of the university there meets every week during term time the hebdomadal council, composed of the heads of colleges and others. Not the least important among the university officers are the proctors. The business of these gentlemen is to guard against any breach of discipline on the part of members of the university; the proctors are two in number, and are assisted by four pro-proctors. Both proctors and pro-proctors must have attained the standing of master of arts, the former for at least four years previous to election.

Before entering the university a preliminary examination, the matriculation, must be undergone, varying in difficulty according to the status of the college. Shortly after entering, the student is confronted by responsions, the first public examination: for this a slight knowledge of classics and mathematics is required. In order to get a degree the student must have resided at least twelve continuous terms at the university, and must have passed the necessary examinations. The study of ancient literature, history, and philosophy—*literæ humaniores*—is the study most largely encouraged at Oxford; the degree is usually acquired in the classical schools. There are also schools in modern history, civil law, and theology, in which the examinations are usually attended by men who have passed through the classical schools. For those who go to study mathematics, natural science, etc., there are also schools in those subjects. Attached to each college are fellowships and scholarships, awarded in most cases by open competition. Until lately fellowships were nearly all clerical, but now, to a great extent, restrictions have been removed, and the fellowships are thrown open as they become vacant to the whole university. In most colleges the fellowships are held for life, so long as the holder remains unmarried; but a sensible change is now largely adopted by making the fellowships tenable for ten years, whether the holders choose to marry or not. Scholarships are awarded after competition to undergraduates who have not exceeded a certain number of terms from matriculation, and to young men entering the university; there is in most colleges a limit of age. The value of the scholarships is about £80 or £100 a year, tenable for five years. Instruction is conducted mainly by the college tutors; lectures are also delivered by the university professors. Expenses vary at the different colleges; at the most economical college, Keble, the course for the year may be gone through on something less than £100. Ordinarily, for a person of inexpensive tastes, about £150 a year—from that to £200—is sufficient. For those who reside in the halls and for unattached students the expenses are considerably less. The university year is divided into four terms—Michaelmas, Hilary, Easter, and Trinity. The intervals between terms are short, with the exception of the long vacation, which lasts from the first or second week in June to the 10th of October. A. H. Bullen.

Ox-gall (*fel bovinum*), the bile of the domestic ox, is used in the arts in scouring wool, since into its complicated composition there enters abundance of soda, which gives it a soapy quality. When properly refined from its coagulable and coloring matters it is used by artists in mixing colors, which it often improves in tint, while it fixes them and makes them flow better. It is also used in some kinds of artists' varnish and in cleansing ivory tablets for artists' use. In medicine it is sometimes given when a deficiency of bile is suspected to exist; in enemata it is believed to dissolve scybalous masses, and as an external application some practitioners consider it powerfully discutient.

Oxidation. See Oxygen.

Ox'ides, compounds of Oxygen (which see) with metallic and other basic substances. Oxides make up almost the whole mass of known matter. Water is an oxide of hydrogen, 88.88 per cent. of its weight being oxygen, and all the massive solid rocks, without exception, are made up substantially of different oxides. All the elements except fluorine combine with oxygen to form oxides, some combining in several different proportions to form as many different oxides. Oxides divide themselves into several natural groups. Basic oxides, or simply bases, are those which combine with acid oxides to form salts or neutral oxides, and, conversely, *acid* oxides, or *acids* simply, are those which combine with bases to form salts. This is, however, a very general definition, subject to several conditions and modifications in certain cases. Generally speaking, again, it may be stated that acid oxides contain larger proportions of oxygen than basic; and when an element combines to form different oxides with oxygen, those which contain most oxygen will be acid, and those containing least basic. The degree of acidity or basicity of an oxide depends also, however, upon the acidic or basic relations of the element which is combined with the oxygen. (On this subject reference may be made to the articles Acid and Base, and under the head of Oxygen further information will be given about oxides.) H. Wurtz.

Oxlip. See Primrose.

Oxpecker. See Beef-Eater.

Oxuderc'idæ [from *Oxuderces*—ὀξύς, "sharp," and δέρκω, to "look"—the only known genus], a family of fishes of the order Teleocephali and sub-order Acanthopteri, related to the gobies, from which it is especially distinguished by the numerous spines of the anal fin and want of ventral fins. The body is elongated, sub-cylindrical, and covered with small scales; the lateral line absent (?); the head elongated, also covered with small scales; opercula unarmed (?); nostrils single (?); mouth with a lateral cleft; teeth in both jaws, but none on the palate; branchial apertures capacious, the gill-membranes being united below the throat and not adherent below the isthmus; branchiostegal rays six (?); dorsal fins two, the first with six spines, the second elongated; the anal fin as long as second dorsal and armed with many (6) spines; caudal not free; ventral fins none. The anatomy is unknown. The family has been proposed by Dr. Günther for a single species (*Oxudercus dentatus*), originally described by Valenciennes from specimens obtained from Macao (Günther, *Catalogue Fishes Brit. Museum*, v. iii., p. 165). Theodore Gill.

Oxus. See Amoo.

Oxychlo'rides, sometimes called **Basic Chlorides.** This class of compounds may in some cases be regarded as compounds of oxides and chlorides, but in many other cases we find difficulty in admitting the presence of two molecules of the basic element. The oxychlorides are sometimes formed by the direct action of an oxide of a metal upon the chloride of the same metal, as in the cases of lime, magnesia, zinc, etc. In the latter two cases important cements are founded upon the formation of such oxychlorides. Other classes of oxychlorides are formed by the partial decomposing action of water upon the chlorides of some metals, acting by removing a portion of the acid, as in the cases of antimony and bismuth. There are some native mineral oxychlorides, as atacamite and tallingite, oxychlorides of copper, and matlockite and mendipite, oxychlorides of lead. Other elements besides the metals form oxychlorides, such as silicon, carbon, sulphur, selenium, nitrogen, phosphorus. Oxychloride of phosphorus, $POCl_3$, is a compound of considerable interest. Some of the oxychlorides have been imagined to contain hypothetical compound elementoids or radicals, called by such names as carbonyle, CO, thionyle, SO, selenyle, SO, nitrosyle, NO_2, etc. Some oxychlorides are powerful acids, as chlorochromic acid, CrO_2Cl_2, chlorosulphuric acid, $S_2O_5Cl_2$, and others. H. Wurtz.

Ox'ygen, Air, and **Ozone.** *Names.*—The word oxygen is from the Greek ὀξύς, "acid," and γένειν, to "engender," or "generate," and was applied by Lavoisier to represent the generalization which he had arrived at, and which in his day was almost universally accepted, that

oxygen was the sole "acidifying principle." To accommodate this hypothesis, muriatic acid, for example, was regarded as an oxide of some unknown element, and, furthermore, by a second subsidiary hypothesis, proposed by Berthollet in 1785, chlorine, which had then been discovered eleven years previously by Scheele, was regarded as an oxide of muriatic acid, as itself an acid substance, and the term "oxygenated muriatic acid" applied to it. In 1809, however, Gay-Lussac and Thénard demonstrated that chlorine contains no oxygen and is elementary; and H. Davy in 1810 entirely demolished the view of Berthollet, proposing the name *chlorine*, which still stands. Since then it has become more and more apparent that the class of substances called "acids" does not owe its characteristics to the presence of oxygen, and that hydrogen is far better entitled to the designation of the "acidifying principle," if there be any such thing. Indeed, there is now an attempt making throughout the range of chemical literature to confine the term acid to hydrogenated compounds, and to abolish it as applied to simple oxides of other elements. Thus, the term oxygen, now so firmly established in the minds of men that it probably never will be changed, must now be recognized as one of the most remarkable and unfortunate cases we have of a name founded upon a fragmentary and entirely incorrect generalization—a misnomer—which is destined to inculcate and perpetuate error, and to stand in the way of true scientific progress, whose object should pre-eminently be to bring our words and our ideas, which must go hand in hand, always into closer approximation to the creative ideas that underlie the scheme of Nature. In the German language, likewise, oxygen is *Sauerstoff*, "acid stuff" or material, again perpetuating Lavoisier's view. The first discoverer of oxygen, Priestley, called it "dephlogisticated air." Condorcet called it "vital air." Scheele called it "Feuerluft," fiery or fire-supporting air.

History.—Air was held by the chemists of old to be one of the elements of matter, all gaseous substances being classed together under this name. Rutherford in 1772 discovered that it contained an ingredient (NITROGEN, which see) incapable of sustaining respiration. Priestley, Aug. 1, 1774, first discovered and prepared in a pure state the life and fire-sustaining gaseous principle of the air, which he called "dephlogisticated air," as he was, even up to the time of his death, an adherent of the phlogistic theory of Stahl. Priestley prepared pure oxygen by heating red oxide of mercury, which is dissociated by heat into metallic mercury and oxygen gas. Priestley, who, from his many important discoveries and inventions relative to different gases and the manipulation of gaseous bodies, is known as the "father of pneumatic chemistry," knew well how to collect, preserve, and experiment upon the new gas. He thus easily proved its identity with the active element of the air. To commemorate this great event in scientific history, the chemists of America assembled Aug. 1, 1874, one hundred years later, at the grave of Priestley, on the banks of the Susquehanna at Northumberland, Pa., to celebrate the "centennial of chemistry." One year later than Priestley, in 1775, the great Swedish chemist Scheele made independently the same discovery. Lavoisier may be justly regarded as the discoverer or propounder of the true theory of fire, oxidation, and combustion, as consisting in combination with oxygen of the air. Grotthuss, and especially H. Davy, investigated flame, and advanced some steps in a theory thereof. Doebereiner made also important investigations upon flame and luminosity, which, though now forgotten, should be revived.

Occurrence in Nature.—It is in an enormous degree the most abundant, as it is in many respects the most important, of the elements of matter, upon our earth at least. The only other element that can compare with it in abundance is silicon, the special element of mineral silicates. Even in these oxygen preponderates largely. The following figures have here been calculated to furnish examples of the proportions of oxygen and silicon in some of the commonest of the minerals that make up nearly the whole mass of the known earth:

	Oxygen per 100.	Silicon per 100.
Quartz	54.	46.
Feldspar (orthoclase)	46.75	29.6
Mica (muscovite)	48.27	21.
Pyroxene	44.6	25.3
Amphibole	46.8	27.6
Limestone	48.	—Carbon... 12.0

From a glance over these figures it is plain that oxygen constitutes nearly if not quite half the total weight of known matter, and silicon not far from one-third. Of water, the liquid part of the earth, oxygen forms a still larger proportion, or *eight-ninths*. Of living matter, vegetable and animal, oxygen also forms by far the largest element, by reason of the fact that water is so predominant a constituent of these. Apart, however, from the water existing as such in living beings, much oxygen is contained in their solid or "plastic" constituents when perfectly dry. Thus cellulose and starch both contain 49.38 per cent. of oxygen, albumen 23.5, and gelatine 27.5 per cent. Of normal atmospheric air oxygen constitutes from 20.8 to 20.9 per cent. by volume, and by weight about 23 per cent., the oxygen being a little heavier than the nitrogen.

Preparation.—Of accomplishing this there are many methods besides that of Priestley, above referred to. Peroxides of manganese and barium both evolve oxygen when strongly heated. Peroxide of barium will take the oxygen up again at a lower temperature from a current of moist air, and the alternation of these two operations upon this peroxide, or, which is the same thing, upon anhydrous baryta, constitutes Boussingault's method of making oxygen. The method of Tessie du Motay, by which oxygen has of late years been manufactured for illuminating purposes, consists in the alternate exposure to a current of air and of steam of a salt of manganic acid. Sulphuric acid will evolve oxygen from a number of substances when heated therewith, such as bichromate of potash, permanganate of potash, peroxide of manganese, peroxide of lead, etc. It may also be obtained by electrolysis of water. Deville and Debray proposed two new methods, both of which furnish it at first in admixture with sulphurous oxide gas, one being to pass sulphuric acid in vapor over heated platinum, the other to heat white vitriol, or sulphate of zinc, to a high temperature. The method still in most general use, both in chemical laboratories and in the manufacture of oxygen for commerce, is to heat chlorate of potash to fusion. The evolution of the oxygen is greatly facilitated and hastened by pulverization of this substance and mixture with small proportions of certain metallic oxides, peroxide of manganese being generally used.

Chemical Properties.—A colorless and inodorous gas which has given no indications of reduction to a liquid under the heaviest pressures, assisted by the intensest cold attainable. It is magnetic—more so than any other gaseous substance. Its density, air being unity, is 1.10561. Bunsen found that ice-cold water can hold in solution 4.111 per cent. of its volume of oxygen, and water at 20° C. (= 68° F.) only 2.838 per cent. When pure, it manifests the most energetic affinities, and when inhaled soon destroys instead of sustaining life, by reason of an abnormally rapid oxidation of the blood. (See NITROGEN.) A combustible body, as a charred splinter of wood, a candle with a snuff upon it, or the like, if having but a spark of fire adherent, instantly kindles into flame when immersed in oxygen. In this way it may be distinguished from all other gases except laughing gas, which has the same power. Oxygen will itself burn with flame in an atmosphere of a combustible gas like hydrogen—a phenomenon now commonly exhibited as a lecture-room experiment. Even gaseous ammonia may be substituted for the hydrogen in this experiment. Oxygen is equivalent to two equivalents of hydrogen, chlorine, or other monadic element, and is therefore a dyad. When it burns with hydrogen, two volumes of the latter combine with one volume of oxygen, and the three volumes condense to two volumes of steam; but whether this condensation is on the part of the hydrogen or of the oxygen, or of both, is as yet matter of speculation.

Uses of Oxygen.—Outside of the applications of oxygen as a purely scientific and analytical agent in the chemical laboratory, its practical uses have not yet been developed to any great extent, in consequence of the large expense of obtaining it free from nitrogen. Dr. Hare's applications of it for producing intense heat for fusing metals, and intense light by the invention properly called Hare's lime-light, remain yet the most important uses. In France some hundreds of pounds of platiniridium have recently been melted at once by Hare's method. Deville and Debray have made an important improvement by enclosing the burning jets of mixed oxygen and hydrogen with the material to be melted in crucibles and small furnaces, built of blocks of quicklime, which is not only highly refractory, but a most powerful non-conductor of heat. A modification of Hare's light, in which the light of rich hydrocarbon gases is greatly enhanced and improved by a current of oxygen, has of late years been persistently tried in Paris, Vienna, New York, and Buffalo by Tessie du Motay and his associates; and if the estimates maintained as to the cost on a large scale of manufacturing pure oxygen by the new and beautiful methods of this ingenious chemist shall be justified in practice, we shall doubtless have very magnificent modes of illumination in connection with petroleum and petroleum-gas arising out of these inventions. Such result is greatly to be hoped for

otherwise, as cheap oxygen will be a most valuable agent in many arts of civilization.

Genesis of Oxygen.—Science seeks to assign causes for all known phenomena. Few known phenomena are more extraordinary than that of the highly oxygenated atmosphere of the earth. The crust of the earth is amply charged with combustible matter sufficient to combine with and appropriate *all* the oxygen of the atmosphere. It appears on a little calculation that a content of pyrites in the solid rocks of the earth's crust, amounting, on an average, to only one-thirtieth of one per cent., in a layer of such rock only five miles in depth, would, on complete combustion to ferric sulphate, absorb all the oxygen of the atmosphere. And there is every reason to believe that such metallic sulphides in the rocks do actually and potentially represent a large part of the oxygen of the atmosphere—all that is not in the same way represented by the carbonaceous matter in the rocks—and that the oxygen now free was once partly contained in the waters of a primeval or prozoic ocean as metallic sulphates, and partly in the prozoic atmosphere in the form of carbonic acid gas, and that this prozoic atmosphere contained *no free oxygen.* These views were taken by the present writer in a communication to the American Association in 1869, and it was at the same time pointed out that we know no mode of genesis of oxygen except the respiratory action of the leaves of plants under the power of the solar ray, and therefore that the potential energy, the life, animal heat, and combustion now dwelling and proceeding upon the earth, have had, through this channel of oxygen-genesis, for the first time pointed out, their sole origin in the sun.

Ozone.—This is a modification of oxygen, known sometimes as "active oxygen," which, up to this time, stands almost if not altogether alone in some respects. Allotropic modifications of solid and liquid substances are exceedingly common, and will soon be recognized as almost indefinite in number, but those of gaseous bodies are little known, ozone being the only one that has been at all studied. As in the case of all allotropic changes, when oxygen passes to the form of ozone there is found to be a change of volume, and, as has already been stated under ISOMERISM (which see, minor head *Allotropism*), a *thermal* disturbance also. Ozone is formed when oxygen is submitted to various agents and operations. The electric spark and the slow oxidation of phosphorus are two of the most familiar. The oxygen formed by electrolysis contains it, also that evolved from a mixture of sulphuric acid and permanganate of potash. The American chemist Oscar Loew found it as a general product of flame in air. It is always readily detectable, when masking odors are absent, by its very singular and characteristic odor, which, once perceived, is always recognizable again. Other tests and other properties of ozone of extreme interest will be found described in the chemical text-books, to which we are forced to refer for them. HENRY WURTZ.

Oxygenated Water. See HYDROGEN PEROXIDE.

Oxygen, Medicinal Uses of. Oxygen is locally irritating to raw surfaces, exciting inflammation if too long applied. Inhaled in health with proper precautions to remove carbonic acid and other products of expiration from the inspired gas, it is perfectly respirable, and does not produce much substantial change in the rate of performance of the functions. This circumstance is accounted for by the fact, proved by experiment, that in health the blood can take up as much oxygen from ordinary atmospheric air as when supplied with the pure gas—in other words, as much as it is capable of absorbing—the only difference in the two cases being that where oxygen alone is breathed the highest point of saturation is reached more speedily than where air is employed. But when from any cause there is defective respiration, and the system suffers in consequence from imperfect oxygenation of the blood, the inhaling of pure or slightly diluted oxygen, by enabling something like the normal quantity of the gas to be presented to the blood at each inspiration, affords prompt and decided relief, and is, of course, *pro tanto*, of great benefit. Hence, in such affections as asthma, pulmonary emphysema, croup, diphtheria, dyspnœa from heart disease, etc. inhalations of oxygen are often exceedingly useful. In other diseases, generally those of mal-nutrition, such as consumption of the lungs, anæmia, severe dyspepsia, indolent ulcers, etc., experience has shown that in some cases much benefit has followed inhalations of oxygen. But where ulceration or active inflammation is present the use of the gas requires care, lest its irritant effects do harm. Oxygen for medicinal use must be perfectly pure, and is best prepared by decomposition of potassium chlorate. It is inhaled from a bag connected with the mouth by a tube provided with a proper mouthpiece to keep the expired air from mixing with the gas; and the nostrils being left free, enough air is at the same time inspired to somewhat dilute the oxygen. Inhalations morning and evening of from one to four gallons generally suffice in chronic affections, but in acute disease the amount must be determined by the necessities of the case. For medicinal use, cylinders holding from 100 to 200 gallons of gas compressed into a moderate compass are exceedingly convenient as portable reservoirs from which to supply the inhaling apparatus. EDWARD CURTIS.

Oxyhy'drogen Blow'pipe, a piece of apparatus invented in 1801 by Dr. Robert Hare of Philadelphia for the purpose of producing a very high temperature by burning hydrogen and oxygen together. It is now extensively used for melting platinum and for producing the Drummond light, by rendering a piece of lime intensely hot. The best form is a jet consisting of a tube for the delivery of oxygen, with a larger tube around it, the hydrogen being delivered through the annular space. (See *Am. Chemist*, v. 77 and 372.)

Oxynot'idæ [from *Oxynotus*—Gr. ὀξύς, "sharp," and νῶτος, the "back"—the generic name], a family of selachians of the order of sharks or squali, distinguished by the armature of the dorsal fins. The body is contracted rather abruptly; behind the dorsal and ventral fins and about the middle is trihedral in section, the sides being compressed towards the back, which is ridge-like (and hence the name); the scales are spiny; the head rather small, oblong, with a snout moderately protuberant; nostrils inferior, but far from the mouth; mouth with the cleft rather small and mostly transverse; teeth in numerous rows; branchial apertures five, all in front of the pectorals; spiracles large, behind the eyes; dorsal fins two, large, armed with robust spines, the first behind the pectorals, with a spine arising in the posterior part of the fin; the second above the ventrals, with the spine anterior; anal absent; tail elongated, with the caudal fin not notched; pectorals with a narrow base; ventrals far behind. The family has been proposed for a single known species (*Oxynotus centrina* or *Centrina Salviani*), found in the Mediterranean Sea. The species attains, generally, a length of little more than, if as much as, three feet. THEO. GILL.

Ox'ysalts, salts or neutral compounds (neither acid nor basic) formed by the saturation of an oxygen acid by an oxygen base. The term is necessary to distinguish this class of compounds from the other large class of salts called by Berzelius haloid salts, which contain no oxygen, being formed by the combination of a metal with one of his halogen group of elements, chlorine, bromine, iodine, and fluorine. To this latter class common salt, NaCl, belongs, and is therefore not an oxysalt. To the oxysalts belong, for example,

Sodic sulphate, $Na_2O.SO_3$,
Potassic chlorate, $K_2O.Cl_2O_5$. H. WURTZ.

Oxysul'phides, compounds formed by the joint combination of sulphur and oxygen with a metal or other element. They are not very numerous or important.

O'yer [L. Fr. *oyer*, from Lat. *audire*, to "hear"]. By the common law rules of pleading, a party to an action who alleged in his pleading any deed upon which he based his claim or his justification in defence was required to make profert of such deed (that is, to allege its production in court), and thereupon the other party was entitled to demand oyer of the deed, or to hear it read. Anciently, the pleadings were entirely oral, and profert then consisted in actually bringing the deed into court, and upon a demand of oyer it was read aloud by the party introducing it. But at an early period it became the practice to conduct the pleading by written instruments, which were delivered by the parties to each other, and profert was made by a formal allegation that the deed was brought into court, though in fact the party pleading it retained it in his own custody. The usual formula in making profert was this: "one part of which said indenture" (or other deed), "sealed with the seal of the said defendant" (or "plaintiff"), "the said plaintiff" (or "defendant") "now brings here into court," etc. Under this system of practice a demand of oyer was made in writing upon the party alleging the deed, who was then bound to deliver it into the other's hands for inspection, and, if required, to leave with him a copy. This was deemed equivalent to an actual reading of the deed in court. The rule permitting oyer was established in order that a party whose interests were affected by the alleged deed might have an opportunity to learn its entire contents or to ascertain its genuineness, and thus be enabled to prepare his answer or defence. The party alleging a deed was not required by the rules of pleading to set forth the entire instrument in every case, but only so much of it as was material for the purpose of establishing his claim or defence. This privilege of demanding oyer was, therefore, of much importance, since it enabled the other party to acquaint himself with facts involved in

the question at issue, of which knowledge could not otherwise be obtained, and which might be essential to the protection of his rights and interests. Oyer could be demanded only in cases where profert was necessarily made. If profert were made in cases where the law did not require it, or if it were omitted when it ought to have been made, there would be no right to demand oyer. If, however, oyer were demanded in a proper case, and the party obtaining it had occasion to found his answer upon any matter contained in the deed, but not set forth by his adversary, he would be obliged to set forth the entire deed in his own pleading. The effect of this would be the same as if the contents of the deed had been stated originally by the party making profert, and it might be demurred to as if it were a part of his pleading. (See DEMURRER.) Oyer was demandable only of deeds or instruments under seal, and of letters testamentary or of administration, and not of private writings having no seal. The practice of demanding oyer has generally been superseded in modern times by more convenient methods, which have been established for accomplishing the same object. In England it was abolished by the Common Law Procedure Act adopted in 1852. The English rule at present in force is that "any party may, without filing an affidavit, apply to a judge for an order directing any other party to the action to make discovery on oath of the documents which are or have been in his possession or power relating to any matter in question in the action." Moreover, every party in an action may obtain an inspection of documents referred to in another party's pleadings by sending a notice in writing to produce such documents for examination. Any party not complying with such a notice is debarred from introducing the documents in evidence in his own behalf, unless he refuse for good and sufficient cause. (*Supreme Court of Judicature Act*, as amended, 38 and 39 Vict., ch. 77, order 31 (1875).) In New York it is provided that the court before which an action is pending, or a judge thereof, may, upon due notice, order either party to give to the other an inspection and copy, or permission to take a copy of any books, papers, and documents in his possession containing evidence relating to the merits of the action or the defence therein. In case of refusal, the paper may be excluded from being given in evidence or the party may be punished (N. Y. Code, § 388). Similar provisions exist in other States. GEORGE CHASE. REVISED BY T. W. DWIGHT.

O'yer and Ter'miner [Fr., to "hear and determine"]. In English practice, courts of oyer and terminer are tribunals having criminal jurisdiction which are held before the queen's commissioners, among whom are usually included two judges of the superior courts at Westminster, in every county of the kingdom. In most of the counties sessions are held twice in each year. The name of these courts is derived from the language of the commission by which the judges are empowered to act. They are directed "to hear, inquire, and determine" all treasons, felonies, and misdemeanors. They can only proceed upon indictments found at the same assizes in which the trial is had. (See ASSIZE.) Upon occasions of special emergency, as when there is a sudden insurrection or riot, or flagrant public outrage which demands speedy redress, a special commission of oyer and terminer is ordinarily issued to expedite the administration of justice and to assist the regular courts in disposing of the increase of business. The course of proceeding is substantially the same as in the courts organized under the general and ordinary commissions. In the U. S. the phrase oyer and terminer is not infrequently employed as a designation of criminal courts, but the extent of the particular jurisdiction which they exercise and the mode of their organization are generally determined by express statutes. In New York this is the highest court of original jurisdiction in criminal cases.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Oys'ter, the English name common to the species of the family Ostreidæ and genus *Ostrea*. All the species of the genus are much alike, and agree in the following characters: The animal has the mantle margin double and finely fringed; the gills are nearly equal; the lips plain; the palpi triangular and attached; the shell is irregular and rough; the left valve adherent and convex; the right free and flat or concave; the umbones moderately prominent, and not or scarcely incurved; the hinge toothless; the ligamentary cavity elongated. The genus is almost cosmopolitan in range, but not represented in the polar seas. About 70 recent species have been recognized by various authors, but the true species are probably considerably less. The most notable are the oysters of Europe (*Ostrea edulis*) and the Eastern U. S. (*Ostrea virginiana*). The former is a comparatively small species, found generally in the European seas, and has a coppery flavor; the latter is the common large American species, and its great head-quarters are the waters of Chesapeake Bay: it has none of the coppery taste characteristic of the European species. Both species (and indeed almost all of the genus) are subject to considerable variation in form, and the American has by some authors been differentiated into two—a northern roundish form (*Ostrea borealis*), and a southern longish one (*Ostrea virginica*)—but these intergrade into each, and are apparently simply varieties of a single polymorphic species. As is well known, the species are the objects of an extensive industry, and to a large extent artificially propagated and raised. THEODORE GILL.

Oys'ter Bay, post-v. and tp., Queens co., N. Y. The tp. extends across Long Island from the sound to the Atlantic, and includes 12 villages. Pop. 10,595.

Oyster-catcher, a name given to various wading birds of the Turnstone family and of the genus *Hæmatopus*. The U. S. have 3 species, *H. palliatus*, called the flood-gull, and *H. niger* and *ater*, the last two from the Pacific coast. *H. ostralegus* of Europe is by some regarded as identical with the first-mentioned species. It is called the sea-pie in England, is a very handsome bird, and the species feed on mollusks and insects.

Oyster-plant. See SALSIFY.

Oys'terville, post-v. and tp., cap. of Pacific co., Wash. Ter., on Shoalwater Bay. Pop. 104.

Ozæ'na [Gr. ὄζαινα, from ὄζειν, to "have an offensive smell"], a disease of the nose, characterized by a discharge of fetid muco-purulent matter from the nostril. It may depend upon caries, and may be a symptom of cancer, syphilis, glanders, or scurvy. It often follows scarlatina, or even a severe cold. General tonic treatment, good food, and weak local disinfectants are indicated in simple ozæna; but if there be caries, or any specific disease of which it is a symptom, such disease will require attention.

Ozaka. See JAPAN.

O'zan, post-v. and tp. of Hempstead co., Ark., on the Little Missouri River. Pop. 4405.

Ozanam' (ANTOINE FRÉDÉRIC), b. at Milan Apr. 23, 1813; studied law at Lyons and Paris; was appointed professor of foreign literature at the Sorbonne in 1844, and d. at Marseilles Sept. 8, 1853. He was a very fervent but liberal Roman Catholic. He wrote *Dante et la Philosophie catholique au Treizième Siècle* (1839), *Études germaniques* (2 vols., 1847–49), which twice received the great Gobert prize, *La Civilisation au Cinquième Siècle* (trans. by Ashley C. Glyn, 2 vols., 1868), *Les Poètes franciscains en Italie au Treizième Siècle* (Paris, 1850). His collected works appeared, with a preface by Ampère, at Paris, 1862–75, in 11 vols., 8vo.

Ozark', county of Missouri, bounded S. by Arkansas. Area, 648 square miles. It is rough and well timbered, with fertile valleys. Tobacco, corn, and wheat are staple products. Cap. Gainesville. Pop. 3363.

Ozark, post-v. and tp., Dale co., Ala., has 1 newspaper. Pop. 1720.

Ozark, post-v. of White Oak tp., cap. of Franklin co., Ark., on the Little Rock and Fort Smith R. R., has 3 schools, 1 newspaper, and stores. Principal employment, farming. Pop. 210. G. L. BROWN, ED. "BANNER."

Ozark, post-v. and tp., Anderson co., Kan. Pop. 617.

Ozark, post-v., cap. of Christian co., Mo., has 2 newspapers and valuable lead mines. Pop. 400.

Ozark, tp. of Lawrence co., Mo. Pop. 1752.

Ozark, tp. of Texas co., Mo. Pop. 638.

Ozark, tp. of Webster co., Mo. Pop. 3488.

Ozark Mountains, a series of steep and heavily timbered ridges of Southern Missouri, extending into Arkansas and the Indian Territory. They are nowhere of great elevation. They are believed to possess great mineral wealth.

Ozau'kee, county of Wisconsin, bounded E. by Lake Michigan. Area, 230 square miles. It is level and fertile, and produces good crops of grain. It has varied and important manufacturing interests. The county is traversed by the Milwaukee and Northern railway. Cap. Ozaukee. Pop. 15,564.

Ozaukee, post-v. and tp., cap. of Ozaukee co., Wis., on Lake Michigan, has 2 newspapers.

Ozaw'kie, post-v. and tp., Jefferson co., Kan., on the Sautrelle River and Atchison Topeka and Santa Fé R. R. Pop. of tp. 1600.

Ozie'ri, town of Sardinia, province of Sassari, about 1000 feet above the sea. In the neighborhood are found many of the round towers called *nuraghe*, for a description of which see La Marmora, *Viaggio in Sardegna*. Pop. 7965.

Ozone. See OXYGEN.

P.

P, a consonant of the class of labial mutes. It is very readily exchangeable with the vocalized labial *b* and the aspirated mute *f*, and even with other mutes and labials, but not especially so in English. P. is an abbreviation for *Pater*, "father;" PP., for "fathers;" p., for "page;" pp., for "pages." P, in chemistry, designates phosphorus. In Latin, P. stands for the proper name Publius. In music, *p.* means *piano*, "soft;" *pp.*, *pianissimo*, "very soft."

Pa'ca, the *Cœlogenys paca*, one of the largest of rodent mammals, a native of S. and Middle America. It

The Brown Paca.

is 2 feet long and generally dark brown with streaks and patches of white. The zygomatic arch is prodigiously developed, so that the cheek pouches are protected by a bony case. Its tail is very small. It is destructive to sugar-cane and other growing crops, burrows in the earth, and is remarkably cleanly in its habits. It is clumsy in build, but very active. When wild it bites fiercely if hard pressed. In captivity it is harmless and somewhat stupid. It is valued as food, but is usually very fat and oily. Its fur is worthless, but its thick skin makes a good leather.

Paca (William), b. at Wye Hall, Harford co., Md., Oct. 31, 1740; graduated at Philadelphia College 1758; studied law in the Middle Temple, London, and became a lawyer at Annapolis, Md.; was a leading patriot in 1774; was in Congress 1774–79, and again 1786; signed the Declaration of Independence; was in the State senate 1777–79; chief-justice of Maryland 1778–80; chief-justice of the State court of appeals for admiralty and prize cases 1780–82; governor of Maryland 1782, 1786; was in the convention of 1788 which ratified the U. S. Constitution; was a U. S. district judge 1789–99. He was a gentleman of wealth and liberality and of elegant habits, and was a very popular public officer. D. in 1799.

Pacchion'ian Bodies [*glandulæ Pacchioni*, named in honor of Antonio Pacchioni, 1665–1726, their discoverer], a group of numerous small whitish bodies found, in man, on the inner and outer surfaces of the dura mater, and also within the superior longitudinal sinus and on portions of the pia mater, whence, indeed, they are originally developed, making their way outward into the dura mater and producing, by pressure and absorption, little depressions in the inner surface of the skull. They are very rarely found in subjects under three years of age, and are sometimes absent in adults. They are not glands, but fibro-cellular nodules. Their use is not known.

Pachacamac', a village of Peru, seven leagues from Lima, is noted for the ruins of the splendid old Indian city of Pachacamac, which cover the surroundings.

Pache'co, post-v. of Contra Costa co., Cal., at the head of navigation, on Pacheco Slough, is the shipping-port for the Diablo and San Ramon valleys.

Pachi'no, town of Sicily, province of Syracuse, pleasantly situated on the sea-coast near Cape Passero or Pachino, from which it takes its name. The little harbor, known by the Romans as *Pachyni Portus*, serves as a shelter, in case of sudden tempests, for the numerous tunny-fishermen of this vicinity. The town is unhealthy from the almost constant prevalence of the sirocco during the winter months. Pop. in 1874, 6452.

Pachomius. See Monachism.

Pachyderm'ata [Gr. παχύς, "thick," and δέρμα, "the skin"], a name applied by Cuvier as an ordinal term to all the non-ruminant ungulates; *i. e.* (1) Ungulata Perissodactyli, (2) Ungulata Artiodactyli Omnivora, (3) Hyracoidea, and (4) Proboscidea. To the same group have also been referred by some (*e. g.* Agassiz, Kneeland, etc.) the Sirenian mammals, and even (*e. g.* by Wyman and Girard) the walrus. Some extinct forms, regarded by some authors as peculiar orders (Toxodontia, Dinocerata, and Tillodontia), would also be referable to the group as defined by Cuvier. The group is now discarded as a heterogeneous compound, and information regarding its members will be found under the heads enumerated. T. Gill.

Pachyu'ra [from παχύς, "thick," and οὐρά, "tail"], a sub-order of Raiæ characterized by the more or less stout and fleshy caudal region of the body, and the development thereon of rayed fins, thus contrasting with the masticura, or rays with a whip-like tail. There is, however, a regular gradation from the shark-like form of the saw-fishes to the comparatively slender tail of the rays. The sub-order includes the families Raiidæ, Rhinobatidæ, Rhamphobatidæ, Pristidæ, and Torpedinidæ. T. Gill.

Pacif'ic, county of Washington Territory, bounded W. by the Pacific Ocean and S. by the Columbia River. Area, about 1500 square miles. It contains the large inlet called Shoalwater Bay. It is principally covered with forests and has ores of silver. Its surface is mostly broken and elevated. Cap. Oysterville. Pop. 738.

Pacific, tp. of Humboldt co., Cal., on the Pacific seaboard. Pop. 818.

Pacific, post-v. of Franklin co., Mo., at the junction of the Atlantic and Pacific and the Missouri Pacific R. Rs., 37½ miles W. of St. Louis, has a public school, 2 churches, 1 flouring-mill, 1 newspaper, and stores. Rich deposits of iron, lead, copper, and glass-sand exist in the neighborhood. Pop. 1208. James H. Combes, Ed. "Democrat."

Pacific, post-v. and tp., Columbia co., Wis. The township contains Portage, cap. of county. Pop. 247.

Pacific Ocean. See Ocean.

Pacific, University of the, located in Santa Clara Valley, 50 miles S. of San Francisco, chartered in Aug., 1851, under the auspices of the Methodist Episcopal Church; the preparatory department opened in May, 1852; in 1854 the college proper was formed. Sept. 22, 1858, the college of medicine was inaugurated in San Francisco, being the first medical college in the State. In 1871 a fine building was erected between Santa Clara and San José, one and a half miles from each city, and both sexes admitted to the same classes. The library is small, and the apparatus and cabinet are sufficient for illustration. The presidency has been occupied in succession by Rev. E. Bannister, D. D., Rev. Thomas Sinex, D. D., and Rev. A. S. Gibbons, A. M., M. D. It has a faculty of seven professors. A. S. Gibbons.

Pacin'ian Cor'puscle. The corpuscles of Pacini or Vater are peculiar structures found as peripheral nerve terminations. They are met with in the subcutaneous layer on the palms of the hands and soles of the feet, numbering in these situations, with those of the palmar surfaces of the phalanges, from 600 to 1400. On the sympathetic nerve plexuses and in the region of the aorta, behind the peritoneum near the pancreas, and sometimes in the mesentery, these bodies are to be seen. Their shape in man is oval or like an egg, having a diameter from one-twentieth to one-sixth of an inch. The structure seems to consist of several concentric layers of connective tissue surrounding the terminal extremity of a nerve-fibre. The connective tissue capsules are made up of either homogeneous or fibrillar substance, or both, through which elongated cells and nuclei are scattered. A mosaic marking has been demonstrated over the inner surface of the concentric membranes, due to a layer of epithelium: while a few blood-vessels ramify over the laminæ. Passing into the interior of the several layers just described may be

seen the nerve, which carries the oval enlargement as the stalk carries the berry. Up to the point where the nerve-fibre enters, it consists of its various sheaths surrounding the *axis cylinder;* as the fibre penetrates the several layers both tubular membrane and medullated sheath disappear, and the naked axis cylinder extends to the innermost layer of connective tissue, generally showing a forked or bifid termination. The corpuscle seems to be one of the modes of termination of the nerves of general sensibility. (See HISTOLOGY.) J. W. S. ARNOLD.

Pack'ard (ALPHEUS SPRING), D. D., a clergyman of the Congregational denomination, b. at Chelmsford, Mass., Dec. 20, 1799; graduated at Bowdoin College in 1816; was a college tutor 1819–24; professor of Latin and Greek languages and literature in Bowdoin College 1824–65, and in 1864 was made Collins professor of natural and revealed religion. He has published the *Writings* of Jesse Appleton, with a memoir (1837), Xenophon's *Memorabilia* (1839; 3d ed. 1843), *History of the Bunker's Hill Monument Association* (1853), contributions to Sprague's *Annals*, etc.

Packard (ALPHEUS SPRING, JR.), M. D., b. at Brunswick, Me., Feb. 19, 1839; graduated at Bowdoin College 1861; studied natural history three years under Agassiz in the museum of comparative zoology at Cambridge, devoting himself particularly to entomology; graduated in medicine at the Maine Medical College 1864; made several scientific expeditions; has been for several years lecturer on entomology at Bowdoin College, a curator of the Peabody Academy of Sciences at Salem, Mass., and one of the editors of the *American Naturalist*, published by that institution, and established the *Annual Record of Entomology* 1868. Author of *Observations on the Glacial Phenomena of Labrador and Maine, with a View of the Recent Invertebrate Fauna of Labrador* (4to, 1867), *A Guide to the Study of Insects* (1869), *Our Common Insects* (1873), and *Half Hours with Insects* (1875).

Packard (FREDERICK ADOLPHUS), LL.D., b. at Marlborough, Mass., Sept. 26, 1794; graduated at Harvard 1814; studied law at Northampton, Mass., and was 1817–29 a lawyer at Springfield, Mass., and editor of the *Federalist* newspaper of that town; was 1829–67 editor of the publications of the American Sunday School Union, Philadelphia; edited also for many years the periodicals of that society and the *Journal of Prison Discipline;* author of the *Union Bible Dictionary* (1837), *The Teacher Taught* (1839), *Life of Robert Owen* (1866), and many other works. Declined in 1849 the presidency of Girard College. D. Nov. 11, 1867.

Packard (LEWIS RICHARD), PH. D., b. at Philadelphia, Pa., Aug. 22, 1836; graduated at Yale College 1856; travelled in Europe; pursued an extended course of study at the University of Berlin; became assistant professor of the Greek language and literature in Yale College 1863, and professor in 1866, and has occasionally written articles upon literary or classical topics for various periodicals.

Pack'er, tp. of Carbon co., Pa., on Lehigh River. Pop. 441.

Packer (WILLIAM FISHER), b. in Howard tp., Centre co., Pa., Apr. 2, 1807, of Quaker ancestry; learned the printer's trade in Sunbury and Bellefonte; became a clerk in the register's office of Lycoming co. 1825; worked as a journeyman printer 1825–27; studied law, and in 1827 became a journalist of Williamsport, Pa.; was 1832–35 superintendent of the West Branch canal construction; became in 1836 a Democratic journalist of Harrisburg; was (1839–42) one of the canal commissioners; in 1842–45 auditor-general of Pennsylvania; was (1847–49) Speaker of the house; State senator 1849–51; became president of the Susquehanna R. R. 1852; was governor of Pennsylvania 1858–61.

Pack'fong, the commercial name of the Chinese *petung*, or white copper, an alloy resembling German silver in appearance, but composed of arsenic and copper fused at a low temperature, 2 parts of arsenic to 5 of copper. It was once extensively exported to Europe and employed in making philosophical instruments and a great variety of other goods. It cannot be fused, for the copper alone will remain after melting. Of late the cheaper nickel alloys have driven this substance out of the European market, but it is still extensively employed by the Chinese. It is probable that the Chinese often manufactured packfong directly from arsenical copper ores. (See NICKEL.)

Packwau'kee, post-v. and tp., Marquette co., Wis., on Wisconsin River. Pop. 612.

Pack'wood, tp. of Tulare co., Cal. Pop. 214.

Pac'olett, tp. of Spartanburg co., S. C., on the Spartanburg and Union R. R. Pop. 1312.

Pacto'lus [Πακτωλός, now *Sarabat*], a small stream of Lydia in Asia Minor, flows from Mount Tmolus into the Hermus. It is barely 10 feet wide and a foot deep. It was formerly famous for the gold contained in its mud. This was the source of the wealth of Crœsus. But for many centuries no gold has been obtained here.

Pactolus, post-v. and tp., Pitt co., N. C., on the Tar River. Pop. 2060.

Pacu'vius (MARCUS), b. at Brundisium about 219 B. C.; lived in Rome; became celebrated as a painter and tragedian; retired when an old man to Tarentum. D. there about 130 B. C. It is probable that he also wrote *Saturæ* and comedies, and his tragedies, which were not mere translations from Greek writers, but often original treatments of subjects from the Roman history, were still appreciated at the time of Julius Cæsar. The fragments of his tragedies which have come down to us are found in Bothe's *Poetarum Latii Scenicorum Fragmenta*, Leipsic, 1834, and in Ribbeck's *Tragicorum Latinorum Fragmenta*, Leipsic, 1852, 2d ed. 1871.

Padang' is a territory of the Dutch dominions on the W. coast of Sumatra, in the West Indies, consisting of the districts of Upper and Lower Padang, and containing the city of Padang, the capital of the territory, situated at the mouth of a river of the same name, in lat. 1° S. The territory comprises some of the loveliest regions found anywhere in the tropical zone. Only the low and marshy coastland is oppressively hot and unhealthy; the slopes of the high, volcanic mountains have a delicious climate and an exceedingly fertile soil, producing coffee, pepper, indigo, and caoutchouc, and yielding gold, iron, copper, quicksilver, and diamonds. Coffee is most extensively cultivated in Upper Padang; the district is said to contain 32,000,000 trees. The city, which is the residence of the governor, contains a Malay population living in bamboo huts on the left bank of the river, and a population of Europeans and Chinese living in houses of stone on the more elevated right bank. The place is unhealthy, but it carries on a most extensive trade. Pop. 12,000.

Pad'dle-fish, the *Polyodon folium*, a fish of the Mississippi, Ohio, etc., remarkable for having the nose prolonged into a thin bony appendage, sometimes about as long as the body. It has no scales, is five feet long, has a tough but eatable flesh, and uses its snout for the purpose of digging in the mud in search of food. It has a bluish back and a white belly. It is also called spoonbill and shovelfish, but the latter name belongs to *Scaphirhynchops cataphractes*, a fresh-water sturgeon.

Pad'dock (BENJAMIN HENRY), D. D., b. at Norwich, Conn.; graduated at Trinity College 1848, at the Episcopal General Theological Seminary, New York, 1852; was an assistant at Epiphany church, New York, 1852–53; rector of Trinity, Norwich, Conn., 1853–60; of Christ church, Detroit, Mich., 1860–69; of Grace church, Brooklyn, 1869–73, and was consecrated bishop of Massachusetts Sept. 17, 1873.

Pa'derborn, an old, queer, and gloomy town of Prussia, province of Westphalia. It has a beautiful cathedral in Byzantine style, under which the sources of the Pader burst forth, many good educational institutions, breweries, distilleries, and manufactures of tobacco, oilcloth, hats, and paper. Pop. 11,176.

Pad'iham, town of England, in Lancashire, on the Calder, has some cotton manufactures. Pop. 5676.

Padron', a v. of Spain, province of Corunna, is the place where the body of St. James landed itself in 829, for which reason it is much resorted to by pilgrims. Pop. 5076.

Pad'ua [It. *Padova;* Lat. *Patavium*], a town of Italy, situated in lat. 45° 24′ N., lon. 11° 52′ E. The city is a triangular enclosure, surrounded by a wall 8½ miles in extent, the base of the triangle being towards the W. The vast plain of Venetia extends to the limits of the horizon on all sides except to the S. and W., where it is broken by the Euganean Hills. Padua is in full railway communication with Venice and Lombardy, as well as with Southern Italy. The walls of the town are remarkable for the great size and strength of their bastions, and three of the seven gates are very fine. The Bacchiglione, a tributary of the Brenta, after entering the town, divides into two branches, and from these a complete network of small canals, some open, others subterranean, intersects the city. These canals are crossed by 25 bridges, 4 of which are of the time of Augustus. After issuing from the town the Bacchiglione falls into the Brenta at Strà, thus forming a navigable communication with Venice, 23 miles to the N. E. The streets of Padua are not generally attractive, being narrow and the houses high and built on arcades, but some of the squares, gardens, and public buildings are very fine. The Prato della Valle or Piazza delle Statue, now called Piazza Vittorio Emanuele, is an irregular triangle surrounded by

water and adorned with about 80 statues, besides much other tasteful decoration. The botanical garden is the oldest in Europe, and is very interesting. The municipal palace is a vast rhomboidal structure, built on arches and surrounded by *loggie,* and containing an immense and highly ornamented hall, the Sala di Ragione, which has given its name to the whole building, and is said to be the largest vaulted room in Europe: length 267½ feet; breadth 89 feet; height from floor to spring of arches 41 feet; to summit of arches 49 feet. The Caffé Pedrocchi is also unrivalled in its way, and is most richly adorned with ancient marbles excavated when the foundations of the edifice were preparing. The justly celebrated University of Padua originated in the early part of the thirteenth century, but the building it now occupies dates only from the close of the fifteenth. It is very large, and contains halls devoted to the illustration of almost every branch of human knowledge. The university library, 128,000 volumes, is in the Palazzo Capitanio. The usual number of students is about 2000. The church of Sant' Antonio (begun in 1232, finished in the fourteenth century) is a grand building of mixed architecture, surmounted by seven cupolas, the centre one of which is over the famous chapel containing the relics of St. Anthony, the wonder-working patron of the city. The magnificence of the interior can hardly be exaggerated. Without, near the façade, should be noticed the admirable equestrian statue of Gattamelata in bronze by Donatello. There are many other sumptuous churches—the Cathedral, Santa Giustina, Sant' Andrea, etc.—but the oratory of the Annunziata nell' Arena, commonly called the Chapel of Giotto, is of the highest interest to the art-student as containing the best preserved frescoes of that great master. The great antiquity of Padua is undisputed, but its certain history begins only with the Roman period. At the commencement of the Christian era it was the largest town of Northern Italy, was famed for its extensive and excellent woollen manufactures, and is said to have furnished from within its own walls a body of 20,000 men for the public service. It was, however, plundered both by Alaric and Attila, and only partially recovered under Charlemagne. In 1087 it became a republic, and in 1110, having formed an alliance with Ravenna and some other towns, it rashly attacked Venice, but was forced to sue for peace. After this Padua was governed for the most part by powerful nobles, now of the Guelph, now of the Ghibelline faction, until it fell in 1405 under the dominion of the most serene republic, in whose possession it remained almost uninterruptedly until France gave both Venice and Padua to Austria. In 1848 a provisory government was proclaimed here, but the Austrians soon recovered their power, and it was only in 1866 that Padua became a part of the united kingdom of Italy. There is as yet very little commercial or industrial activity in this town. Pop. in 1874, 66,107. CAROLINE C. MARSH.

Padua, post-v. and tp., McLean co., Ill., on the Toledo Wabash and Western R. R. Pop. 1249.

Padu'cah, city, cap. of McCracken co., Ky., on the Ohio River, near the mouth of the Tennessee River, and on the Paducah and Memphis and the Louisville Paducah and South-western R. Rs., was incorporated in 1856, has a county court-house, a city court-house, 15 churches, a female seminary, public and private schools, a number of mills, factories, and tobacco-houses, 2 daily, 4 weekly, and 2 monthly newspapers, and is the shipping port for a region whose productions are tobacco, grain, and pork. Pop. 6866.

Padu'la, town of Southern Italy, province of Salerno, situated on a hill above the river Tanagro. It was governed by a baronial house during the Middle Ages. Pop. in 1874, 8662.

Padus. See Po.

Pæ'an [Gr. παιάν, Παιών, properly a name of Apollo, or of the god of healing], among the ancient Greeks, a hymn of thanksgiving and joy, such as was sung especially before and after battles. The pæan was addressed to Apollo and afterwards to other gods, and even to men.

Pæonia. See MACEDONIA.

Pæonine (*coralline*), a red coloring-matter obtained by treating phenol with sulphuric and oxalic acids. (See PHENOL and ROSOLIC ACID.) C. F. CHANDLER.

Pæ'ony [Gr. παιωνία, probably from Pæon, the god of medicine, on account of its medicinal qualities], a name given to herbs and shrubs of the genus *Pæonia,* order Ranunculaceæ. The U. S. has but one native species, *P. Brownii,* of the Pacific States and British America. It has small purple flowers. The various Old World species are cultivated as ornamental plants. The flowers are generally showy. Of the many artificial varieties some are fragrant. All have a poisonous principle, and some species were once employed in medicine, but none are much used at present. The seeds and roots of some species are used as food by wild tribes in Asia and America. The finest varieties in garden-culture belong to *P. officinalis, albifolia, tenuiflora, paradoxa,* etc. The tree-pæony of Japan (*P. Moutan*) affords some very fine varieties.

Paër' (FERDINANDO), b. at Parma June 1, 1771; composed when only sixteen years old his first opera, *La Locanda de' Vagabondi,* which was well received; was director of the opera at Venice 1791–97; at Vienna 1797–1801; at Dresden 1801–06; at Paris 1807–27; then chapel-master to Louis Philippe, and d. at Paris May 3, 1839. He composed a great number of operas rich in light and brilliant melodies, enthusiastically received at their first appearance, but now mostly forgotten; the intrigues, however, by which he tried to keep down Rossini are not forgotten.

Pæsa'na (*Padusana*), town of Northern Italy, province of Cuneo, about 13 miles W. of Saluzzo. This town belonged to the marquisate of Saluzzo, but was sold in the fourteenth century to the house of Savoy. A very valuable iron-mine in this neighborhood was abandoned in 1780 for lack of fuel to carry on the works. Pop. in 1874, 7176.

Pæs'tum (*Posidonia;* It. *Pesto*), an ancient town of Southern Italy, on the Gulf of Salerno, about 40 miles S. E. of Naples. It is spoken of by Strabo as a Greek colony from Sybaris; it was afterwards taken by the Lucanians, who named it *Pæstum,* then by the Romans, and it was finally destroyed by the Saracens in the tenth century. In the eleventh century Robert de Guiscard stripped the abandoned city of some of its finest marbles, after which it seems to have been forgotten. The magnificent ruins which are now so celebrated were first made known to modern Europe in 1755 and described by Antonini in 1795. They consist, in the main, of crumbling walls and towers and of several more or less well-preserved temples. These are all built of travertine blocks from 6 feet to 8 feet in length and from 3 feet to 4 feet in width, the surfaces in contact being so smoothed and well fitted as to require no mortar; the external surface, in case of the temples, was covered with stucco. The walls form a pentagon 3 miles in circumference, the N. and E. sides being best preserved; one of the eastern gates still exists, and an old street of tombs is traceable beyond the ruins of another. Colossal porphyry and granite vases have been found here, and medals with figures of anchors, rudders, etc., both of the Greek and later periods. The chief interest of Pæstum, however, is in two very ancient Doric temples, sacred, one to Neptune, the other probably to Ceres, and a third, of unusual construction, called without reason the Basilica. The first, or that of Neptune, is 196 feet in length and 79 feet in width, with a peristyle of 36 fluted columns (28 feet in height, 7½ feet in diameter), supporting an architrave without moulding, and frieze with the usual triglyphs; the pediments at the two ends are surrounded by a cornice and are of similar architecture. The cella is of the same form as the exterior, has two rows of eight columns each, and these are surmounted by smaller ones to support the roofs of the aisles, the cella itself having been hypæthral or uncovered. The temple of Ceres (some say of Vesta), though less imposing, is still worthy the palmy days of Greek art. Between these two temples are the ruins of, probably, a Roman theatre and amphitheatre. The so-called Basilica, S. of the temple of Neptune, is held by some to be the most ancient of the three temples, as it is certainly the most ruinous; but most antiquaries regard it as of later date. It is remarkable for having nine columns in each façade, with a row of eighteen running down the centre. The malaria of this coast has left it almost without inhabitants, but neither this nor the danger from brigands prevents Pæstum from being frequently visited.

Paez' (Gen. JOSÉ ANTONIO), b. near Acarigua, Venezuela, June 13, 1790; entered the patriot army in 1810, and for victories over the Spanish rose to general of division 1819; took a leading part at the battle of Carabobo, which secured the independence of Colombia 1821; became military commandant of Caracas; opposed the new Colombian constitution 1826; was at the head of the revolution which culminated in the independence of Venezuela Sept., 1829; was the first president of the new republic; again elected 1839; was minister to the U. S. 1860–61; was made dictator 1861–62; again came to the U. S.; published his *Autobiography* (New York, 1867); visited the Argentine Republic and Peru, and returned to New York 1872. D. there May 6, 1873.—His son, RAMON PAEZ, resident for many years in New York, is author of *Public Life of José Antonio Paez* (1854), *Wild Scenes in South America* (1862), and *Ambas Americas Contrastes* (1872.)

Paga'ni, town of Southern Italy, province of Salerno, about 22 miles S. E. of Naples. This is a very old town,

and in the seventeenth century contained 3 universities, but is now a place of little interest. Pop. in 1874, 12,492.

Pagani'ni (Nicolo), b. at Genoa Feb. 18, 1784; gave, when nine years old, his first public concert as a violin-virtuoso in his native city, and produced an extraordinary enthusiasm by his performance of *La Carmagnole* and the variations he had put to this air. From 1805 to 1808 he was engaged as first violinist to the princess Eliza of Lucca, a sister of Napoleon, whose whole circle at Parma he put in the wildest excitement, especially by his sonata *Napoleon*, composed for one string. Afterwards he led for many years a most adventurous life, emerging suddenly from obscurity and oblivion, thrilling the inhabitants of some Italian town, or rather putting them into a fit of frenzy, by his violin, and then disappearing as suddenly, sometimes playing for bread in a market-place and sometimes refusing to play though a fortune was offered him. From 1828 to 1833 he made a concert tour from Vienna, through Germany, to Paris and London, and the sensation he produced by his extraordinary virtuosoship, by the novelty and peculiarity of his effects, and by the mystical glimmer which surrounded his life, has never been equalled before or since by any virtuoso. Wealthy, but with broken health, he returned in 1834 to Parma, where he bought the Villa Gajona, and d. at Nice May 27, 1840. His compositions, of which the *Carnival of Venice* is one of the most famous, have no very great musical worth, but for the violinist they are of course of immense interest.

Pa'ganism, as a name for heathenism, originated among the Christians when Christianity gained superiority in the cities and the worship of the old Greek and Roman gods was confined to remote villages (*pagi*) and the scattered settlers in the country (*pagani*). It is now used as a general term including all polytheistic religions in opposition to Christianity, Judaism, and Mohammedanism; in the Middle Ages it also included Mohammedanism. In Germany it is also applied to tendencies within Christianity itself which are deemed polytheistic in their nature, such as the worship of the Virgin and the saints in the Roman Catholic Church.

Paga'no (Mario), b. at Brienza, near Salerno, in 1748, and studied at Naples, where he formed a friendship with Filangieri. Being employed to prepare a sketch of a reformed code of criminal law, he wrote his *Considerazioni sul Processo Criminale.* After this appeared *I Saggi Politici* and several dramas of a national tendency. In the reaction following the French Revolution, Pagano defended with great warmth the liberals who were arrested at Naples. Being himself thrown into prison, he there produced his essays *Sul Gusto*, *Sulla Poesia*, and *Sul Bello.* On the proclamation of the Parthenopean republic he was appointed to prepare the new constitution. The republic being overthrown, he was accused of treason, and declined to make any defence. D. by the hand of the executioner on the 29th of October, 1799.

Page [akin to the Gr. παῖς, a "boy"], in feudal times, a boy employed to attend upon a knight or lady as an attendant and companion, rather than as a menial servant. Pages were a kind of apprentices to the future ranks of esquire and knight. They were often of noble blood. The practice survives in a modified form in European courts. The pages of the British court may receive promotion to commissions in the foot-guards. The houses of Congress in the U. S. employ a number of "pages" as attendants upon the members while on duty.

Page, county of S. W. Iowa, bounded S. by Missouri. Area, 576 square miles. It is well watered and very fertile, and produces live-stock, wool, and grain. The county is traversed by several beautiful river valleys and by a branch of the Burlington and Missouri River R. R. Cap. Clarinda. Pop. 9975.

Page, county of Virginia, bounded E. by the Blue Ridge, W. by the Massanutten Mountains, and traversed by the S. fork of the Shenandoah River. It is highly fertile, and abounds in limestone, iron, and copper. Grain and tobacco are leading products. Distilled liquors are the principal article of manufacture. Area, about 250 square miles. Cap. Luray. Pop. 8462.

Page (Charles Grafton), M. D., b. at Salem, Mass., Jan. 28, 1812; graduated at Harvard 1832; practised medicine in Virginia 1838–40, and in 1839–40 was professor of chemistry in Columbian College, Washington, D. C.; examiner in U. S. Patent Office 1840–68. When ten years old he made an electrical machine, and acquired distinction by his experiments and machines designed to develop the economic use of dynamic electricity as a motive-power. Author of *Psychomancy* (1853), of a treatise on electricity, and of many scientific papers. D. at Washington, D. C., May 5, 1868.

Page (David P.), b. at Epping, N. H., in 1816; was for some years principal of the New York State Normal School at Albany; author of a valuable work, *The Theory and Practice of Teaching, or the Motives of Good School-Keeping*, and of an *Elementary Chart of Vocal Sounds* (1847), which was one of the first attempts of the kind in the English language. D. in 1848.

Page (John), b. at Rosewell, Gloucester co., Va., Apr. 17, 1743; graduated at William and Mary College 1763; was an ardent patriot and leading statesman of Virginia during the Revolution, and held the lieutenant-governorship and other public offices; was in Congress 1789–97; a Presidential elector 1800; governor of Virginia 1802–05. D. at Richmond, Va., Oct. 11, 1808.

Page (John), b. at Haverhill, N. H., May 21, 1787; was a State legislator 1818–20 and in 1835; register of deeds for Grafton co., N. H., 1828–34; U. S. Senator 1836–37; a State councillor in 1838; governor of New Hampshire 1839–42. D. at Haverhill, N. H., Sept. 8, 1865. He was a leading Methodist and a prominent Freemason.

Page (Thomas Jefferson), b. in Virginia about 1815; entered the U. S. navy 1827; became lieutenant 1833; was engaged for many years upon the coast survey and subsequently in the China squadron; commanded the U. S. Exploring Expedition on the La Plata, Paraná, and Paraguay rivers 1853–56; became commander Sept., 1855; published *La Plata, the Argentine Confederation, and Paraguay* 1859; resumed and completed his explorations 1859–60, and served in the Confederate navy, attaining the rank of commodore.

Page (William), b. in Albany, N. Y., Jan. 23, 1811; came to New York City when eight years old. A precocious talent for art took him from the study of law, and afterward from divinity. He studied with Mr. Herring, the portrait painter, and with S. F. B. Morse; painted portraits in Albany and New York with eminent success, being even then distinguished by his skill in drawing and in color; executed a few compositions, a *Holy Family*, *The Infancy of Henri IV.*, and others; resided in Rome and Florence several years; returned to New York in 1860, and has since resided there. Page is known as an experimenter in color, and has painted many extraordinary pictures to illustrate his ideas—a *Flight into Egypt*, *Moses and Aaron on Horeb.* His *Venus* became famous; copies of Titian by him have been mistaken for originals of the master. Page has been president of the National Academy and has written and lectured on art. His last work of absorbing interest has been a reproduction of the head of Shakspeare from the Kesselstadt mask. He is a man of enthusiastic temperament and daring genius, poetic, eloquent, and engaging. O. B. Frothingham.

Pagès. See Garnier-Pagès.

Pa'get (Sir James), Bart., F. R. S., D. C. L., b. at Great Yarmouth, England, in 1814; educated in surgery at St. Bartholomew's Hospital; reached the highest honors of his profession, and was made a baronet 1871. Author of *Lectures on Surgical Pathology* (1853), and many contributions to the *Transactions* of learned societies.

Page'ville, a v. (Downington P. O.) of Scipio tp., Meigs co., O. Pop. 80.

Paging-Machine, an apparatus used for paging blank books, numbering checks, railway tickets, packages, etc. There are many machines of the kind, some of which are so arranged that it is impossible to print duplicate numbers with them without going twice through the whole series for which the machine is set.

Pa'go, an island in the Adriatic, belongs to Austria, and is separated from Croatia by the Strait of Morlacca. Area, 106 square miles. Pop. 4500. It is mountainous and not very fertile, but is rich in salt and excellently cultivated. Sheep, fish, wine, and salt are exported.

Pago'da [Pers. *but-gada*, the "house of idols"], a name applied to a great variety of East Indian temples and religious monuments, both Hindoo and Boodhistic. They are often of most elaborate and costly architecture, and not unfrequently are very beautiful. They are usually of stone, are mostly terraced pyramids, and in some instances are purely monumental, having no interior apartments; such buildings are more frequently Booddhistic. They have often slighter surrounding structures, which are used as sanctuaries or as the dwellings of priests. Such is the great pagoda of Rangoon. The principal Hindoo pagodas are dedicated to the worship of Siva and his wife Parvati.

Pahaquar'ry, post-v. and tp., Warren co., N. J. Pop. 405.

Pahlampoor' is a small state of Hindostan, tributary to Great Britain, and situated between lat. 23° 57′ and

24° 41′ N., and between lon. 71° 51′ and 72° 45′ E. Pop. 322,000, of whom one-seventh are Moslem. The capital, of the same name, is surrounded with walls, has an extensive trade, several manufactures, and 30,000 inhabitants.

Pahranagat Valley, tp. of Lincoln co., Nev. P. 39.

Pah U'te, county of N. W. Arizona. Area, 4360 square miles. It is bounded N. by Utah and separated from Nevada on the W. by Colorado River, which traverses the county in deep cañons. It is a dry and unfruitful region. Cap. St. Thomas.

Pah-Ute Indians, a tribe of degraded Indians of the Shoshone stock. They number some 6000, and are placed upon two reservations of 320,000 acres each, one on Walker River and one on Pyramid Lake in Nevada. They are quiet, harmless, and subsist upon fish, game, roots, and the like. They show some disposition to be industrious. Besides these, there are some 2500 wandering "Pi-Utes" in S. E. Nevada, a destitute and degraded class of savages.

Paige (Alonzo Christopher), b. at Schaghticoke, N. Y., July 31, 1797; graduated at Williams College 1812; was admitted to the bar in 1819; as reporter of the New York court of chancery 1828–46 he published 11 volumes of *Reports;* was in the New York assembly 1826–30; a State senator 1838–42; a justice of the State supreme court 1847–51, 1855–57, and was a member of the New York constitutional convention of 1867. D. at Schenectady, N. Y., Mar. 31, 1868.

Paige (Elbridge Gerry), b. at Hardwich, Mass., about 1816; was for some time editor and proprietor of the New York *Sunday Mercury,* for which he wrote, under the pseudonym of "Dow, Jr.," a series of *Short Patent Sermons* (3 vols., N. Y., 1854), which were widely copied; was unsuccessful in business, and went to California. D. Dec. 4, 1859.

Paige (Lucius Robinson), A. M., D. D., b. at Hardwick, Mass., Mar. 8, 1802; educated in common schools; became a Universalist clergyman, and preached in Springfield and Sandy Bay, now Rockport, Mass. In 1839 he relinquished pastoral duty, and has published *Selections from Eminent Commentators* (1833), *Commentary on the New Testament* (6 vols., 1844–69), etc.

Paine (Charles), b. at Williamstown, Vt., Apr. 15, 1799; graduated at Harvard 1820; became a successful manufacturer; was governor of Vermont 1841–43; was a liberal benefactor of the State University and other institutions of learning, and one of the fathers of the railroad system of Vermont. He was active in the Southern Pacific R. R. movement, and d. at Waco, Tex., July 6, 1853.

Paine (Elijah), LL.D., b. at Brooklyn, Conn., Jan. 21, 1757; graduated at Harvard 1781, and in 1784 became a lawyer in Vermont; was a member of the State constitutional convention of 1786; of the legislature 1787–91; a judge of the State supreme court 1791–95; U. S. Senator from Vermont 1795–1801; a U. S. district judge 1801–42; was also a successful manufacturer of cloth at Northfield, Vt., a member of many learned and benevolent societies, a liberal benefactor of institutions of learning, and held numerous positions of honor and trust. D. at Williamstown, Vt., Apr. 28, 1842.

Paine (Elijah), b. at Williamstown, Vt., Apr. 10, 1796, a son of Judge Elijah Paine; graduated at Harvard in 1814; studied law at Litchfield, Conn.; became a law-partner of Henry Wheaton, and assisted in preparing Wheaton's *Reports;* was a judge of the New York superior court 1850–53; author of *Paine's Reports* (1827, 2d vol. 1856), and one of the authors of Paine and Duer's *Practice in Civil Actions* (2 vols., 1830). D. New York Oct. 6, 1853.

Paine (Gen. Halbert E.), b. at Chardon, O., Feb. 4, 1826; graduated at Western Reserve College 1845; was admitted to the bar at Cleveland 1848; removed to Milwaukee, Wis., 1857; was colonel of the Fourth Wisconsin regiment of volunteers 1861–63; brigadier-general Mar., 1863; participated in the defence of Washington against Early's raid; commanded a division in the Vicksburg campaign, and lost a leg in the last assault on Port Hudson June, 1863; was brevetted major-general Mar., 1865; was a delegate to the Philadelphia "Loyalist Convention" 1866, and was a Republican member of Congress 1865–71.

Paine (Levi Leonard), A. M., b. at E. Randolph, Mass., Oct. 10, 1832; graduated at Yale 1856; tutor there 1859–61; studied divinity at New Haven; Congregational minister at Farmington, Conn., 1861–70; became in 1870 professor of ecclesiastical history in the theological seminary at Bangor, Me.

Paine (Martyn), M. D., LL.D., son of Judge Elijah Paine (1757–1842), b. at Williamstown, Vt., July 8, 1794; graduated at Harvard in 1813; studied medicine under Dr. John Warren of Boston, Mass., and took his medical degree there 1816; practised his profession at Montreal 1816–22; removed to New York City, where he became one of the leaders of the medical profession; was one of the founders of the University Medical College 1841, in which he subsequently held important professorships. Author of a work *On the Cholera Asphyxia* (1832); *Medical and Physiological Commentaries* (3 vols., 1840–44); treatises on *Materia Medica* (1842, 1848); a very valuable standard treatise on the *Institutes of Medicine* (1847); *The Soul and Instinct* (1849), and other works. D. in N. Y. City Nov. 10, 1877.

Paine (Robert), D. D., b. Person co., N. C., Nov. 12, 1799. His father, James Paine, was a highly respectable farmer. Robert removed to Tennessee early in this century; in 1818 joined the Tennessee conference of the M. E. Church, and did pastoral work till 1830; became president of La Grange College, Ala., till 1846, when he became bishop; was a member of every General Conference from 1824 to 1846; chairman of the committee of nine which reported the plan of separation on the basis of which the M. E. Church was divided; was a prominent member of the Louisville convention in 1845 which organized the M. E. Church, South, and also of the General Conference of 1846, by which he was elected bishop. He has great pulpit ability, good learning, and great executive ability. His *Life and Times of Bishop McKendree* (2 vols.) is highly esteemed. T. O. Summers.

Paine (Robert Treat), b. in Boston, Mar. 11, 1731; graduated at Harvard College 1749; studied theology and acted as chaplain in the Northern army; subsequently studied law and admitted to the bar 1759, settling at Taunton; in 1770 was prosecuting officer (in the attorney-general's absence) of Preston and his men for the massacre at Boston; elected to the legislature 1773; delegate to Continental Congress 1774–78, meanwhile filling various important positions in Massachusetts; was one of the signers of the Declaration of Independence, attorney-general of Massachusetts 1780–90, and judge of the supreme court of Massachusetts 1790–1804, when he resigned. With others he founded the American Academy of Massachusetts (1780). D. at Boston May 11, 1814.

Paine (Robert Treat, Jr.), son of the signer of the Declaration of Independence of the same name, b. at Taunton, Mass., Dec. 9, 1773; graduated at Harvard College 1792; became a frequent contributor to the *Massachusetts Magazine;* established the *Federal Orrery* Oct., 1794; sold his newspaper the following year; wrote in 1798 the celebrated song *Adams and Liberty;* removed to Newburyport and commenced the study of law under Theophilus Parsons 1799; delivered a *Eulogy* on Washington Jan., 1800; practised law at Boston in partnership with Parsons 1802, and abandoned it 1803 to devote himself to theatrical literature. D. at Boston Nov. 13, 1811. His works were edited, with a prefatory *Memoir,* by Charles Prentiss, 1812. His original name was Thomas Paine, but to avoid confusion with a more celebrated writer he took that of his father by permission of the Massachusetts legislature in 1801.

Paine (Thomas), b. at Thetford, England, Jan. 29, 1737, son of a Quaker; received an indifferent education at the Thetford grammar school, but acquired a considerable range of knowledge by private study while working at his trade as a stay-maker at London, Dover, and Sandwich; served a short time on board a privateer 1755; preached occasionally as a dissenting minister; married in 1760 the daughter of an exciseman; obtained a post in the revenue service; became a grocer and tobacconist at Thetford and at Lewes in Sussex; cultivated literature; acquired so clear and forcible a style as to be chosen by the excisemen as their representative in advocating their interests, in which capacity he published a pamphlet, *The Case of the Officers of the Excise* (1772), which probably led to his introduction to Dr. Franklin; was dismissed from his office on a charge of smuggling 1774, when, cherishing a violent resentment against the British government and influenced by the advice of Franklin, he proceeded to America; arrived at Philadelphia Dec., 1774; obtained immediate employment as editor of the *Pennsylvania Magazine;* published in Bradford's *Pennsylvania Journal* in Oct., 1775, an article entitled *Serious Thoughts upon Slavery,* which attracted great attention; wrote, at the suggestion of Dr. Rush, his celebrated and widely-circulated pamphlet *Common Sense,* which struck the keynote of the situation by advocating independence and a republican government; received from the Pennsylvania legislature a grant of £500 in recognition of its value; established in Dec., 1776, a periodical entitled *The Crisis,* which appeared at irregular intervals and had

great influence in maintaining the spirit of the army and the people; was chosen in 1777 secretary to the committee of foreign affairs, from which post he was dismissed and censured by Congress in 1779 for revealing diplomatic secrets in a controversy with Silas Deane; was soon afterward elected clerk to the general assembly of Pennsylvania; rendered good service in 1780 in promoting a subscription for relieving the distress of the army; went to France with Col. Laurens, whom he aided in negotiating a loan 1781; received from Congress a grant of $3000 (1785) and from the State of New York an estate at New Rochelle as rewards for his services; went again to France 1787; invented an iron bridge, which was set up the following year at Rotherham, Yorkshire; published in 1791–92 his *Rights of Man*, a vindication of the French Revolution, in reply to Burke, which gave him immense popularity in France and led to a bestowal of citizenship and his election to the French National Convention as deputy for Calais; took his seat in that body; usually acted with the Girondists; opposed the execution of the king, advocating his banishment to America; was imprisoned by the faction of Robespierre, Jan. to Nov., 1794, narrowly escaping the guillotine; wrote in prison a portion of his *Age of Reason* (1795), a deistical work; again took his seat in the Convention; resided nearly two years in the family of James Monroe, then minister in France; wrote several political letters and pamphlets of minor importance: visited the U. S. in 1802, making the voyage in an American sloop-of-war; was cordially received at Washington, Philadelphia, and New York, and by Jefferson at Monticello, but insulted by the Federalists at Trenton and elsewhere, and resided the remaining years of his life in comparative obscurity at New York, and on his estate at New Rochelle. D. at New York June 8, 1809. He was buried on his estate at New Rochelle, where a monument was erected by his admirers in 1839, though his supposed remains were carried to England in 1819 by William Cobbett. Biographies of Paine have been written by Chalmers, Cobbett, Cheatham, Rickman, Sherwin, and G. Vale (New York, 1841), and a complete edition of his works was published by J. P. Mendum (Boston, 1856). PORTER C. BLISS.

Paines'ville, tp. of Stearns co., Minn. Pop. 318.

Painesville, post-v. and tp., cap. of Lake co., O., on the Lake Shore and Michigan Southern and the Painesville and Youngstown R. Rs., has a fine harbor, 1 park, a female seminary, 5 graded schools, 6 churches, 3 banks, 3 weekly newspapers, 2 machine-shops, a flouring-mill, foundries, tanneries, and factories. Pop. of v. 3728; of tp. 4995. MERRILL & SCOFIELD, PROPS. "TELEGRAPH."

Paint [Lat. *pingere*, to "paint"] is a name which is generally limited to mixtures of insoluble colors or pigments with certain materials which prepare them for application to surfaces of wood, iron, stone, plaster, canvas, etc. by the aid of a brush. When the colors are soluble, the preparation is more properly a stain or a dye. Paints are used not only for purposes of decoration, but to protect surfaces from moisture and decay, which they accomplish by closing the pores and excluding the agents of destruction. (See FERMENTATION and PRESERVATION OF TIMBER.) All paints consist essentially of two parts: (1) the pigment; (2) the vehicle. *The pigments* are very varied in character; the whites are generally white lead, more or less adulterated with barytes, oxide of zinc, prepared chalk, etc.; the yellows are ochres, chromate of lead, etc.; the reds are red oxide of lead, ochres, oxides of iron, red oxide of copper, vermilion, dichromate of lead, carmine, carmine-, madder-, and other lakes, etc.; the blues are Prussian blue, ultramarine, smalt, Thénard's blue, verditer, etc.; the greens are verdigris, Paris green, verditer, borate of copper, chromate of copper, oxide of chromium, cobalt green, and green lakes, the most common being, however, a mixture of chrome yellow and Prussian blue; the browns are umber, bole, terra di Sienna, bistre, sepia, etc.: the blacks are lampblack, bone-black, anthracite, graphite, etc. (See also the article on LAKES.) *The vehicles* determine the character of the paint: we have oil-paints and water-colors.

Oil Paints.—The most common vehicle is linseed oil, which is especially valuable on account of the property it possesses of oxidizing to a resinous body, which holds the paint in a firm waterproof varnish. By boiling this oil with litharge and sulphate of zinc it acquires the property of drying very rapidly, though the color is darkened by the operation. For some purposes other oils, as nut and poppy oils, are substituted for linseed oil; the latter, being colorless, is preferred for very delicate colors, but it dries very slowly. In the preparation of oil-paints the pigment is mixed with a small quantity of raw linseed oil and ground in a mill to make the mixture homogeneous. About 8 per cent. of oil is added to white lead, 12 or 13 per cent. to zinc white. The pigment, ground in oil, is put up in convenient packages for the painter, who mixes it for use with a further quantity of raw and boiled linseed oil, and colors it to any desired shade with colored pigments, which are also furnished ground in oil. Pigment and oil alone would be so thick as to make the labor of applying the paint to any large surface almost impossible, so a third class of agents is employed in preparing paints, the *thinners.* Thinners are either spirits (oil) of turpentine or benzine, the portion of petroleum having a gravity of about 62° B. (See PETROLEUM.) As they are solvents for oils, they mix freely with the oil-paint and thin it to any desired degree. As it is desirable that the paint, after it has been applied to a surface, should dry speedily before it is contaminated by dust or rubbed off by accident, it is necessary to do something more than boil the linseed oil; a fourth class of substances is used, the *driers* or *siccatives.* Driers are sugar (acetate) of lead, sulphate of zinc, verdigris, binoxide of manganese, red lead, japanner's gold size, etc. By far the most powerful siccative is the borate of manganese, one one-thousandth being sufficient to greatly hasten the drying of linseed oil. This agent is supplied to the painter ground in oil in a convenient form for mixing with the paint. It is always necessary to mix the above-mentioned materials, pigment, oil, thinner, and dryer, just before the paint is to be used, as, if the mixture is allowed to stand for any length of time, the pigment settles to the bottom, the thinner evaporates, and the oil absorbs oxygen, becomes thick and ropy, and a hard skin forms over it, which cannot be dissolved again. No amount of labor will restore to such a pot of paint the qualities which it possessed when first prepared. To meet this difficulty a new system of mixing paint, the invention of D. R. Averill, has been introduced, by which paints of any color can be made and mixed on a large scale at the factory, and put up in convenient packages from one pound cans to barrels, which are always ready for use. Any portion which may be left over after painting any work can be returned to the package for future use. The painter is thus saved all the trouble of mixing the paints, and great economy is also introduced, as nothing is wasted. The principle involved in the preparation of these ready-mixed paints is the formation of an emulsion which holds the pigment in suspension and prevents its settling. In the Averill patent the preferred process involves the use of (1) a solution of acetate and sulphate of zinc, made by mixing solutions of acetate of lead and sulphate of zinc; (2) a solution of silicate of soda; (3) lime water; (4) linseed oil. These are mixed in the order in which they have been mentioned, and the resulting product is a thick, gelatinous, oily emulsion, like a salad-dressing. To this is added the pigment and an additional quantity of linseed oil. The whole is finally thinned with turpentine or benzine, and then passed through a paint-mill to make it homogeneous. The pigment is generally white lead or oxide of zinc, and any desired color is obtained by adding colored pigments. For the emulsionizing agents above mentioned many others may be substituted; it is necessary, however, in order to secure a paint that will not drop the pigment, to combine water with the oil by the aid of some alkaline or gelatinous material which will produce an emulsion.

Water-Colors.—For many purposes paints are prepared with the aid of water as a vehicle, glue or gum being added to make the pigments adhere after the evaporation of the water. Such paints can only be used for interior work, walls and ceilings, for coloring pictures, maps, etc. They must be mixed as they are used, as a solution of glue or gum would mould or putrefy and dry up if kept for any time. The most common paint of this kind is called "kalsomine," and is a mixture of prepared chalk with a solution of glue, to which ultramarine is added to neutralize a faint yellow tint for white, and ochres, etc. for other colors. The solid cakes of water-color are made by mixing the pigments with gum and water to a thick paste, pressing in moulds, and drying in warm air. By rubbing them in water or applying a wet brush to them the color is liquified for use. Silicate of soda, soluble glass, has been suggested as a vehicle for pigments and as specially adapted for application to walls and ceilings, as it produces a very hard and durable surface. Sometimes the silicate of soda paint is applied to the ceiling, and a thin solution of the clear silicate is afterwards sprayed over the entire surface. Naphthas and tars, both coal and wood, are used as vehicles for cheap paints or for paints for special purposes, as for protecting iron, ships' bottoms, etc. Poisonous pigments are also used to prevent the adhesion of barnacles and other marine animals and sea-weeds to ships' bottoms, specially copper compounds, the red oxide, etc. Artists' colors are composed of very carefully prepared pigments ground in a small quantity of very fine oil, and put up in

metallic tubes. It is estimated that the value of the raw materials used in making paints which are annually made in the U. S. or imported exceeds $125,000,000, and that when properly mixed and sold to consumers the value is double this amount.

Literature.—The Painter and Varnisher's Guide, P. F. Tingry (London, 1816); *The Interior Decorator*, D. R. Hay (Philadelphia, 1867); *A Treatise on Colors and Pigments*, George Field (London, 1869); *The Painter, Gilder, and Varnisher's Companion* (Philadelphia, 1870); *Magazin für die Druck- Färbe- und Bleichkunst*, Joh. G. Dingler (Augsburg, 3 vols.); *Farben-Chemie insbesondere der Oel- und Wasserfarben*, S. Tschelnitz (Wien, 1857); *Lehrbuch der Farbenfabrikation*, J. G. Gentele (Braunschweig, 1860).

C. F. CHANDLER.

Paint, tp. of Fayette co., O. Pop. 1742.

Paint, post-v. and tp., Highland co., O., on Paint Creek. Pop. 2429.

Paint, tp. of Holmes co., O. Pop. 1212.

Paint, tp. of Madison co., O. Pop. 955.

Paint, tp. of Ross co., O., on Paint Creek. Pop. 1001.

Paint, tp. of Wayne co., O. Pop. 1418.

Paint, tp. of Clarion co., Pa. Pop. 346.

Paint, tp. of Somerset co., Pa. Pop. 923.

Paint Creek, tp. of Allamakee co., Ia. Pop. 1141.

Painted Post, post-v. and tp., Steuben co., N. Y., situated on the Erie R. R., 18 miles W. of Elmira, has 3 churches, 1 bank, 1 newspaper, 2 large saw-mills, iron-works, 2 hotels, and stores. Principal business, manufacturing and farming. Pop. (1850) 4334.

S. H. FERENBAUGH, ED. "TIMES."

Paint'er (GAMALIEL), b. at New Haven, Conn., May 22, 1743; erected the first house at Middlebury, Vt., 1773; served as captain and quartermaster in the war of the Revolution; was a delegate to the convention which in 1777 declared the independence of Vermont; was representative in the Vermont legislature; member of the constitutional convention 1793, and judge of the county court; councillor 1813–14. D. at Middlebury May 21, 1819. He was the principal founder of Middlebury College, to which he left $10,000 by his will.

Painter's Colic. See COLIC.

Painter's Cream, a mixture of mastic, lead, acetate, nut-oil, and water, applied by artists to unfinished oil-paintings to prevent them from drying during the interruptions of the work. It is applied with a brush and washed off with water.

Paint'ing [Lat. *pingere*, to "paint"], as a fine art, consists of drawing, invention, relief, perspective, and color (in the modern artistic sense), and history shows that its development has taken place in the above-mentioned order. *Drawing* consists not only in outline, but in the correct form of any surface expressed by the pencil or brush. It is form, as distinct from color. Latterly the word modelling has been borrowed from the sister art and applied, with the same meaning, to the representation of the inequalities of surface in the human form, not including the outline. *Invention* is the method with which the artist disposes his figures in order to explain his meaning, to tell his story—the variety of gesture, pose, expression, drapery, and accessory. It includes composition, and is the highest quality of the art. *Relief* is that management of light and shade which gives the pictured figure the appearance of standing out from its surroundings and background. *Perspective* is the application of geometry to the art in representing streets, buildings, galleries, and interiors by mathematical rules. Aërial perspective consists in representing the effects of distance and atmosphere upon objects, landscape, or figures. *Color* is intimately connected with light and shade (chiaroscuro); for until the gradations and alterations of tone made by it are recognized, color may be ornamental, but never artistic. It consists of harmony, opposition, sentiment, and truth, and is never seen except when art has arrived at its highest state. Color is the luxury of art, and usually precedes its decadence. The first art-impulse is plastic; the earliest known monuments of art are in rude sculpture; the most primitive form a heap of stones to mark an event, a boundary, a grave. These rough piles suggested the idea of representing the figure of the person to whose memory they were raised. The sphinxes of Egypt (those with human heads) are probably likenesses of the Pharaohs, the others being symbols. All primitive art is commemorative; and the same feeling which formed the statue built the tomb, and afterward the temple. From the effigy of the king it is a natural step to represent scenes in his life, when need was felt for more than a single figure, and thus the bas-relief and intaglio were invented. Colored reliefs led to color without relief, or pictures, the oldest examples of which have been found on the walls in the tombs of Thebes, on mummy-cases, and on pottery. They comprise a multitude of domestic, historic, and mythologic subjects, are spirited in action, aiming at accuracy of representation, and showing much invention in grotesque forms of animals, ornaments, and symbols. They consist of a simple outline filled in with flat tints, making a solid figure or monochrome, without lights, shades, or any attempt at background other than the color of the substance painted upon, reminding us in style of many of the Chinese figures of to-day. The pigments used are black, white, yellow, red, brown, blue, green, and also gilding. The colors, mixed with gum and water, were sometimes laid immediately on the stone wall, sometimes on a coating of plaster, as in modern fresco, and at times on wood, on baked and on wet clay, as is seen in their vases. "The series of Egyptian art," says Pulszky (in Gliddon's *Indigenous Races*), "continues in an unbroken chain from the thirty-fifth century B. C. down until long after the Christian era. It culminated under Sesortasen, twenty-second century B. C., when it was excellent in portraiture, delicate, and refined, but emotion was never portrayed by them, and the feeling of ideal beauty remained unknown." This criticism applies only to their statues, which attained a much greater artistic excellence than their paintings. The latter date from 1500 B. C., showing that in Greece, and later in Italy, the sculptor's art preceded the painter's, that form is portrayed before feeling, that pictures are a result of the reflecting period of a nation's life, and that Egyptian paintings were only illustrations of events, not expressions of ideas. A more intellectual people was needed before painting could rise to a higher plane, but Egypt taught the first lesson. The Assyrians took Egyptian forms and made them greater in size, the Hebrews took them and made them richer in material, both missing the true art-idea. Assyria introduced landscape and a more pictorial arrangement of figures into bas-reliefs; and there are some remains of Persian reliefs that show an excellent appreciation of the different types of men, with a refined execution; but it was in Etruria that Egyptian forms were gradually improved upon. This improvement can be traced on their terra cotta vases dating from 700 to 200 B. C., rising from the rudest shapes and designs to the most elegant and artistic. They vary with the changing civilizations around them, but show an inherent adaptability which marks the artist. The first have simple objects, wreaths, flowers, animals, painted in a uniform color on a ground of a different tint, chiefly brown on ash color. In 600 B. C. figures are introduced, brown on cream color; a little later black, white, and crimson figures appear with incised outlines. At the date of 450 B. C. we have black figures with a red ground, the flesh of women white, also black glazed vases with figures of red, white, and blue, the colors harmonious and ornamental, though never seeking to imitate nature, except in the few attempts of representing flesh as white, and with no light and shade; but in form, design, and composition the Etruscans are unrivalled, which excellence many seek to explain by saying that they had Greek workmen.

It is of this classic country we have now to speak. Pliny (*Hist. Nat.*, lib. xxxv.) says the Egyptians boast of having invented painting six thousand years before it passed into Greece, but adds: "Their vanity and lying are well known." However averse Pliny was to acknowledge this fact, we now know it to be true: but the profit gained from it was not sufficient to prevent the earliest art of the Greeks from being very rude, the author assuring us that they were obliged to write at the bottom of their pictures the name of the object represented. He refers at the same time to the perfection of Etruscan art and the brilliancy of the colors yet remaining on the walls of ruined temples, older, he says, than Rome itself. Tradition, which always contains some truth, designates Eumaras the Athenian (vide Pliny) as the first who distinguished the sexes; Cimon of Cleone, who attempted foreshortening, painted the veins, muscles, and articulations of the joints, and gave to draperies their natural folds; Panænus, who painted portraits in his battle-pieces; Polygnotus of Thasus, who observed expression and grace, making the lips smile and the draperies fly, ornamenting and arranging the hair; Apollodorus of Athens, celebrated for color, light, and shade (of which this is the first mention), representing things "alive." He was one of the great pioneers of the art, and lived about 376 B. C., more than a century after the perfection of sculpture in the Parthenon. The way being opened, Zeuxis appeared, celebrated for natural color, or close imitation of color; Parrhasius, the first who succeeded in giving his figures relief, observing manners, customs, and passions with the mind of a philosopher, and delineating the same in his pictures, for which

he first made designs on parchment with pen and ink; Pamphilus applied perspective to painting and founded an academy; Apelles, the Rafael of his age, seized that undefinable quality called grace; Calades preferred subjects from ordinary life rather than from history or fable, and painted small pictures (our modern genre), and Marcus Ludius was a celebrated landscape-painter. It was no wonder that painting, as the Greeks knew it, was said to be invented by them. With the Etruscans it was an ornament, with the Egyptians it was a record, with the Greeks it was an art. They first discovered its capabilities and used it as a medium of thought. None of their pictures remain, but the descriptions of their writers and the perfection of their sculpture lead us to suppose that they attained as high a state of excellence as was afterwards attained in Italy, except, perhaps, in color. They mostly used panels to paint on, sometimes walls, and in a few instances canvas. Apelles who was a colorist, was said to paint with four colors, white, yellow, red, and black; but later, Pliny mentions twenty pigments, with the manner of preparing, mixing, and using them, indicating those that altered their tone when applied to plaster. As at present, they consisted of various earths, minerals, and extracts, the last being tempered with chalk to give them consistency. The colors were mixed with gum, the yolk and white of egg, and water—a method which is called distemper. Melted wax was sometimes used as a varnish. Colored wax was also used as a pigment, and afterwards melted into harmony. (See ENCAUSTIC.) The Romans conquered pictures rather than made them. Less ideal than the Greeks, they excelled in portraiture, and in their compositions expressed more movement. Their art being but a reflex of that of Greece, it could scarcely be called national. The Byzantine period came next, through which art languished, shackled by traditions to which it was unable to give life. But finally, the old civilizations being ended and a new one established, its demand for expression formed a third great era in painting, called the Renaissance.

The building of the cathedral of Pisa in 1063, and of St. Mark's at Venice, brought many Byzantine artists into Italy, where they had their pupils and imitators. Nature appears distorted rather than represented by them, but from this beginning, with a growth as slow as that described in the rise of Greek art, came the school of Italy. Cimabue (1240–1300) was the first to make any noticeable change in the old manner, throwing off the yoke of arbitrary forms and going to nature for his inspiration. The three centuries from this date are reckoned the period of the greatest artistic activity the world has known. Vasari, who died 1574, mentions about 176 artists who flourished during this time—painters, sculptors, architects, mosaic-workers, goldsmiths, and followers of trades like leather-painters, armor-makers, and others. Cities emulated each other in the building of churches, palaces, theatres, arches, gateways, and streets. The art of engraving on wood and copper belongs to this epoch, about the year 1441. Oil was made available for the painter's use in 1410 by John Van Eyck, who thus initiated our modern school of painting. Perspective was again practised about 1464, anatomy was thoroughly investigated and applied to art by Da Vinci and Michael Angelo, and painting on glass reached great perfection. Every Italian city had its school of painting which boasted of some characteristic invention, and prided itself on its line of artists, culminating in one great master, the result of their teaching. School in this sense does not mean an academy, but a manner of painting, each school having a peculiarity by which it is known and of which it is the exponent. That of Florence was celebrated for drawing and learning; it attained its highest perfection in Da Vinci (1445–1520) and Michael Angelo (1474–1564). The Roman school found its glory in Rafael (1483–1520), noted for expression and invention. Bologna had Guido (1574–1642), whose works are distinguished for devotional grace. Parma is known by Correggio (1494–1534), whose specialty was the poetry of light and shade. Naples, Genoa, Mantua, Cremona, and Milan all had their schools and their masters. Venice, latest in date, and consequently most perfect in the mechanical parts of the art, uniting sentiment with color in Titian (1480–1576), and Greek appreciation of pure nature, the dignity of humanity, and the beauty of color in Paul Veronese (1530–88). Until 1410 the Italians used the distemper of the ancients to paint with, and after the discovery of oil it was still used in fresco painting, as it is to this day. Most artists of that time painted in both, their easel-pictures in oil and their frescoes in distemper. Thus they mixed the methods, used their oil as water, made their colors too thin, blended them or washed them on, and produced a hard, dry style from not understanding the capabilities of their materials. The Venetians, on the contrary, used their colors in a stiff paste, laid it on, not in washes, but with separate strokes of the brush; and even their wall-paintings were on canvas. They are the beginning of our modern school of art. The German school, with Albert Dürer (1471–1528), is noted for its close adherence to nature, but it lacks nobility in its first teachers, and has gone to the other extreme of being too academical in the later ones. The Flemish school, with Rubens (1577–1640), shows great wealth of color with poverty of ideas. The Dutch school, with Rembrandt (1606–74), also shows grace and poetry of color, but lacks refinement of subject. Spain was but a reflex of Italian art, following most nearly Venice. It is refined, dignified, good in color and drawing, lending to a borrowed manner an originality of treatment, which gives it the right to be called a national school. Ribera (d. 1655), Zurbaran (1598–1662), Velasquez (1594–1660), and Murillo (1613–85) are its shining lights.

The art of painting, as taught in the Middle Ages, has never been lost, and our modern schools follow their teaching, uniting in a greater or less degree their characteristics. The school of Munich of the present day takes the Roman for its model, Düsseldorf imitates the Florentine, Antwerp the Venetian; France is eclectic, and has followers of every school. But though the manner may be traced, the modern artist expresses himself, his age, and his country in the subject of his work. It is thus that true art is always original, that centuries never reproduce themselves, and that invention always finds a sphere. The Greeks painted heroes and gods; the Italians painted saints and angels; we paint ourselves or others like ourselves. The art has become democratic, as has the world. Architecture for the first time in history uses its best energies to build homes, not palaces; and modern art finds its highest expression in domestic decoration. The individual, not the prince or state, is its patron; consequently, the subject of the picture concerns itself with the broad interests of the people, their joys and sorrows, thoughts and affections, manners and customs. In the arts which preceded it this has been sometimes attempted, notably in the Dutch school, but it never before attained its present importance or perfection.

The modern teaching is academic. Most of the great cities have academies devoted to this purpose, the method pursued being much the same in all. The student is taught drawing from the antique (Grecian statues, busts, and reliefs, or casts taken from them). Charcoal pencils are used in making the first sketch, as it is easy to efface and correct. The drawing is then made permanent with crayons (colored chalks, black, white, and red), mistakes which occur in this stage being rubbed out with bread-crumbs or India-rubber. The rudiments of using the brush and colors are acquired from copying a few of the best paintings. The outlines are here again put in with charcoal; when correct, this is blown off, leaving a slight trace, which is followed with a camel's-hair brush containing a mixture of drying oil and one color—any that is preferred by the student. The shadows of the picture are usually marked out with this mixture also, which is then allowed to dry. The palette is set—white in the centre, with the browns, blues, and blacks to the left, the yellows and reds to the right. The colors are mixed by the colorman of the right consistency (that of a stiff paste) and enclosed in leaden tubes. They are laid on the canvas with bristle brushes, round and flat, in touches, the color thick in the lights and thin in the shadows. This may be afterwards retouched when dry, and is sometimes glazed, for which linseed oil is mixed with a color and washed over the parts desired. Next, the student copies the living model, both nude and clothed, striving always to follow nature in form and color. During this time the master points out the various effects of expression, composition, light, and shade. The student attends lectures on anatomy from a prepared subject, that he may know the position of the superficial muscles under varying circumstances, and have correct ideas of the skeleton, the basis of the human form. When sufficient accuracy has been attained, the invention of a picture is attempted, in which the living model is also used. After the subject has been decided upon, a sketch is made of the general disposition of the figures, their costumes, of which the color as well as the form must be considered, and their attitudes. The person acting as model is then made to assume these attitudes, and the artist proceeds as in copying a picture. Sometimes the model is copied exactly, as by Courbet; sometimes ideally, as with Delacroix. It is only in the decadence of art that a careful study of nature is neglected. For amateurs who wish to understand painting, the only way is to study the pictures themselves and seek for the various qualities that have been mentioned as forming the art. Any picture, to be good, must possess them in a greater or less degree, though it seldom happens that all are present on the same

canvas. Reading of pictures without seeing them gives but little instruction except in the history of art.

ELISA J. HALDEMAN.

Paint Rock, post-v. and tp., Jackson co., Ala., on Paint Rock River and the Memphis and Charleston R. R. Pop. 1502.

Paint Rock, tp. of Marshall co., Ala. Pop. 471.

Paints'ville, post-v. and tp., cap. of Johnson co., Ky. Pop. 247.

Paisiel'lo (GIOVANNI), b. at Taranto May 9, 1741; received his musical education in the conservatory of San Onofrio at Naples, and composed in 1763, for the stage of Bologna, his first opera, *La Pupilla*, which made a great success, and was followed, in the course of the next ten years, by about fifty operas. From 1776 to 1784 he was director of the opera at St. Petersburg; returned then by way of Dresden and Vienna to Naples, where he took charge of the opera; went in 1802 to Paris as director of the private orchestra of the First Consul, but returned again in 1806 to Naples, where he d. June 5, 1816. Besides a great number of masses, cantatas, and symphonies, he composed about 100 operas, of which *Nina, La Molinara, I Pitagorici*, etc. at one time reigned on all stages of Europe. At present they are forgotten.

Pais'ley, town of Scotland, in the county of Renfrew, on the White Cart, 3 miles from its junction with the Clyde. It consists of an old town situated on the western bank of the river, and presenting a mean appearance, and a new town on the opposite bank, paved and well built. The abbey is a historically interesting building, but it is the only remarkable edifice the city contains; Paisley is merely a manufacturing place. Of its manufactures cotton thread occupies the first place; the value of the annual production of this branch of industry amounts to £570,000, and it employs between 3000 and 4000 people. Next in importance rank the shawl manufactures, which were started in the beginning of this century and have developed to a high degree of perfection. Its manufactures of silk gauze were flourishing already in the middle of the last century, and employed 5000 looms in 1784. Besides these three chief branches of industry, many others are pursued with success in Paisley, such as cotton printings, handkerchiefs, carpets, soap, and starch. Pop. 48,257.

Paisley, post-v. of Bruce co., Ont., Canada, 16 miles N. of Walkerton, has 1 weekly newspaper. Pop. about 1000.

Paixhans Guns. See COLUMBIAD and ARTILLERY.

Paix'hans (HENRI JOSEPH), d. at Metz Jan. 22, 1783; was educated in the Polytechnic School; entered the army; served in Napoleon's campaigns, but left active service after the Restoration; was employed in the war ministry and on the committee on the artillery. In 1824 experiments were made at Brest, at Col. Paixhans' suggestion, upon cannon for horizontal shell-firing. The idea was taken up by the English admiralty, and the PAIXHANS GUNS (which see) were the result. He published *Considérations sur l'Artillerie* (1815), *Nouvelle Force maritime* (1822), and *Force et Faiblesse de la France* (1830). D. near Metz Aug. 19, 1854.

Pa'jaro, post-v. and tp., Monterey co., Cal. Pop. 761.

Pajaro, tp. of Santa Cruz co., Cal. Pop. 3114.

Pa'kenham (Sir EDWARD MICHAEL), G. C. B., a brother of the earl of Longford, was b. in Ireland in 1779; entered the light dragoons in early life, and served with brilliant reputation under Wellington (whose quartermaster-general he became), and also in the West Indies. In 1812 became major-general; in 1814 commanded the expedition against New Orleans; was killed in the battle of New Orleans Jan. 8, 1815, an action in which he displayed great gallantry.

Paks, town of Hungary on the Danube, has breweries and distilleries and trades in wine and agricultural produce. Pop. 9070.

Palac'ky (FRANTISEK), b. at Hodslawitz, Moravia, June 14, 1798; studied at Presburg and Vienna; made very comprehensive researches of documents relating to the history of Bohemia in the archives and libraries of Prague, Presburg, Vienna, Munich, and Rome, and wrote the *History of Bohemia* (5 vols., 1836–67), publishing at the same time the *Archiv Cesky* (5 vols., 1840–66). Being a member of the Bohemian diet and afterwards of the Austrian upper house, he played a conspicuous part in politics as leader of the Czech party and adherent of the Pan-slavonic movement. His publications of documents relating to the oldest history of the Bohemian language, and to the life and doctrine of Huss, are of great interest. D. May, 1876.

Pala'cios, a v. of Matagorda co., Tex. Pop. 35.

Palæog'raphy [formed from the Greek παλαιός, "ancient," and γραφή, "writing"] is the science of reading old manuscripts and determining their age from circumstantial evidence in the absence of any formal authentication, the data being the materials, bark, leaves, skin, paper, etc. which have been used for writing, the character of the letters, and the whole style of writing, the form of signatures, superscriptions, etc., all of which have varied with time and place. The founder of this science was Jean Mabillon, whose *De Re Diplomatica* was published in 1681. The principal work on the subject is *Paléographie universelle* (5 vols. fol., Paris, 1839–45).

Palæol'ogus, the last Byzantine dynasty, ascended the throne in 1261 (Michael VIII.) and lost it in 1453 (Constantine XIII.). (See BYZANTINE EMPIRE.) One branch of the family held possession from 1305 to 1533 of Montferrat, an independent principality of Northern Italy, between the territories of Piedmont, Genoa, and Milan. Another branch ruled over Morea from 1380 to 1460.

Palæontol'ogy [Gr. παλαιός, "ancient," ὄντα, "beings," and λόγος, "a discourse"], the science that treats of fossil remains of animals and plants. Though of very modern date, this science has acquired such dimensions that nothing but the briefest review of its history and conclusions can be brought within the enforced limits of this article. More than 2000 years ago the remains of marine animals imbedded in the rocks had attracted attention, and their true character had been recognized by both the Egyptian and Greek philosophers. In after times the minds of men were so darkened by ignorance and superstition that at the beginning of the sixteenth century, when fossil shells were observed in Northern Italy, they were attributed to the influence of the stars, to the fermentation of a certain *materia pinguis*, or the action of an imaginary "plastic force," and were called "the sports of nature." For two centuries and a half afterward this question of the character of fossils was discussed with great interest and no little acrimony, and the tide of public sentiment, mainly due to monkish influence, was so strongly opposed to the acceptation of the view that they were the remains of animals and plants that had once existed on the globe that the advocates of this theory were made to suffer not only obloquy, but persecution. Among those who deserve special mention for the clearness of their perception and the boldness of their defence of the truth are Leonardo da Vinci (1500), Palissy the potter (1580), Steno the Dane (1659), and Scilla, a Sicilian painter (1670).

About the beginning of the eighteenth century the old superstition had been so far vanquished that fossils were generally accepted as relics of living organisms; but it is doubtful whether the opposition would not have been much longer maintained had it not been suggested that all marine fossils were the products of the Noachian deluge, and thus a confirmation of Scripture. This view was quite generally entertained even as late as the early part of the nineteenth century. During the eighteenth century the facts of geology were subjects of investigation by some of the foremost intellects of the age, and the true nature of fossils having been generally recognized, they were studied with much care, both in comparison with living forms and in connection with the strata that contained them. After the first great step had been made, others followed, though still slowly, and it gradually came to be known that most of the remains found buried in the earth represented animals or plants different from those now living, and that certain groups of fossils were associated with certain strata. Still later it was discovered that the sedimentary rocks formed a sequence which was invariable wherever observed, the different members of this sequence being identified by their relative positions and by their characteristic fossils. When a large amount of material had been collected, it was noticed that the animal and vegetable forms buried in the lowest and oldest rocks were most unlike those living on the surface of the globe; also, that the fossils contained in strata more recent than these approached nearer and still nearer to those now living. Thus it was learned that the earth in the different geological ages had not only exhibited great diversity of physical geography, but that the aspects of nature had varied greatly, from the prevalence in each of animals and plants peculiar to itself. All this sequence of events required immense intervals of time, and the logical consequence of the acceptance of the truth in regard to fossils was the abandonment of the conventional notion universally entertained in former times, that the earth was only 6000 years old, and it was seen that millions of years were necessary for the accomplishment of the changes recorded on its surface. These millions are now generally conceded by all intelligent men, and the dogma of 6000 years, formerly insisted on with such pertinacity, is seen to be a matter of man's invention, and without authority from the Scriptures, where the chronology of creation is left untold.

In tracing the history of palæontology it may be said that the foundations of the science as it now exists were really laid in Paris in the first quarter of the present century, when Cuvier, Lamarck, and Brongniart took up the study respectively of fossil mammals, mollusks, and plants, and began the careful comparison of their structures—with each other and with living organisms—which has since yielded such important results. From the fragmental or otherwise imperfect condition of many fossils, the more obvious characters, such as were commonly used in the comparison and classification of living animals and plants, could not be appealed to, and attention was turned to their external forms and to the microscopic structure of the fragments submitted to observation. Thus, a single tooth or bone was found by Cuvier to be so characteristic of the structure to which it belonged that, as it was somewhat extravagantly said, he proved it to be possible "from a tooth or toe to reconstruct a whole lion." In this research the science of comparative anatomy had its origin. Lamarck in a less degree accomplished for the Mollusca what Cuvier had done for the vertebrates, and Brongniart, by studying the nervation of leaves and the cell-structure of wood, showed that the minute anatomy of plants is hardly less diagnostic of their relations than their external and more apparent characters. In order to make such comparisons intelligently, however, it became necessary to subject living forms and structures to a far more close and careful study than had before been bestowed on them. The result was not simply the discovery of characters by which extinct forms could be compared with living ones, but a flood of light was poured on the whole subject of the organization and relation of living animals and plants, greatly to the advance of zoology and botany.

Life of the Geological Ages.

Eras.	Ages.	Periods.	
PSYCHOZOIC..	Age of Man.	Human.	
CENOZOIC......	Age of Mammals and Angiosperms.	Quaternary. Tertiary.	
MESOZOIC......	Age of Reptiles and Cycads.	Cretaceous. Jurassic. Triassic.	
PALÆOZOIC...	Carboniferous, or Age of Amphibians and Acrogens.	Permian. Carboniferous. Sub-Carboniferous.	
	Devonian, or Age of Fishes.	Catskill. Chemung. Hamilton. Corniferous. Oriskany.	
	Silurian, or Age of Mollusks and Algæ.	Upper Silurian.	Helderberg. Salina. Niagara.
		Lower Silurian.	Hudson. Trenton. Calciferous. Primordial.
EOZOIC...........	Eozoic.	Eozoic.	

The above table exhibits the principal subdivisions of the geological column. The details of each of the great systems will be found in the article GEOLOGY.

Palæontology has also broadened and deepened our knowledge of the living flora and fauna by illuminating the whole subject of classification. The number of fossil species known in some departments of natural history far exceeds that of those now living, and the material for comparison is not only thus proportionately increased, but the extinct forms so frequently supply the missing links in the classification of recent species that their aid is now regarded as indispensable. Our living forms are often so disconnected that their relationships are exceedingly obscure, and their classification constitutes a kind of Chinese puzzle in which many of the pieces are missing. Some of these are supplied by palæontology, so that what seemed before a broken, chaotic, and confused series is brought into beautiful relationship and symmetry. We are compelled to look to palæontology for the origin and history of our living groups of animals and plants; and although by far the greater part of the organisms which have existed on the surface of the globe have probably perished, and the great treasury of the earth holds far more material than has been taken from it, we may still say that palæontology has given us all we know of the history of life on the globe. Every day adds to the value and interest of its teaching, and we may reasonably hope that through the study of extinct forms of life we shall ultimately gain what we now lack—a clear comprehension of the system of nature.

The value of palæontology is also manifested in another and eminently practical way. Since it has been demonstrated that certain fossils are peculiar to certain strata, that fact has been made the basis of the classification of the entire series of sedimentary rocks, and all the great groups into which the geological series has been divided are named according to the character of the remains of life they contain. This will be seen by a reference to the table given above, in which the different geological systems are placed in their relative positions, with their current names.

The following is a brief *résumé* of the characteristic features of the life of each of the geological ages, beginning with the oldest:

The Geological Record.—The materials which compose the earth's crust form three distinct classes of rocks—the igneous, the sedimentary, and the metamorphic. Of these, the first class includes those that are the direct products of fusion, such as igneous granite, syenite, porphyry, trachyte, basalt, lava in all its different forms, pumice, obsidian, etc. These were undoubtedly the first-formed rocks in the consolidation of the globe, and they constituted the primeval continents. As soon, however, as these rocks were exposed to the action of the elements, they began to be worn down and washed away, and the materials derived from them were deposited as sediments in the first existing water-basins. That process went on through subsequent ages, so that most of the rocks which we now encounter belong to the class of sedimentary deposits. These are conglomerates, sandstones, shales, limestones, etc., the consolidated forms of gravel, sand, clay, and calcareous mud. The solidification of these rocks is mainly due to the cementing of their particles by solutions of silica or lime. When baked by heat or penetrated by highly-heated water or steam they have been rendered much more compact and crystalline, and have been converted into what are called metamorphic or changed rocks. The process of destruction and re-creation of rocks is now going on with perhaps as great activity as ever, and can be easily observed. The rain that falls on the land, assisted by sun and frost, is constantly disintegrating the materials with which it comes in contact. Part of this material is dissolved and part mechanically divided, until it can be washed down through the channels of rivers to the sea. The magnitude of the valleys excavated by the currents of rivers attest the potency of this agent. Shore-waves are still more effective agents of destruction; whether they break on cliff or beach, they are constantly employed in grinding up, and by their undertow carrying away, the barriers against which they beat. Nothing can resist their force and industry. In time the most iron-bound coasts and broadest continents would be swept away in their slow but sure advance, and the comminuted materials would be spread far and wide in the rear of their line of progress.

Another influence has greatly facilitated the action of shore-waves, for the crust of the earth is constantly warping up and down, and over wide areas the subsidence of the land has permitted the sea to come in and cover much of what was before a continental surface, and spread over it its series of sediments. This we know from finding far inland rocks full of marine organisms; and we learn from these, further, that over much of the land now inhabited by man the sea has rolled not once, but many times. Just what effect was produced by such invasions can be best learned by examining the present action of the sea. On any shore beaten by the waves we find along the sea-margin a belt of sand or gravel upon which the grinding force of the waves has been exerted. This we call the sea-beach, and it is a place from which material is always being removed. Outside of this the sea-bottom is covered with a constantly accumulating sediment worn from the beach or brought down by rivers, and which consists of finer mechanical materials, sand or clay. Still farther out, and beyond the reach of the wash of the land, a calcareous mud accumulates, derived from the hard parts of marine animals, which have the power to draw from sea-water the lime that forms their shells or bones. This we may therefore call an organic sediment. Hence, the materials thrown down by the sea naturally arrange themselves in three belts, more or less blended along their margins—viz. (1) that of the coarse mechanical materials, gravel and coarse sand, along the beach; (2) sand and clay, forming off-shore deposits; and (3) outside of this and in the depths of the ocean a calcareous mud or organic sediment. In any sub-

mergence of the land these different belts would move inland in regular order. First, the sea-beach, with its coarser and finer mechanical sediments, gravel, sand, and clay, forming an unbroken sheet, would be spread over all the area submerged; and in the rear of this, and wherever deep and clear water prevailed, a layer of ooze or calcareous mud would be laid down on top of the mechanical sediments. Should the sea for a long time occupy the submerged area, this organic sediment might accumulate to a great thickness, and when consolidated would form a limestone full of the shells of mollusks and other traces of marine life. When the land was again slowly elevated, the sea would shallow and retire, leaving a mixed sediment, formed by the mechanical material drained from the land and the calcareous deposit of the sea, as the last product of this invasion. In few words, the result of each submergence would be the formation of a circle or trinity of deposits—viz. a sheet of mechanical sediment at the bottom, a greater or less mass of organic sediment in the middle, and a stratum of mixed clay and lime at top. If in the advance or retiring of the sea the natural progress of events were checked or reversed, there would be an alternation of strata in any particular locality, according as shore, off-shore, and open-sea conditions prevailed there. It should also be said that where a shore submerged and acted upon by advancing shore-waves was composed of limestone only, the mechanical materials resulting from the action of the waves would be conglomerates of limestone pebbles and limestone—for there would be no material from which quartz conglomerate and sandstone could be produced.

In due time after the retreat of the sea the land would be clothed with vegetation, cut by the draining streams into hills and valleys, and more or less covered with gravel and sand brought from portions of the continent not covered by the previous submergence. If excavations were made on this land, beneath the soil would be found impure limestones; below these, purer limestones; and still lower, strata of shale, sandstone, or conglomerate, resting upon the eroded pre-existing continent. If, after the lapse of thousands or millions of years, another submergence should take place, it would result in a similar circle of sediments, but these would differ from the previous ones in this, that during the great lapse of time the fauna of the sea would probably have greatly changed, and the new sediments would contain a different group of fossils from the old. Afterward, no matter how much broken up and contorted these strata might be, and how much alike they were in lithological characters, they could be easily distinguished by their fossils.

This imaginary history is, so far as we can learn, an accurate description of what has taken place in the formation of each of our great geological systems. The oldest rocks of which we have any knowledge are those of the Eozoic system, the Laurentian and Huronian. These are now exposed along the belt extending from Labrador to the Lake of the Woods, and thence northward to the Arctic Sea, and in the adjacent areas of the Adirondacks, a portion of the Alleghany belt, and a district S. of Lake Superior. This Eozoic area is bordered by a plain composed of Silurian, Devonian, and Carboniferous rocks, mostly marine sediments deposited in the sea, which at different times advanced and retreated along the slopes of the old continent. The mechanical materials which form the Palæozoic strata have been derived from this continent as it has been worn down by shore-waves and atmospheric erosion, and these alternate with limestones which were deposited by the sea from organic materials when it stood at its deepest. The mechanical sediments are naturally thickest along the old shore-lines, and thin out and give place to limestones in the direction of the sea-basins. Each of the great formations referred to consists, at base, of a mass of mechanical material—sandstone, shale, and conglomerate—often ripple-marked and sun-cracked, showing that they were shore and shallow-water deposits; while the limestones which form the central mass of each circle, often pure and of great thickness, could only have accumulated in deep and comparatively clear sea-water. The upper members of each series consist, as a general rule, of earthy limestone or alternations of limestone and shale, proved by many circumstances to be the deposit of shallowing and retiring seas.

In the Lower Silurian circle of deposits the basal member is the Potsdam sandstone. This lies at the bottom of the series of sedimentary rocks throughout all the great basin which extends from the Alleghanies, the Adirondacks, and the Canadian highlands to the Black Hills and Rocky Mountains. Wherever it has been examined, the Potsdam sandstone rests on the upturned and eroded edges of the Laurentian and Huronian rocks, has generally conglomerate at the base, often shows ripple-marks and sun-cracks, and its layers are sometimes covered with impressions of fucoids. Its characteristic animal fossils are beach-inhabiting linguloid shells (*Lingulepis*, *Lingulella*, etc.), and everything proves it to be a shore-deposit.

The Potsdam sandstone is succeeded above by a great limestone formation, divisible into several members where deposited near the old shores and affected by local changes, but in the interior of the continental basin an indivisible calcareous mass. This is the deposit from the sea which formed the Potsdam sandstone in its encroachment on the land. In its long occupation of the conquered territory this sea precipitated on its sandy bottom a layer of calcareous mud sufficient to form, on an average, 1000 feet of limestone. This limestone is not only filled with, but in many places is totally made up of, the remains of the invertebrate animals (there were then no vertebrates in existence) which inhabited its waters. The Trenton limestone group, as we may call by a general name the sediments deposited by the abiding Lower Silurian sea, has been deeply cut in many directions by the erosion of our lakes and rivers, and its fossils have been so carefully collected and studied that they have given us what may be considered a satisfactory view of the marine life of the time and place in which they lived. Above the Trenton limestone, in most parts of the interior basin of our continent, are calcareous shales or earthy limestones, called the Hudson River group, which contain some forms of life not found in the lower and purer limestone series, and which, by a combination of proofs, are shown to be the products of a shallowing and retiring sea. This epoch forms the closing chapter of the Lower Silurian age. A similar group of strata found in other parts of the world, holding the same relative position and marking the same relative period in the sequence of events, gives us wider views of this age in the world's history, and proves a general uniformity in the aspects of life on the globe.

Above the Lower Silurian series of rocks over great areas we find another group of deposits, to which the name Upper Silurian system has been given, and this exhibits a remarkable similarity of structure to the lower series. The base of the group is a well-marked sheet of mechanical sediment, the Medina sandstone, locally a conglomerate. This also is ripple-marked, and its layers are often covered with impressions of *Lingulæ* and fucoids, but of quite different species from those which lived on the Potsdam beaches of the first Silurian sea. The Medina sandstone is, however, much less widely spread than the Potsdam, as it rapidly thins to an edge in passing from the old shore toward the sea-basin.

Above the Medina lies another great calcareous group, locally divided into the Clinton and Niagara, but becoming more homogeneous to the S. and W., and evidently the deposit of a great body of water which had again submerged much of the area left bare by the retirement of the Trenton sea. Of the animal forms imbedded in the sediments of this second sea, numerous as they are, not more than half a dozen can be asserted to be identical with those that inhabited the first. This indicates that during the interval between the formation of the two sets of deposits, down in the oceanic basins that have always been ocean, the marine life of the globe had been almost completely revolutionized. By what causes these changes were effected we can as yet only conjecture, as the record of this interval, which must have been immense, is almost unknown to us.

After the Niagara sea had stood long enough upon the land it occupied to throw down upon the Medina sandstone perhaps 500 feet of organic sediment (the Niagara and Clinton limestone groups), the land was elevated so that the Niagara sea was greatly shallowed and partly withdrawn. A landlocked basin, lying between the Adirondack and the Cincinnati arch, covering parts of the adjacent areas of New York, Canada, and Ohio, was, however, left. In this basin the salt water was evaporated, as in the Dead Sea or Salt Lake, till it precipitated its solid constituents in great sheets of salt and gypsum, intermingled with earthy matter washed into it, the whole forming saliferous marls, the Salina group, which in Central New York has a thickness of nearly 1000 feet. Subsequently, the ocean-water again flowed in, and remained long enough to deposit the Helderberg series of impure limestones. Of these the most important member is the Water-lime, so named from its earthy limestones, which have hydraulic properties. When this formation had been laid down, the continent was again elevated, but most rapidly toward the W., making the Helderberg rocks thickest toward the E.; and the sea was then withdrawn, completing its second circle of sediments and closing the history of the Upper Silurian age.

A third circle of deposits was in after times laid down on the Upper Silurian, and forms what is known as the De-

vonian system. Of this the Oriskany sandstone and Schoharie grit form the mechanical shore-deposit which lies at the base of the series; the Corniferous limestone, the calcareous centre, the product of the sojourn of the ocean in this third submergence; and the Hamilton shales and limestones, the mixed sediments produced by the shallowing, retiring Devonian sea. The life of this sea differed even more from that of the Niagara age than that did from the Trenton; for among the thousands of marine invertebrates which lived in and retired with the Niagara sea, not more than a mere handful, perhaps a half dozen species, survived to join the hordes which peopled the inflowing Devonian sea. The fauna of the Devonian age shows this marked difference from those that preceded it, that while in the Silurian seas all the great groups of invertebrate life were fully represented, in this country no traces of vertebrates have been found in any deposit older than the Devonian. In the Corniferous sea, however, fishes abounded, and attained such dimensions, and were so well armed for attack and defence, that they would if now living prove formidable antagonists to even the most powerful of existing fishes. In regard to the origin of this great fish-fauna we as yet have no satisfactory information, for it comes into our view from the depths of the primeval ocean full grown and complete. If it had a birth and infancy, the records of that interesting period in its history are as yet inaccessible to us. In the Old World, fishes made their appearance in the last portion of the Upper Silurian age; and as their remains are found in the upper portion of the group equivalent in age to our Niagara, we thus have evidence that they inhabited the Upper Silurian sea in the later period of its existence. These first fishes are there few and small, and no clue has yet been obtained to their origin.

Another great advance in the life of this continent has left its record in the Devonian rocks. In the strata formed in the preceding ages no traces of land-plants have been found, but in those of the Devonian age the remains of a varied and beautiful terrestrial flora are met with in many localities. The plants of this age were cryptogamous, but they included many species of the highest of this group—ferns, lycopods, and equiseta far exceeding in size any of their living representatives. In the Old World, land-plants, like fishes, left their traces in the Upper Silurian rocks, but there, as here, all indications of their origin are as yet wanting.

By continuing the analysis of the geological formations through those of a later date, it could be shown that they exhibit the same general structure with those already examined, and that they resolve themselves into circles of deposition which are the records of a similar sequence of events to those already noted. For the present purpose it is unnecessary to carry the study farther, as the examples cited will illustrate the character and mode of formation of the record to which we must go for our information in regard to the life history of the globe. Each great formation exhibits a degree of unity in its fauna and flora which has induced its erection into a distinct system, or group, and is composed of a circle of deposits which mark a more or less extensive submergence of the country where they are found. The great subdivisions of the geological column are the products of great and wide-spread changes of this nature, and such as have occurred in different countries, if not at the same absolute, at least at the same relative, time, so that they reveal with more or less fulness the aspects of nature in the periods or ages of their formation. The views which geology thus affords us of the life of the globe cannot in any one country form a continuous panorama, but rather a series of detached tableaus, in some instances separated by long and as yet blank intervals. Since the marine life of the geological ages is by far most fully represented in this record, and since the seas, occupying a far greater area than the land, have been more continuous and uniform in their existence, it might be inferred that the record of marine life would be so nearly complete as to enable us to read from it the history of all the changes through which it has passed; but from what has been said of the nature and relation of deposits left by the sea now exposed to our inspection, it will be seen that for any one country the geological record of even marine life forms a series of chapters separated by blank intervals of such length that the thread of the story is often nearly lost. By comparing chapter with chapter or picture with picture we are struck with the great differences they exhibit, and easily trace through all a progress from the lower to the higher, as we say, or, to speak more accurately, from the simpler to the more complex, from the generalized to the specialized. We may also note great and progressive changes in the fauna of the sea during the long period of its occupation of any submerged territory. The study of the fauna of one great limestone group may give us some insight into the nature of the influences by which species are evolved or created; but demonstration of the derivation of the great geological groups, one from another, if they have been so derived, may perhaps never be reached until the secrets of the great deep are fully revealed to us. By comparing the deposits that are alternated in different countries, we shall perhaps find that one supplies in part what the other lacks; but detailed study has extended over so small a portion of the earth's surface that comparatively little light has been thrown by such comparisons on the great questions of biology.

In addition to the series of marine sediments, which constitute by far the greater portion of the geological column, there are two other classes of deposit which sometimes contain the remains of animals and plants, and therefore form a portion of the record from which we may read the history of life of the past ages. These are lacustrine and terrestrial deposits. The first category includes all strata deposited in lakes of salt or fresh water. The sediments that have accumulated in such basins are, in quantity, as far surpassed by marine deposits as the bodies of inland water are exceeded in area by oceans; and yet from the fact that all landlocked basins which have existed have been surrounded by areas occupied by land animals and plants, they have been the repositories of most of the terrestrial forms that have been preserved.

Any lake-basin into which rivers flow receives much sediment, and with this leaves, fruits, and floated tree-trunks, which in turn sink to the bottom and are buried in silt, that settles down over them as gently as falling snow. Here they may be preserved through countless ages, until some of the changes constantly taking place on the land-surface bring them resurrection. In the same manner the remains of land and water animals are buried in lake-sediments. These include not only fishes and mollusks which are aquatic in habit, but all the reptiles, mammals, and even birds that frequent the water, are sure to find in it their graves. Sooner or later, too, most terrestrial animals which inhabit the shores of lakes or the valleys of streams are by floods and other accidents drowned and floated to the common receptacle of all the freight a river-current bears. In process of time lake-basins are shallowed by accumulations of sediment in them, and by slow but incessant wearing away of their outlets. Thus, the area once covered by water becomes in time dry land; and in many instances the streams which once flowed through lakes, after the water-basins have been drained, have cut deeply into the ancient lake-sediments, bringing all their hidden treasures to light. From deposits of this kind have been obtained nearly all the strange and varied forms of mammalian life which inhabited the globe immediately anterior to the advent of man. The gypsum-beds of Paris, which contain *Palæotherium* and other extinct animals, studied with such important results by Cuvier; those of the Sewalik Hills in India, where Falconer and Cautley found *Sivatherium*, the Ganessa elephant, etc.; and those from which Leidy, Marsh, and Cope have obtained the material that has enabled them to rehabilitate the Tertiary fauna of America,—all belong to the same category.

Among lake-deposits should be also included the cannel coals and bituminous shales, which were formed at the bottoms of lagoons in the old coal-marshes. Here we sometimes find within the space of a few acres and the thickness of half a foot the remains of many genera and species of fishes and amphibians that inhabited the waters of landlocked basins. The terrestrial deposits include peat-bogs and their ancient representatives, coal-beds, in which we find nearly all the forms of vegetation which flourished within the area they occupied; travertine, cave deposits, amber, etc.

In the foregoing list all the purely *fossiliferous* deposits have been enumerated, but the life of past ages has left us as part of its record still another class of inscriptions—viz. the "footprints on the sands of time" made by bird or beast on the shores of ancient lakes, bays, or seas. Of these, the most striking examples are furnished by the so-called *bird tracks*—probably for the most part reptilian—of the Connecticut Valley. As indicative of the absolute richness and yet relative poverty of the geological record, these inscriptions are of peculiar interest.

From the foregoing description of the manner in which the geological record has been formed a general idea of its scope and trustworthiness may be gained. In considering it as a whole, it will be noticed that it is as yet an incomplete and broken narrative, but that such portions of it as have been recovered and deciphered give a series of pictures of the aspects of nature in past ages which are in the highest degree interesting and instructive. The incompleteness of any exposition that can now be given of the life-history of the globe is dependent on two

causes: (1) the imperfections of the record itself; (2) our incomplete recovery and translation of that which remains. The imperfections of the geological record are also of two kinds. So far as we now know, all the earlier chapters are rendered illegible by the metamorphism of the stone tablets on which they were inscribed. The beginnings of life were probably recorded in the Laurentian and Huronian rocks, but, though traces of ancient inscriptions are everywhere visible, they are here almost obliterated. With the exception of *Eozöon Canadense,* no individual organisms have been found in the Eozoic rocks, though organic sediments, and even organic matter, are abundant. Our knowledge of the progress and development of life is therefore drawn from a study of the remains of the animals and plants found in the upper half of the geological column. This portion of the narrative also has its imperfections. In the first place, it has been but partially read. The study given to the faunæ and floræ of the different geological systems, though sufficient to determine their essential characters and fully to warrant the broader generalizations of the palæontologists, is still in progress. New facts are being gathered day by day, and this new material explains, and sometimes qualifies, conclusions based upon previous experience.

From the very nature of the case, also, the record must always remain in some respects incomplete. We have seen that by far the greater part of the sedimentary strata are marine, and hence the remains of marine life have been in all ages much more fully preserved than those of the land. Over all the area occupied by the sea in any age we might expect to find traces of the organisms inhabiting that sea that possessed tissues or parts which would resist decay; yet on the continents of the same age comparatively few of the terrestrial animals—birds, beasts, or insects—would leave any trace behind them. We may therefore conclude that aquatic animals and plants are much more fully represented in the geological record than those which occupied the land. In addition to this, all animals without shells, skeletons, or other hard parts must have perished and passed out of knowledge, and these have constituted an important part of the ancient fauna, now utterly lost to us.

From the manner in which marine deposits have been formed—by successive invasions of the sea, and these invasions frequently separated by long intervals of time—until we gain access to the missing links in the geological sequence we lack the connection between the successive faunæ, and therefore want the most important elements in the estimation of the causes of the revolutions of which we have evidence. It will be seen, therefore, that our most promising field for the study of the causes which have produced changes in the fauna and flora of the globe is to be found within the limits of each geological system. In many instances intervals of time practically incomprehensible to us elapsed, during which the physical conditions of large portions of the earth remained essentially the same. The different limestone strata must each have required many thousands of years for their accumulation; and by a careful study of the changes of fauna which took place within a circumscribed area during such intervals we may hope to acquire some knowledge of the nature and mode of action of the influences which have controlled the stability and mutation of species.

During the entire *Tertiary* age the continent of North America was in all its general topographical features what it is now, but we know its central and western portions were once occupied by broad expanses of inland waters, and that in process of time these were drained away and ceased to exist; and since our continent acquired nearly its present form and geological structure it has been swept by alternations of climate which must have powerfully influenced the development and distribution of life. Within the limits specified, therefore, we must look for the most important testimony afforded by the geological record on the great questions of biology.

It may also be said that the knowledge already derived from the sources enumerated has considerably modified the conclusions that were formerly universally accepted. In some instances the derivation of genera and species from what had seemed to be other genera and species has seemed to be clearly proved; while, on the other hand, the great number of what Prof. Huxley calls *persistent types*—that is, types that have continued to exist through incalculable intervals of time, and have spread through the diversified topography and climate of the world without sensible change — apparently indicates an inherent conservative influence in the life-principle which is incompatible with the theory that external circumstances alone have determined the forms assumed by plastic organic matter.

In the succeeding paragraphs the characteristics of the organic world in the different geological ages will be briefly sketched:

Eozoic Age.—The life of the incalculable lapse of time represented by the immense mass of sedimentary strata which form the Laurentian and Huronian systems has been almost entirely obliterated by the metamorphism of the rocks on which its history was once inscribed. Only one fossil has been found in the Laurentian, and the organic nature of this has been strenuously denied, though now established, as far as this can be, by weight of authority. This fossil is the *Eozoön Canadense,* supposed to be a protozoan, and nearly allied to the Foraminifera. Though the individual fossils have disappeared from the Eozoic rocks, abundant evidence remains that life in great abundance prevailed during the time of their deposition. This evidence consists of (1) immense beds of limestone, which are generally conceded to be of organic origin; (2) beds of graphite which rival in their extent the carbonaceous deposits of the Carboniferous and more recent ages (this graphite is undoubtedly the residuary product of the distillation of vegetable tissue which accumulated as our coal-beds and bituminous shales have since done); (3) apatite, the phosphate of lime, an abundant constituent of the Eozoic rocks, the phosphorus of which is supposed to be derived from organic tissue; (4) numerous and extensive deposits of iron ore, in the deposition of which organic matter doubtless played an important part, as it has done in the precipitation of the later beds of this material. The Eozoic rocks form a series of sedimentary strata estimated to have a maximum thickness of nearly 50,000 feet, or nearly half of the geological column, and the view is entertained by good geologists that they represent a large fraction, perhaps half, of the time covered by the geological record.

Cambrian Age.—The limits of the Cambrian system are as yet undefined, and it remains for geologists to decide by convention how large a portion of the fossiliferous rocks shall be included in it, and where the line shall be drawn between this and the overlying Silurian. For convenience, however, it is assumed here that the Cambrian system reaches up to the Potsdam sandstone and the "Lingula flags," and includes the greater part of the "Primordial" fauna of Barrande. The type rocks of this system are the Longmynd series of Wales, the Harlech and Menevian beds of England, Barrande's *Étages* "B" and "C" of Bohemia, Angelin's divisions A and B of Sweden, the St. John's or Acadian group of Newfoundland and New Brunswick, etc. The life of this age is represented by the remains of sea-weeds in large numbers, and animal forms belonging to all the invertebrate subkingdoms, the protozoans by sponges, the radiates by crinoids and polyzoa, the mollusks by pteropods and brachiopods, the articulates by worms and trilobites—the latter in very large numbers, including the genera *Paradoxides, Conocoryphe, Microdiscus, Olenus, Agnostus,* etc. More than 200 species of trilobites have been found in the primordial beds, and some of them two feet in length. These constitute the most striking feature of the fauna of the age and its highest development of life; and this may be considered the culminating period in the life of this group of crustaceans. No corals have yet been found in these oldest fossiliferous rocks, nor any traces of the highest orders of mollusks.

Lower Silurian Age.—In the classification here adopted the Lower Silurian system includes the Potsdam sandstone, the Calciferous sandrock, the Quebec group, the Chazy, Bird's-eye, Black River, and Trenton limestones, and the Utica and Hudson shales. In the British islands the Lower Silurian system contains the Lingula flags, the Tremadoc and Skiddaw slates, the Llandeilo rocks, Bala limestone, Caradoc sandstones, and the Llandovery group. The rocks of this age are highly fossiliferous, and over 10,000 species of fossils have been described from them. They include numerous representatives of all the invertebrate groups, but the remains of mollusks far outnumber all others. From this fact this is sometimes called the Age of Mollusks. The remains of protozoans are also in some localities exceedingly numerous. They consist of sponges (*Brachiospongia, Archæocyathus,* etc.) and Foraminifera (*Receptaculites, Ischadites,* etc.). The *Receptaculites* were Foraminifera of gigantic size, forming disks sometimes a foot in diameter, and so numerous in the Galena limestone on the upper Mississippi and the Trenton in Nevada that they constitute an important portion of the mass of the rock. The radiates are represented by crinoids, corals in considerable numbers, but generally of small size, and graptolites which are so numerous and varied as to constitute one of the most peculiar and characteristic features in the life of the age. The mollusks include an immense number of brachiopods, some pteropods (*Hyolithus, Conularia,* etc.), numerous gasteropods, and

conchifers, and a great variety of cephalopods, some of which attained gigantic dimensions. A species of *Orthoceras*, for example, attained a diameter of fifteen to eighteen inches, and a length of from twenty to thirty feet. The articulates of the Lower Silurian embrace annelids, phyllopods, eurypterids, and ostracods. The trilobites were mostly of different genera from those of the primordial fauna. They were scarcely less numerous or varied, but they were relatively less important elements in this than in the preceding fauna. The annelids are represented by tracks and burrows and by the genera *Concholites*, *Serpulites*, *Ortonia*, etc. The phyllopods are represented by *Ceratiocaris*, *Peltocaris*, etc.; the ostracods, which were very abundant, by *Leperditia*, *Byrichia*, etc. The plants of the Lower Silurian were probably all marine; certain casts of stems found at Cincinnati and in Sweden have been described as those of terrestrial plants, but none of their tissues have been preserved, and their external forms do not prove this.

Upper Silurian Age.—After the deposition of the marine sediments of the Lower Silurian the sea retired, and land conditions supervened over much of the area it occupied. After an indefinite period of absence the sea returned and again covered parts of its old bed, depositing on these parts a new series of sediments that contained a new fauna, in which, however, a few of the old species remained. What relationship existed between the faunas of the Lower and Upper Silurian we have as yet no means of accurately determining. Either the Lower Silurian fauna in the long period of its residence in the deeper sea-basins was transmuted by evolution, or it was replaced by new forms migrating from other regions. Doubtless, more light will be thrown on this question by future discoveries, but as yet it is one of the problems remaining to be solved.

The Upper Silurian fauna is essentially that of the Niagara sea, which in its advent produced the Medina sandstone, with its beach-inhabiting *Lingula cuneata*, the seaweed *Arthrophycus Hallii*, etc., and in its sojourn spread the great calcareous sheet of Niagara and Clinton limestones over most of its bed. In the subsequent shallowing and withdrawal of this sea the Salina group was formed in an isolated evaporating basin, and by a temporary return of deeper water the earthy limestones of the Helderberg group were deposited. In the diverse conditions recorded by these different sediments the life-record of the age was also much varied, but, on the whole, the fauna of the age shows a good degree of uniformity. In America no traces of vertebrate life have yet been found in the rocks of this age, but in the Old World fishes inhabited the Upper Silurian sea during the later epochs of its existence. As a whole, the Upper Silurian fauna may be regarded, zoologically, as a continuation of that of the Lower Silurian, as it is composed of the same great groups. The protozoans are represented in it by sponges and rhizopods, but these are smaller and less numerous than before. Among them are the genera *Asterospongia*, *Astylospongia*, and *Receptaculites*. Corals are far more numerous than in the sediments of the Lower Silurian ocean. In some localities the limestone is largely made up of them, though they are not known to have anywhere formed coral-reefs. Crinoids are abundant and form a large number of genera, of which the most characteristic are *Ichthyocrinus* and *Caryocrinus*. Star-fishes (*Palæaster, etc.*), as in the Lower Silurian. were not uncommon. Among the mollusks all the different orders, except the Tunicata, are well represented. We cannot infer from the absence of ascidians that they had no existence at that age, for they may have been numerous, but, like those now living, soft-bodied, and therefore could leave no trace of their existence. The Bryozoa are represented by numerous species of *Fenestella*. Brachiopods are abundant in the Upper Silurian rocks, the genus *Pentamerus*, forming several species, being the most characteristic. Conchifers were still comparatively rare, though they included much larger forms than any of those of the Lower Silurian, such as *Megalomus Canadensis*. Gasteropods are much more numerous and larger than in the older rocks, some species of *Murchisonia* attaining a length of five inches, and a discoid, *Pleurotomaria* (*P. Solaroides*), being four inches across. The pteropods exhibit several species of *Conularia*, and the cephalopods include a large number of straight and coiled shells (*Orthoceras*, *Cyrtoceras*, *Gomphoceras*, etc.), none of which, however, attained the dimensions of those inhabiting the Lower Silurian sea. Among the articulates, trilobites were numerous, and included some of the most interesting and highly-organized species known, belonging to the genera *Lichas*, *Homalonotus*, *Calymene*, *Dalmanites*, and *Illænus*. The ostracod or bivalve crustaceans were exceedingly numerous in the landlocked basins of the Salina and Helderberg epochs. Among these the genus *Leperditia* had several species, one of which (*L. alta*) covers the surfaces of the layers and composes much of the mass of the Water-lime. The phyllopods had numerous and striking representatives in species of *Ceratiocaris*, but the most remarkable crustaceans of the Upper Silurian were the Eurypterida (*Eurypterus*, *Pterygotus*, *Slimonia*, *Stylonurus*, etc.), and they formed the summit of the life-series of this age in America. The most conspicuous additions made to the life of the globe in this age were land-plants (lycopods) and fishes (small bucklered placoderms), which came on to the stage in Europe during the last epoch. No clue has yet been obtained to the origin of either of these groups.

Devonian Age.—The Devonian rocks exhibit the same general arrangement—*i. e.* a circle of deposition—as the formations below; in America the Oriskany sandstone and Schoharie grit forming the mechanical base, the Corniferous and Hamilton limestones the organic centre, and the Hamilton, Genesee, and Portage shales, generally carbonaceous, its mixed summit. We thus have conclusive proof that the series was formed by the third submergence of portions of the land, similar in kind and effects to those which had preceded it. The life of the incoming sea of this age was in some respects very different from that of the preceding ages, inasmuch as this sea was populated with great numbers of fishes. (See Fossil Fishes.) Of the origin of this fish-fauna we as yet know absolutely nothing, as no connecting links have been found between the vertebrates and the invertebrates. The bucklered fishes of the Devonian are not unlike in general aspect to some of the crustaceans which formed the preceding dynasty, but in structure they are as widely separated from them as are the fishes and crustaceans of the present day. The other forms of marine life of the Devonian were exceedingly numerous, but allusion can only be made here to some of the most conspicuous of them. The protozoans were abundantly represented by sponges, but the Foraminifera seem to have been all small, and they have left no such striking record of their existence in this age as in those that preceded and followed it. The radiates, on the contrary, seem to have had great development in the Devonian seas. Corals abounded, and in some instances formed reefs which rival those of the present day in extent and the variety of forms they included. Crinoids were extremely abundant, and large masses of rock are chiefly composed of their débris. Mollusks were represented by all the living orders, except the Tunicata. Among the brachiopods, Spiriferæ are more numerous and larger than before, and *Orthis*, *Strophodonta*, and *Streptorhynchus* exhibit a profusion of species which attained sizes not reached below. The pteropods were chiefly of the genera *Tentaculites* and *Conularia*, the former of which were very numerous. Conchifers show an increase in numbers and size over those of the preceding ages; the more important genera were *Avicula*, *Grammysia*, *Conocardium*, *Paracyclas*, etc. The gasteropods of the Devonian exhibit a corresponding advance, both in size and numbers. The cephalopods, however, show the most striking evidence of progress, for many of the discoid forms (*Nautilus*, *Gyroceras*, etc.) rival in magnitude those of later ages. The genera *Clymenia* and *Goniatites* are here introduced, and the former becomes characteristic. The Crustacea of the Devonian include many trilobites, but this group is already on the decline, for they are fewer and smaller than in the Silurian ages. The Eurypterida are quite numerous, and some of them (*Pterygotus*) attain dimensions never reached by crustaceans before or since. The phyllopods are represented by many species of *Ceratiocaris*, *Dythyrocaris*, etc., and this was probably the culminating period in the life of this group. The fishes of the Devonian include scaled and plated ganoids and elasmobranchs, the latter, however, far inferior in size and numbers to the former, which ruled the seas and formed the highest development of animal life.

The continents of the Devonian age, for the first time in the history of the world, were covered with land-plants. These were mostly acrogens (ferns, lycopods, and equiseta), among which were tree-ferns which equalled, if they did not exceed, in size any of those now living. Conifers seem to have occupied the higher portions of the land, and to have formed several genera which belong to the family of the Araucarians. Sea-weeds grew along the shores of the Devonian oceans, and in the period of the shallowing and retiring of the water they flourished in unprecedented variety and luxuriance, as their decomposing tissues seem to have supplied the carbonaceous matter with which the shales of the Upper Devonian are impregnated.

Carboniferous Age.—The Devonian sea deposited the Hamilton and Huron shales in the last period of its existence, when it was already narrow and shallow. Subsequently it was withdrawn from its ancient bed, and then ensued a period of oscillation of its level which caused it to spread over the previously-deposited sediments a broad sheet of mechanical materials, now known by the

name of the Portage sandstones and the Chemung, Catskill, and Waverley groups. These consist of shales and sandstones, with some layers of impure limestone, evidently the product of shore and shallow-water accumulation. All this mass of mechanical sediment was finally overflowed by the ocean in a submergence that was (on this continent) more extensive than either of those which have been described. In this invading sea the Carboniferous limestone was deposited. This is made up of the remains of a new fauna, so entirely distinct from that which preceded it that only a single species (*Strophomena rhomboidalis*) is known to have been an inhabitant both of the Devonian and Carboniferous oceans. The Carboniferous age, as is well known, takes its name from the beds of coal contained in the strata then formed. The life of this age included far more terrestrial forms of animals and plants than that of the preceding periods. It is marked by many important additions and changes: the chief additions are, in the beginning of the age, amphibians, and in its last epoch true reptiles. The sea of the Carboniferous age abounded in fishes, both ganoids and elasmobranchs, the latter having now become far more powerful in size and numbers than they were in the Devonian sea, while the ganoids seem to have been for the most part driven from the open ocean and confined to shores, rivers, and lakes. The invertebrate life of the Carboniferous sea was as varied as before, but in many respects different. The protozoans have left comparatively few distinct forms, but one genus (*Fusilina*) was so abundant that thick and widespread strata of limestone are composed almost entirely of its shells. Crinoids were exceedingly numerous, and this was the golden age of the group. True echinoids made their first appearance in the genus *Archæocidaris*. Corals are comparatively few and small in the Carboniferous rocks. Polyzoa were, however, very numerous, and constituted many genera, of which *Retepora Archimedes* is the most characteristic. The brachiopods were already declining, but two families introduced in the Devonian become conspicuous elements in the molluscous fauna—*Productus* and *Chonetes*. The pteropods were chiefly represented by *Conularia*, of which there were many species and the largest of the group known. The gasteropods of the Carboniferous form a great number of genera, among which may be mentioned *Bellerophon, Pleurotomaria, Euomphalus* and *Macrocheilus* as the most characteristic. Of the cephalopods, *Nautilus* and *Goniatites* are the most abundant, this being the culminating period in the life of both these genera. *Orthoceras* is feebly represented both in the number and size of the species. The conchifers show a considerable advance in numbers over the groups of the lower systems. For the most part, they belong to the genera *Allorisma, Aviculopecten, Sanguinolites*, and *Myalina*. Perhaps the most striking additions to the molluscous fauna are the land-shells *Pupa* and *Conulus*. The crustaceans were comparatively few and small, but include higher forms than the older fauna. Among them we find *Bellinurus* and *Prestwichia*, related to *Limulus*, and *Anthracopalæmon* and *Gampsonyx*, the forerunners of our shrimps and lobsters. In the Coal-measures myriapods and insects of several orders have been found. The fishes were ganoids, sharks, and rays, all in large numbers. Amphibians have left their remains mostly in the sediments of the lagoons of the coal-marshes. Traces of something like thirty genera and sixty species have been found in rocks of this age. True reptiles seem also to have been in existence during the coal-measure epoch; the vertebræ of an Enaliosaur having been found by Prof. Marsh in the coal-strata of Nova Scotia. The plants of the Carboniferous age included algæ, lycopods, ferns, equiseta, and conifers. No mosses, lichens, liverworts, grasses, palms, or angiosperms have left any traces of their existence. Cycads grew in the Coal-measures, but were apparently small. These, with a few monocotyledonous flowering plants, were prophetic of the flora of the succeeding age. The life of the Permian was simply a continuation of that of the Carboniferous.

Triassic Age.—The Triassic is the first of the Mesozoic ages; it ushers in a new era in the world's history, and one separated from the preceding by a more distinctly-marked hiatus than appears elsewhere in the series. The American representatives of the Trias are chiefly terrestrial, shore, and shallow-water deposits containing little limestone, and therefore affording an imperfect record of the marine life. In some parts of the Old World we find evidence of a distinct submergence, as the Trias constitutes a typical circle of deposition of which the base is the Bunter-sandstein, the calcareous marine centre, the Muschelkalk, and the mixed Keuper above. The fauna and flora of the Trias include many new and striking forms, which must have given a peculiar aspect to nature in that age. The vegetation was chiefly gymnospermous, the cycads predominating; conifers also being numerous. Endogenous plants likewise began to make their appearance in considerable numbers, and in the beautiful forms of *Yucca* and *Pandanus*. We find in the Trias traces of the first-known mammals, the little marsupials *Microlestes* and *Dromatherium*. By far the most conspicuous feature in the fauna was, however, formed by the great development of the Amphibia, of which this seems to have been the golden age. Amphibians were then the ruling dynasty, and they included in their number many which in size and prowess would compare with the most formidable reptiles now living. The most highly-organized members of the class, the *Anoura*, seem not to have then existed. True reptiles were also numerous in the Triassic age, and we have here the introduction to the "Reign of Reptiles," which was the characteristic feature of the life of Mesozoic times. Although numerous skeletons of reptiles and amphibians have been found in rocks of this age, by far the most impressive traces they have left are the tracks which the shore-inhabiting species made on the beaches washed by the waves of the Triassic sea. These impressions are found in great numbers in the Connecticut Valley, New Jersey, and Kansas. They were formerly called bird-tracks, but are now believed to be rather the tracks of amphibians and reptiles, and by their variety and abundance are significant of the richness of the fauna of which they constitute almost the sole record. Most of these tracks were probably made by terrestrial labyrinthodonts, but there were also marine lizards, allied to *Plesiosaurus*, in the age (*Nothosaurus, Simosaurus*, etc.). Another peculiar group of Triassic reptiles were the *Anomodontia*, chiefly found in South Africa, some of which had heads like turtles, but most were provided with huge canine teeth. The invertebrate life of the Trias is very imperfectly represented. In the Muschelkalk, however, and the Rhætic beds—which latter form the summit of the formation—a large number of radiates and mollusks have been discovered. These show a peculiar mingling of Palæozoic and more recent types. For example, in mollusks the genera *Orthoceras* and *Goniatites*, so abundant below, disappear altogether, and are succeeded, first by the more complex *Ceratites*, and in the Upper Trias by the genus *Ammonites*, so much expanded in the Jura and Chalk. Also, *Murchisonia*, which began in the Silurian, is associated with *Nerinea*, and *Megalodon* with *Trigonia*. Among the most characteristic Triassic mollusks are *Monotis* and *Myophoria*. Fishes have left numerous remains in the Triassic rocks, and these show that only ganoids and elasmobranchs were living in that age. Most of the fishes are of small size, and were the inhabitants of bays, lakes, and rivers. They include *Palæoniscus* and the peculiarly Triassic forms *Catopterus*, *Ischypterus*, etc. All of these have heterocercal tails, but this feature is less strongly marked than in the older fishes.

Jurassic Age.—The Jurassic rocks rest upon the Trias in Europe, in many localities without break, and the chain of life that pervades them is continuous. For the most part they seem to be the effects of a gentle subsidence with many oscillations, all without much disturbance. This resulted in covering the coarser sediments of the Trias with alternations of calcareous shale and limestone which form the Liassic and Oolitic groups. The most conspicuous feature in the life of the Jurassic is formed by the development of reptilian life, and this is the culminating period of the great reptilian age. The vegetation consisted mainly of cycads, conifers, and ferns. The cycads here attain their greatest development, and must have given a peculiar aspect to the scenery of the age. The Protozoa are represented by sponges and foraminifers, both of which groups have left a large number of representatives in the fossil state. Corals were numerous, but no portion of the Jurassic sea-bed yet exposed to our view exhibits any traces of coral-reefs, and most of the forms preserved are small. The echinoderms were exceedingly abundant, and *Pentacrinus* must have covered portions of the sea-bottom with a thicket-like growth of stems and branching arms. The echinoids proper were in this age far more numerous than before, and many beautiful species have been collected belonging to the genera *Hemicidaris, Diaster, Diadema*, etc. Star-fishes and ophiurans were also abundant, and all this group of radiate forms is far better represented here than in the rocks of the preceding ages. Among the mollusks, bryozoans are rare, and the same may be said of pteropods. Brachiopods were not uncommon, but were far less numerous and varied than in the earlier seas. The Palæozoic genera *Leptæna* and *Spirifera* disappeared in the Jurassic age, and the most abundant brachiopods were *Rhynchonella* and *Terebratula*. The conchifers exhibit great expansion in the long list of genera and species which inhabited the Jurassic ocean. Among them the oysters, with their associates, *Gryphæa* and *Exogyra*, are notable additions to the older molluscous fauna. The same may be said of *Trigonia, Lima, Phola-*

domya, and *Diceras;* the latter a genus of this order, in which the valves were coiled spirally like rams' horns. The Gasteropoda of the Jurassic are more numerous and varied than in the older faunas, and they have much more the aspect of those of the present day. A large number of genera which are now living make their first appearance in the Jurassic rocks, such as *Nerita, Turritella, Pteroceras, Buccinum, Fusus, Murex*, etc. The Cephalopoda have left an immense number of species in the sediments of the Jurassic seas. These include both the dibranchiate and tetrabranchiate groups. The latter are represented by several species of the genus *Nautilus*, which has run almost unchanged through the geological ages to the present day; and, far more numerous than the *Nautili*, the *Ammonites*, which form a group which must have given a peculiar character to the molluscous fauna of the age. The dibranchiate cephalopods were represented by the Belemnitidæ, a family which began in the latter part of the Triassic age, and ended in the Cretaceous, but which had its maximum development in numerous and varied species of *Belemnites* that form one of the most characteristic features in the Jurassic fauna. In the Jurassic system we first find unmistakable fresh-water deposits—the Purbeck beds. These contain numerous mollusks, such as *Cyrena, Limnea*, and *Viviparus*, which have continued to inhabit fresh-water lakes and streams, with little change of form, to the present day. The persistence of these types of fresh-water mollusks through so many and so great changes constitutes one of the most surprising facts of palæontology, for the inhabitants of fresh-water streams and basins are not only exposed to modifying circumstances that are extremely local and varied, but they would seem to be exposed to much greater probability of extermination than the inhabitants of the ever-continuous sea. The *Unios, Melanias, Paludinas*, etc. of the Purbeck and Wealden beds have, however, been much more persistent than their marine contemporaries, and they are so much like the species now living that when both are stripped of the epidermis they can hardly be distinguished. Whether birds existed in the Triassic age is still an open question, but that they lived in the age of the Jura is proved beyond a question, not only by single feathers, but by the discovery of *Archæopteryx* in the Solenhofen slates. This bird, however, and perhaps all others of the age, differed considerably from the birds of the present day in this, that the vertebral column was prolonged into a tail of considerable length. In this and some other features the *Archæopteryx* seems to be a kind of connecting link between birds and reptiles. The mammals of the Jurassic age, though evidently somewhat numerous, were small, and held a completely subordinate place in the fauna. It is probable, also, that they all belonged to the lowest group of mammals, the marsupials. Reptilian life in the Jurassic age seems to have expanded in every direction, for there were then swimming, walking, and flying reptiles, and their huge dimensions and formidable armaments serve as central and hideous figures in the pictures which the imagination paints of the age. Of the Jurassic marine lizards, the *Ichthyosaurus* and *Plesiosaurus* are best known, though the remains of many others have been found. Another great group, that of the *Dinosauria*, inhabited the land, and surpassed in dimensions our largest pachyderms. Some of these were carnivorous (*Megalosaurus*), while others were vegetable feeders (*Hylæosaurus*, etc.). The *Pterosauria* (winged lizards) form several genera (*Pterodactylus, Rhamphorhyncus*, etc.), and some of them exceeded our largest birds in size. Turtles and crocodiles existed in the Jurassic age, and one of the latter, *Teleosaurus*, resembled in form and equalled in size the gavial of the Ganges. The fishes of the Jurassic were all ganoids and elasmobranchs, the latter chiefly represented by hybodont sharks, of which the defensive fin-spines and pointed teeth are not uncommonly met with. Most of the ganoids had rhomboidal scales, and were but slightly heterocercal. These formed a great number of genera, varying in size from *Pholidophorus*, but little larger than a minnow, to *Lepidotus*, fully six feet in length, and covered with bony and enamelled scales half an inch in thickness.

Cretaceous Age.—In most respects the life of the Cretaceous age is but a continuation of that of the Jurassic; some very important additions were, however, made to pre-existing forms. In many countries where they are found, the Cretaceous rocks, by their composition and structure, as well as by their fossils, are shown to be deposits of deeper and clearer water than that of the seas where the Jurassic strata accumulated. They therefore indicate a period of greater submergence, and the fauna of this period includes a greater number of purely marine forms. As a whole, this age must be regarded as a final chapter of the Mesozoic history, in which all the prominent characters retain their places on the stage and play leading parts in the drama. Reptilian life seems to have been scarcely less abundant in the Cretaceous than in the Jurassic age. The cephalopod mollusks that were so abundant in the Jurassic seas become still further multiplied and varied, until they become a more striking feature of molluscous life than in the preceding age. We have to record the advent in the Cretaceous age of the highest order of plants, the angiosperms, and of fishes, the teleosts—which rapidly superseded, one the cycadaceous flora, and the other the ganoid fauna of the preceding age. The base of the Cretaceous in England is formed by the fresh-water beds of the Wealden, which, besides the mollusks already alluded to, contain the remains of several huge dinosaurs, among the most conspicuous of which was the *Iguanodon*. The Chalk itself is mainly composed of the remains of Foraminifera, which seem to have been specially abundant in this age. Though mostly microscopic in size, their shells form almost the entire mass of strata several hundred feet in thickness. Sponges are also numerous in the Cretaceous; scarcely any but the calcareous and silicious species have been preserved, but these were much more abundant than in the present seas. Molluscous life in the Cretaceous age approached still more closely to that of the present day than did that of the Jurassic, and a large part of the genera which left their remains in the Chalk are represented, though by different species, in the present seas. Radiates were abundant, and among the Cretaceous species we find nearly all the groups now living, with some that have passed away. Reef-building corals seem not to have existed in any of the Cretaceous seas the sediments of which have been examined, though the smaller forms are quite numerous. The echinoderms were represented by few crinoids as compared with preceding ages, but more than are now living. Of the higher members of the group, the echinoids and asteroids, the number was large, and in character they closely resembled those of the Jurassic. We know little of the articulates of the Cretaceous, except the marine crustaceans. They are more highly organized than those of the preceding ages, and they include representatives of both our lobsters and crabs. The teleost fishes, which began in the Cretaceous, seem to show no evidence of derivation from previously-existing forms, and they included at least one genus, *Beryx*, which is now living in the Atlantic. *Osmeroides* is another well-known Cretaceous genus, supposed to be allied to the salmons, and to represent the highest group of the teleosts. The change in the vegetation of the earth which took place in the Cretaceous age gave some signs of its approach in the first-formed strata of the system, where a few angiospermous leaves are found mingled with a vastly preponderating number of acrogenous and monocotyledonous plants. By the middle of the Cretaceous age the angiosperms had spread over the European and American continents, and vegetation had assumed the general aspects which it has at the present day.

Tertiary Age.—The rocks of this age are in some places several thousand feet in thickness. They were divided by Lyell into three groups, of which the lowest he called the Eocene, the middle Miocene, and the uppermost the Pliocene. In many parts of the world the Tertiary strata are of fresh-water origin, and hold the remains of a much larger number of land animals and plants than are to be found in the older formations. The diagnostic character of the fauna and flora of the Tertiary was considered by Lyell to be this, that they contain more or less living species, but it is doubtful whether any of the Eocene species have come down to modern times. The general character of the life of the Tertiary is expressed by designating this as "the Reign of Angiosperms and Mammals." Even in the Eocene rocks the remains of mammals abound, and these indicate such size and variety as to prove that the group of huge reptiles which dominated the world in Mesozoic times had, even thus early, given place to a mammalian dynasty which had become the rulers of the animal kingdom. The first knowledge of the mammalian fauna of the Eocene was gained through the discoveries of Cuvier, made in the gypsum-quarries of Montmartre, near Paris, where the skeletons of *Palæotherium, Anoplotherium*, and some other tapiroid animals were found. Since then great additions have been made to the known fauna of the Eocene by explorations in Western America, where, in the sediments of ancient lakes, there have been found and described by Leidy, Marsh, and Cope the remains of perhaps 200 distinct species. These include many large animals allied to the rhinoceros, but attaining nearly the size of the elephant, and provided with several pairs of horns and two huge canine tusks in the upper jaw. These constitute a new order of animals, the Dinocerata of Marsh, and form the most striking feature in the life of the first epoch of the age of mammals. One remarkable thing in the structure of these monsters, as shown by Marsh, is the very small

size of the brain, which is formed by a very slight bulbous expansion of the spinal cord. The associates of the Dinocerata included small four-toed horses and many genera of animals allied to *Palæotherium*. In the later deposits of the Eocene are carnivores related to cats, wolves, and foxes, also quite a number of lemurine monkeys, as well as many forms now quite extinct. The marine life of the Eocene was, like the terrestrial, very different from that of the Cretaceous, which indicates the lapse of vast periods of time between the deposits of the two systems. Among the marine vertebrates, the most striking are *Zeuglodon*, a peculiar cetacean which attained a length of seventy feet and inhabited the Atlantic and Gulf waters; *Carcharodon*, a shark of nearly equal size; and a manatee (*Squalodon*). The smaller fishes of the Eocene are chiefly teleosts, which had now almost completely supplanted the ganoids. The remains of rays, sword-fishes, and saw-fishes are not uncommon in the Tertiary marls of New Jersey and South Carolina. The reptiles of the Eocene include snakes (which here make their first appearance), turtles, and crocodiles, the latter being abundant. Birds seem to have been fairly represented in the Eocene fauna, and, like those found in the Cretaceous by Prof. Marsh, some of them were provided with teeth. Among the invertebrates, the most conspicuous features are as follows: the Protozoa are chiefly represented by Foraminifera, of which some existed in great numbers and attained relatively large size. Among these may be mentioned *Nummulites* and *Orbitoides*, which had discoid cells, sometimes an inch in diameter, and made up almost mountain-masses of limestone. Corals are not numerous in the Eocene rocks, and those found are closely allied to living forms. In the mollusks we find a great change from the fauna of the Cretaceous. All the great family of the Ammonitidæ, which filled the Cretaceous sea, had disappeared from the world before the deposit of the Eocene strata. The dibranchiate *Belemnites* also left no representative whatever in Tertiary rocks. *Nautilus* held on the even tenor of its way, as throughout the preceding ages. The gasteropods and conchifers are more numerous and varied than in any former age, and many of the former are siphonated. A large part of the genera now living were well represented in the first Tertiary sea. The fresh-water mollusks of the Tertiary, like those of the Wealden and Purbeck, have a most remarkable resemblance to those now living. The vegetation of the Eocene of Europe is subtropical in character, including forms that now flourish in the East Indies and Australia. At this time the great chains of the Pyrenees, Alps, Carpathians, etc. were not raised, and the southern coast of Europe was probably washed by a tropical sea. In America the Eocene flora was much more like that of the present day, but the abundance and variety of palms give it a sub-tropical character.

The life of the Miocene and Pliocene epochs shows an increase in the number and elevation of the rank of mammals and the culmination of the mammalian age. The elephant, mastodon, and camel, with a large number of extinct herbivores, and carnivores allied to our lions, hyænas, wolves, bears, and ferrets, go to make up a fauna far richer than any now existing upon the globe. In addition to the orders obtained from the Eocene, we here meet with edentates, proboscidians, and true monkeys. The Tertiary horses, which are numerous, had four toes in the Eocene, three useful toes in the Miocene, and one useful and two dwarfed toes in the Pliocene, showing a gradual transition to the present horse, in which the lateral toes are obsolete. (See HORSE, by PROF. O. C. MARSH.) The vegetation of the Miocene was in many respects similar to that of the present day, and included a number of species now living. The climate of the northern hemisphere was in the Miocene mild, and a luxuriant vegetation covered all North America to the Arctic Sea. At this time there must have been a land-connection between this continent and Europe on the E. and Asia on the W., as the American Tertiary flora is found in the Miocene deposits of Europe, and is now living in China and Japan. From Europe the flora was apparently exterminated by the Ice period; while having space for a southward retreat, it survived in America and Eastern Asia.

Glacial Period.—Immediately following the Tertiary, with its immensely-developed mammalian life and a rich vegetation which reached almost to the poles, came a period of great cold, when the present climate of Greenland descended on the American continent as low as New York, and all the northern half of the continent was covered with ice and snow. By this great revolution of climate a large part of pre-existent animals and plants were destroyed. The life-history of this period of the world is exceedingly meagre. In the alluvial deposits and caves of Europe, and in some of the inter-glacial peat-beds of both America and Europe, mere glimpses of it are obtained. We there find the evidence of the existence of elephants and rhinoceroses, provided with thick wool and hair to protect them from the severity of the climate, and of the presence in low latitudes of the musk-ox and reindeer, now the inhabitants of the Arctic regions. The giant beaver (*Castroides*), the mastodon, elephant, and several species of rhinoceros, which were then associates with the musk-ox and reindeer, have now entirely disappeared. With the amelioration of the climate and the retiring of the glaciers northward the larger mammals referred to extended their migrations to the Arctic seas, where their remains are now found in great quantities. By what influences they were exterminated we are as yet unable to say. Contemporary with the animals last mentioned was man, who made his advent in Europe probably immediately after the culmination of the Ice period. Whence he came and what was his origin are not yet taught by palæontology. J. S. NEWBERRY.

Palæosau'rus [Gr. παλαιός, "ancient," and σαῦρος, "lizard"], a genus of fossil thecodont lizards having affinities with the crocodiles and the dinosaurs. Their bones are found in the Permian strata of Europe, and relics referred to this genus occur in the Triassic of the Carolinas.

Palæotheri'idæ [from *Palæotherium*—παλαιός, "ancient," and θηρίον, an "animal"—the typical genus], a family of mammals of the order Ungulata and sub-order Perissodactyla, related to the horses and rhinoceroses. The form resembled somewhat that of the llama, the neck and legs being elongated; the teeth formed series interrupted by wide gaps for the reception of the canines of the respective jaws, and were in full number (M. $\frac{3}{3}$, P. M. $\frac{4}{4}$, C. $\frac{1}{1}$, I. $\frac{3}{3}$); the upper true molars had each a deep valley extending obliquely inwards from the median portion of the narrow wall, and a shallow one extending from the angle or posterior wall; the lower molars two (anterior and posterior) crescent-shaped ridges; the canines were well developed; the skull somewhat resembled that of a hornless rhinoceros; the basi-occipital was comparatively narrow forwards; the nasal bones produced forwards and ending in a free narrowed surface; the supramaxillary bones, expanded upwards, were widely separated above and in front, and connected with the nasal bones; their feet had three toes each. This family was formed for the reception of one of the animals famous for restoration by Cuvier, who had, however, quite an erroneous idea respecting the form, and likened it to that of the tapir, influenced thereto by the relations of the nasal bones. The animal was, however, of very different form, being slender and agile, and undoubtedly the snout was blunt and not provided with any proboscis such as was formerly attributed to it. The species had no relationship with the tapirs, to which they were approximated by Cuvier, but were much more nearly allied to the horses (Equidæ); and, indeed, between the two families there is quite a regular gradation of form through the intervention of Anchitheriidæ. The following genera have been referred to the family: *Palæotherium*, *Monacrum*, *Propalæotherium*, and *Paloplotherium*, or *Plagiolophus*. These forms flourished chiefly in the Eocene and Miocene epochs. They ranged in size from about the dimensions of a sheep to those of a horse. THEODORE GILL.

Palæozoic Ages. See GEOLOGY.

Palæph'atus [Παλαίφατος], a grammarian of Athens or of Egypt, was the author of a variety of works treating mostly of the current myths; *e. g.* Αἰγυπτιακὴ Θεολογία, Μυθικῶν Βιβλίον, and, most celebrated, Τρωϊκά, which are all lost. There is extant a treatise, Περὶ Ἀπίστων Ἱστοριῶν (*Concerning Incredible Tales*), usually ascribed to this Palæphatus, though both it and the Τρωϊκά are sometimes assigned to another of the name. The work is not complete, and may be a compilation from a larger treatise; it consists of 51 sections, and contains 50 of the Grecian legends, with an attempt to separate the true from the mythical in each. The best editions are those of Fischer (Leipsic, 1789), and of Westermann in his *Mythographi Græci* (Brunswick, 1843). (See Grote's *Hist. of Greece*, vol. i., pp. 341 *seq.*) HENRY DRISLER.

Palafox' y Mel'zi (Gen. JOSÉ), b. in Aragon, Spain, in 1780; became an officer of the royal body-guard; was proclaimed by the populace of Saragossa captain-general of Aragon when that city was threatened by the French invading army 1808; conducted the heroic defence of that city during the two sieges; was sent as a prisoner to Vincennes, France, in violation of the capitulation of Feb., 1809; released in 1814; became again captain-general of Aragon 1814–20; favored the constitutional movement of 1820; protested against the restoration of absolute government 1823; was a partisan of the young queen Isabella 1833, but lost favor and was for some time imprisoned;

was made duke of Saragossa by the queen-regent, Maria Cristina, 1836; called the Aragonese to the support of Isabella during the Carlist war, and became director of the Invalides at Madrid, where he d. Feb. 16, 1847.

Palagia'no, town of Southern Italy, province of Lecce, about 15 miles from Taranto, in a district abounding in grain, vines, and olives. Pop. in 1874, 5204.

Palai'a, town of Italy, province of Pisa, situated on a high hill at the foot of which flows the Chiecinella. This town is about 19 miles from Pisa, and was once strongly fortified. It was ceded to Florence by the Pisans in 1250. Pop. in 1874, 10,119.

Palamede'idæ [from *Palamedea*—παλάμη, the "palm of the hand"—the first described genus], a family of birds most closely related to the ducks (Anatidæ), but resembling also the rails (Rallidæ), and remarkable for their large feet. In general aspect they resemble the rails more than the ducks. The neck is comparatively short; the head small; bill short, compressed, and with the culmen decurved to the tip; the nostrils large, lateral, and exposed in a membranous groove; the wings large and armed at the shoulder with two strong spurs; the tail rather small; legs enlarged, covered with numerous oblong and somewhat hexagonal scales, which extend on the tibiæ as well as tarsi, and with larger oblong scales in transverse rows on the upper surface of the toes; the tarsi widened towards the toes; the toes long, three before and one behind, the anterior connected by slight scaly webs; claws rather long and slightly curved. In the osteology the species essentially resemble the ducks, and have been combined with them by Huxley under the name Chenomorphæ as typical desmognathous birds. The family is composed of but two genera: (1) *Palamedea*, Linn., with one species, *P. cornuta*, and (2) *Chauna*, Illig., with two species. All are inhabitants of S. America, and frequent marshy grounds and borders of lakes and rivers. They generally associate together in pairs, but sometimes in troops of many individuals. Their gait when undisturbed is slow, their flight easy and rapid; they rest in high trees, and in these they make their nests, wherein the female generally lays two eggs.

THEODORE GILL.

Palanquin' [Port.; Javanese *pâlangki;* Hind. *palkî*], a portable litter for conveying travellers. Palanquins are employed extensively in India, China, and other Asiatic countries, for the Japanese *norimon* and *kango* are but forms of the palanquin. The Indian palanquin has a waterproof cover, with Venetian shutters at the sides. The traveller is carried in a recumbent posture. The palanquin is borne by four men, who are relieved at regular intervals by others. Quite a train of attendants accompany the palanquin on foot, and the bearers while on duty keep up a monotonous chant. The journey is often continued for long distances by day and night.

Pal'atal Bones, a pair of irregular bones which in man concur in forming the roof of the mouth, the outer walls and floor of the nose, and the lower side of the orbit of the eye. Each bone has a horizontal and a vertical plate, and the latter sends out two processes, an orbital and a sphenoidal. Each bone is developed from a single centre of ossification.

Pal'ate [Lat. *palatum;* Fr. *palais*]. The arch or roof of the mouth is made up of two parts, called the hard palate and soft palate, or *velum pendulum palati.* The hard palate, which is situated anteriorly, is bounded in front and at the sides by the gums and alveolar arches, being continuous behind with the soft palate. It consists of a bony structure, formed by the union in the median line of the two palate bones. These bones are wedged in between the superior maxillary and pterygoid process of the sphenoid. In form each palate-bone resembles the letter L, and is divided into a superior or vertical plate and an inferior or horizontal plate. The inferior surface of the horizontal plate forms the back part of the hard palate. The anterior border of each palate-bone articulates with the palate process of the superior maxillary bone. The bony structure of the hard palate is covered by periosteum, to which is firmly attached the mucous membrane. A linear ridge or raphe extends along the middle line, terminating anteriorly in a small papilla. The mucous membrane in front of and upon either side of the raphe is pale, thick, and corrugated; behind, it is smooth and deeper in color. A number of small glands are situated in the mucous membrane, the surface of which is covered with squamous epithelium. The *soft palate* is composed of muscular fibres covered by mucous membrane with gland structures embedded in its substance. From the middle of its lower border hangs a conical-shaped process, the *uvula,* and upon either side of the uvula, arching downwards and outwards from its base, are the pillars of the soft palate. The mucous membrane is thin, covered by squamous epithelium on both surfaces, except near the orifice of the Eustachian tube, where it is columnar and ciliated. The muscles of the soft palate are five in number on either side, viz. the levator palati, tensor palati, palato-glossus, palato-pharyngeus, and azygos uvulæ. Upon either side of the fauces, between the anterior and posterior pillars of the soft palate, are two glandular organs, the tonsils. During the first part of deglutition the food is carried back by the tongue, pressing against the hard palate; at the same time the base of the tongue is retracted and the larynx raised with the pharynx, and carried forwards under it. Then the epiglottis closes the entrance to the larynx, and over this the food glides, the palato-glossi muscles contracting at the same time that the levator and tensor palate with the palato-pharyngei prevent the passage of the food into the upper part of the pharynx or posterior nares. Thus the palate serves an important part in the act of swallowing or deglutition. J. W. S. ARNOLD.

Palat'inate, The [Ger. *Pfalz*], formerly a political division and independent state of Germany, consisted of two separate territories, respectively called the Upper Palatinate, now forming the northern part of the kingdom of Bavaria, and the Lower Palatinate, situated on both sides of the Rhine, and now forming the southern part of Rhenish Prussia, the northern part of the grand duchy of Baden, and the province of Bavaria, called Rhenish Bavaria. From the eleventh century these two territories belonged together and formed an hereditary monarchy, their ruler being one of the electors of the German empire. But in 1648, by the treaty of Westphalia, they were separated, the Upper Palatinate falling to Bavaria, while the Lower Palatinate continued a possession of the original dynasty. At the Peace of Lunéville, in 1801, the Lower Palatinate ceased to exist as an independent state, its territory being divided between Hesse-Darmstadt, Baden, and France, and the only alteration which the Congress of Vienna made in this arrangement consisted in transferring to Bavaria that part of the Palatinate which France had occupied. Its people emigrated largely to Pennsylvania. (See PALATINE.)

Pal'atine [from the Lat. *palatium,* a "palace"]. In mediæval France and Germany there were counts palatine attached to the court and palace of the sovereign for the purpose of assisting the latter in his judicial duties. Later, in these and in other countries, counts palatine were detached from the court and placed in charge of remote or turbulent provinces, where they maintained a court and palace in the sovereign's name. This was the origin of the counties palatine. Lancaster and Chester, in England, as formerly Durham, Hexham, and Pembroke, are counties palatine. King John divided Ireland into twelve counties palatine. Scotland had anciently a county palatine of Strathearn.

Palatine, post-v. and tp., Cook co., Ill., on the Wisconsin division of the Chicago and North-western R. R., 26 miles N. W. of Chicago, has 3 churches, 2 large grain-elevators, 1 newspaper, and stores. It is a place of summer resort for Chicago people. Pop. of v. 950; of tp. 1855. FRANK E. HOLTON, PUB. "HERALD."

Palatine, post-v. and tp., Montgomery co., N. Y., on the N. bank of the Mohawk River and N. Y. Central R. R., settled by Germans from the Palatinates 1713; was afterwards called "Stone Arabia," and the battle of that name, Oct. 18, 1780, between the Tories, under Sir John Johnson, and the Continental forces of Col. John Brown, was fought here. Pop. 2814.

Palatine, post-v. of Union tp., Marion co., West Va. Pop. 558.

Palatine Bridge, post-v. of Palatine tp., Montgomery co., N. Y., on the N. Y. Central and Hudson River R. R. and Mohawk River. Pop. 493.

Palatine Hill (*Mons Palatinus*), one of the most important of the seven hills of ancient Rome, was the site of *Roma Quadrata,* the original city. It is S. of the Capitoline Hill and S. W. of the Forum. It was the official abode of the emperors, and in mediæval times of the highest dignitaries, but has since then fallen into decay. Extensive excavations are now making, bringing to light many rich and extremely valuable remains of the imperial period.

Palat'ka, post-v., cap. of Putnam co., Fla., on the St. John's River, 75 miles from Jacksonville, is well situated, has several churches and schools, 3 hotels, and 1 weekly newspaper. Pop. 720.

Palaz'zo Acrei'de, town of Sicily, province of Syracuse, situated in a fertile region about 16 miles from Noto. This town stands on the ruins of the ancient Acræ, many interesting remains of which still exist. In the neighborhood are found a great variety of objects from the so-called

Stone Age down to the later periods of Syracusan culture. Pop. in 1874, 10,132.

Palaz'zo Adria'no, town of Sicily, province of Palermo. This town was an Albanian colony, and the inhabitants mostly adhere to the Greek Church. Pop. in 1874, 5438.

Palaz'zo San Gerva'sio, town of Southern Italy, province of Potenza, 20 miles S. E. of Melfi. This town is situated in a hilly, fertile country, but the extent of its external relations may be inferred from the fact that it has no post-office. Pop. in 1874, 6896.

Palefits, Lacustrine Villages, or **Lake Dwellings.** In many parts of the world, as in the East Indian Archipelago, we find races of men living partially in dwellings built upon piles over water, and Herodotus describes this custom as prevailing amongst certain ancient tribes. A new interest has of late years been given to this mode of constructing habitations from the discovery in Switzerland of the remains of villages that had been thus built by a people or peoples belonging to a period anterior to authentic history. Continued examination has revealed the remains of quite a large number (upwards of 200) of such settlements, or Pfahlbauten, situated at various points beneath the waters of the shallow borders of the Swiss lakes. It is also shown distinctly that these settlements were not confined to one epoch in the history of European man, since some of them belong to the later Stone Age, or Neolithic Period, others to the Bronze Age, whilst the latest bring us down to the introduction of the Iron Age and to the time of the Romans, anterior, however, to our era. The extent to which researches have been carried (from the settlement of Concise alone we are told that 25,000 relics have been obtained) has revealed to us an unexpected accumulation of facts regarding these ancient peoples, and has shown us that their numbers were considerable and that their favorite sites must have been occupied during very extended periods of time. In the Stone Age we are impressed with the labor and ingenuity displayed in the building of these pile-villages by men whose most effective tools were chipped flints and other stones (though they had also implements of bone) with which to cut and point the numberless piles upon which their rude huts were supported. In the one settlement of Wangen it is calculated that at least 50,000 piles must all together have been used, and so far no trace of metal has been discovered in the settlements of this period proper. As the Stone Age gradually gave place to the Bronze, and metal was introduced, we have, from the very composition of the metal, evidence of a growth of commerce. The rude pottery of the Stone Period is succeeded by improved kinds, and the metallic implements are often of great beauty. The inhabitants of both periods fed upon the flesh of the urus (*Bos primigenius*), of the aurochs (*Bison Europæus*), the elk (*Cervus alces*), and of other animals long extinct in Switzerland, and with these are found the remains of the beaver, the ibex, and the bear, almost exterminated, as well as those of the fox, the sheep, and numerous other still abundant forms; but the mammoth, the rhinoceros, the reindeer, etc., which were the associates of Palæolithic man, are quite unrepresented. Domesticated forms appear both in the "Stone" and the "Bronze" villages, but they are relatively more abundant in those of the later date; thus, the horse, rare in the former, becomes evidently more common in the latter. In both periods cereal plants were cultivated, thus indicating some amount of agricultural knowledge, and marking a strong point of difference between the lake-dwellers of Switzerland and the authors of the kitchen-middens of Denmark. By the computations of Prof. Morlot and others it would seem that the date of the Bronze Age carries us back from 3000 to 4000 years, and that of the Stone Age to from 6000 to 7000 years, though these must be considered as minimum figures.

EDWARD C. H. DAY.

Pale, Irish, a name formerly given to that part of Ireland which was completely under English sway, in distinction from the parts where the old Irish laws and customs were prevalent. The counties of Dublin, Carlow, Louth, Kilkenny, and Meath are generally given as belonging to the Pale; but its limits were at times much greater and sometimes smaller than the present limits of those counties.

Palembang', a Dutch possession on the E. coast of Sumatra, lies between lat. 5° and 0° 30′ S., and comprises an area of 61,911 square miles, with 573,697 inhabitants, of whom a number are Europeans and Chinese. The coast-land is low, marshy, overgrown with jungles, and extremely hot, but it is not unhealthy except in the immediate neighborhood of the swamps. The inland is higher, and covered with rice-fields and plantations of sugar, cotton, pepper, and tobacco, and with immense forests of gum and cocoanut trees. Coal and oil-springs are found, also gold dust, iron ore, sulphur, and arsenic. The tiger, leopard, panther, elephant, and rhinoceros haunt the country. The capital is Palembang, where the Dutch governor resides. It is built on both sides of the Moosee, a broad and deep river, which admits the largest vessels and forms a fine harbor. The city has upwards of 40,000 inhabitants, and carries on a very active trade both with the inland and with Java, China, and Siam. The value of exports amounted in 1870 to 2,123,180 gulden.

Palen'cia, province of Spain, consists of parts of Old Castile, and comprises an area of 4580 square miles, with 184,668 inhabitants. With exception of the northern part, which is mountainous, the surface presents an extensive table-land, cold and treeless, but fertile, well cultivated, and rich in salt, copper, saltpetre, chalk, and coal. Wheat, wine, vegetables, and fruit are produced.

Palencia, an old but well-built town of Spain, the capital of the province of the same name, on the Carrion, has large manufactures of woollen blankets and an active trade in corn and wool. Pop. 12,811.

Palen'que, a ruined Mexican town of the Pueblo type, near the modern hamlet of St. Domingo de Palenque, in the state of Chiapas and on the river Chacamas, in lat. 17° 30′ N.; lon. 92° 25′ W. The ruins were discovered in 1750; and as the town is not mentioned in connection with the conquest of Cortez, it is believed to have been destroyed long before that time, and forgotten by reason of its burial in the dense tropical forest. The area occupied by the ruins is quite large. A brief notice of the architecture of the most important of its ruins and of the probable social status of its inhabitants is given in this work in the article ARCHITECTURE OF THE AMERICAN ABORIGINES, by Lewis H. Morgan, LL.D. Further details may be gathered from the works of Stephens, Catherwood, and Morelet.

Paleocapa (PIETRO), b. at Bergamo in 1789. After receiving a military education in the artillery and engineer school at Modena, was at once appointed to superintend the works on the fortifications of Osopo and Mandella. After the fall of the first Napoleon, filled successively several important posts as director of hydraulics and other public constructions. In 1848 was elected member of the provisory government of Venice; became minister of public works, and afterwards minister of the interior. On the overthrow of that government retired to Piedmont, where he was most honorably employed, and in 1849 Gioberti offered him the portfolio of public works, a position which he retained until 1859, although totally blind during the latter part of this period. The advice of Paleocapa was most important in the construction of the Mont Cenis tunnel, and in that of the Suez Canal. D. at Turin 1867.

Paler'mo (anc. *Panormus*), city of Sicily, situated on the N. coast, in lat. 38° 6′ 44″ N.; lon. 13° 20′ E. It lies on a beautiful bay formed by a deep and spacious inland sweep of the sea between Cape Zafferano on the E. and Monte Pelegrino on the W. This enchanting bay, unrivalled, perhaps, in the world, unless by that of Naples, has received the name of the Conca d'Oro, the Golden Shell, a name also applied to the city and to the plain which extends from the sea to the mountains in the rear—a region upon which nature has lavished her best gifts in the way of climate, soil, and landscape beauty. The city walls, 4½ miles in circumference, form a square, the four angles corresponding very nearly to the four cardinal points of the compass, and the town is entered by sixteen gates. The harbor lies to the N. of the town, and is sheltered by a huge mole. The Oreto, which, with its many small tributaries, waters the adjoining plain, flows into the sea near the E. angle. Two fine streets, the Macqueda or Strada Nuova, and the Vittorio Emanuele, formerly Toledo, intersect each other at right angles near the centre of the city, thus dividing it into four sections. Most of the other streets are narrow, crooked, and in bad condition. Among the public squares are the Villena or Vigliena, very picturesque and decorated with fountains and statues in the Renaissance style; the public garden on the left of the Porta Felice, abounding in almost tropic vegetation; the Bologni, the Senatoria, San Spirito, Liberta, etc. The favorite promenade, however, is the beautiful Marina, running along the shore on the line of the old fortifications. The churches of Palermo (about 300) are, many of them, very sumptuous. The cathedral, built in the twelfth century, though disfigured by later changes and additions, is highly interesting, and contains very curious mediæval monuments. San Domenico is the largest church in the city, and will hold 12,000 persons; the Olivella is the most gorgeous church of Palermo; the Della Catena has a remarkably fine portico; San Giovanni was built by King Roger; the Compagnio del Rosario contains admirable pictures; and besides these, there are many other very

noteworthy churches. The royal palace is in part the work of the Arabs, for whom it served as a fortified castle, but it was transformed by the Normans. It is an immense building, and its architecture and decorations are of the greatest interest. The chapel and the Sala di Ruggiero are richly encrusted with curious old mosaics, and among the many inscriptions on this building is one recording the construction of a clock by order of the first Roger. The Palazzo de' Tribunali is very old, having been rebuilt in 1307; the Palazzo della Città was begun in 1300 by a king of the Aragonese line. Some of the private edifices are remarkable for their antiquity, others for their architecture. Palermo contains a university with about 600 students, several public libraries, and various literary and scientific associations, also hospitals and other charitable organizations. The environs of Palermo abound in objects of interest—the great cathedral of Monreale (see MONREALE); the Castello della Zisa; the Castello della Cuba; Monte Pellegrino, in which is the grotto of Santa Rosalia, the patroness of the city; and besides these, numerous other noticeable castles and villas. The *festa* of Santa Rosalia is celebrated in July with great pomp by a procession bearing from the city to the cavern a huge silver image of the saint on a gigantic car in the form of a Roman galley.

Palermo is probably of Phœnician origin, and is first known in history as a Carthaginian dependency. During the Punic wars it fell into the hands of the Romans and became a great naval station. In the fifth century A. D. it was taken by the Vandals, and was ceded by them to the Goths, who were driven out by Belisarius. The wretched rule of Byzantium was terminated by the Saracens (830), who made Palermo the capital of their Sicilian dominions, and under whom it became a splendid Arab town, in which Oriental luxury was combined with taste and elegance. In 1071 the Normans, under Count Roger, took Palermo, and it continued the capital of the Sicilian kingdom through the Norman and Swabian dynasties. Charles of Anjou removed his court to Naples (1269), since which time Palermo has never been a permanent royal residence. (For further historical details see SICILY and SICILIAN VESPERS.) From 1820 the revolutionary failures of Naples were repeated in Palermo until the landing of Garibaldi at Marsala (1860) caused an uprising here, which, headed by the hero himself, put to flight 30,000 Bourbon troops, backed by a strong fleet; and by an enthusiastic *plébiscite* the city became a part of the new kingdom of Italy. The condition of Palermo was at this time most lamentable—a disgrace alike to government and people. The dilapidated streets were without drains and filthy beyond description, not the least regard being paid to hygiene, or even to decency. Here and there an oil-lamp was lighted at night, but gas was unknown. There was not a fire-engine in the town, the police was worthless, and the misery and degradation of the lower classes were indescribable. Considerable material improvement has already taken place, though much remains to be done. Efforts are also making to advance general education. In 1860 there were in Palermo 9 primary schools with a total attendance of 783 children; in 1865 the number of schools was 206, total attendance 11,500. Trade and industry are increasing, though not rapidly. The number of vessels annually entering and clearing the port is about 7000, with a tonnage of 1,000,000; annual exports—fruits, wines, silks, gloves, etc.—about $10,000,000; the imports a little less. Pop. in 1874, 219,398. CAROLINE C. MARSH.

Palermo, post-v. and tp., Grundy co., Ia. Pop. 684.

Palermo, p.-v., Marion tp., Doniphan co., Kan. P.138.

Palermo, post-v. and tp., Waldo co., Me. Pop. 1223.

Palermo, post-v. and tp., Oswego co., N. Y. Pop. 2052.

Pa'les, in Roman mythology, a divinity of flocks and shepherds, corresponding in some respects to the Greek Pan, was probably of old origin, but is seldom mentioned, and played in historical times only a subordinate part in the religion of the Romans. It is uncertain whether this divinity was imagined as male or female. The festival of Pales, called Palilia, was celebrated on the 21st of April, considered the birthday of Rome.

Pal'estine [Heb. פְּלֶשֶׁת, *Pelesheth*, "land of sojourners;" from which came Παλαιστίνη, originating apparently in Egypt, and occurring for the first time in Herodotus, i. 105], a name designating originally only the country of the Philistines, but in the later Greek and Roman period applied, as we now apply it, to the whole country of the Israelites on both sides of the Jordan. Josephus (d. 97 + A. D.) uses the name in both of these senses. The oldest name was the Land of Canaan, or sometimes simply Canaan, "lowland," by which was meant, however, only the country W. of the Jordan, which is all that was promised to Abraham. Other Scripture names are Judæa, the Land of Israel, the Land of Promise, the Holy Land, which last name has now for several centuries been more current than any other.—The boundaries of Palestine cannot be determined exactly. Approximately, they were as follows: On the W. the Mediterranean; on the N. a line beginning near the *Promontorium Album*, S. of Tyre, in lat. 33° 10′, trending northward till, near the southern base of Hermon, it strikes lat. 33° 16′, and then runs straight on to the desert; on the E. the Arabian desert; and on the S. the parallel of lat. 31°, a little S. of Beersheba (31° 16′), curving to take in Kadesh. Within these boundaries, as recently determined, there are, on the W. side of the Jordan, about 6600 English square miles, and on the E. side, including ancient Moab, S. of the Arnon, more than 5000, perhaps nearly 6000, square miles. The length of this territory is about 150 miles; its average breadth W. of the Jordan more than 40, and E. of the Jordan about 40 miles.—The country is made up of four long parallel strips of territory, lowland and highland alternating. Along the Mediterranean coast is a strip of lowland, in the northern or Phœnician section of it about 20 miles long and from 4 to 6 broad; in the middle, Sharon section of it, S. of Carmel, more than 30 miles long and about 10 miles broad; and in its southern, Philistine section, 40 miles long and from 10 to 20 broad. This strip of lowland is interrupted by the ridge of Carmel, which branches off from the mountains of Samaria, runs north-westward for 18 miles, rises at one point to the height of 1750 feet, and thrusts out into the sea a promontory about 600 feet high. On all this coast there is not one good harbor. Next comes the highland strip, some 25 or 30 miles broad, which springs from the roots of Lebanon, swells into the hills of Galilee, is interrupted by the plain of Esdraelon, as the lowland strip is interrupted by the ridge of Carmel, swells again into the hills of Samaria, reaches its greatest average height in Judæa, and then sinks away into the desert S. of Beersheba. This broad, high central strip of West Jordanic territory has been compared to a ship's longboat turned downside up. Among its highest points in Galilee are Safed (perhaps the "city set on a hill" of Matt. v. 14), 2775 feet above the sea, and Jebel Jermûk, near by, about 4000 feet above the sea. In Samaria the highest points are Ebal, 2750, and Gerizim, 2650 feet above the sea. In Judæa the highest point of Jerusalem is 2581, Olivet 2643, Hebron 3029, and Beersheba 1100 feet above the sea. The Jordan valley, at some points quite narrow and at others from 5 to 10 or 12 miles broad, is one of the wonders of the world. The Jordan itself, in going from its Hasbeiya source to the Dead Sea (115 or 120 miles), plunges down a descent of more than 3000 feet, from 1700 feet above to more than 1300 feet below the level of the Mediterranean. The fourth parallel strip, E. of the Jordan, is, most of it, high table-land, some of it 3000 feet above the sea, sinking away eastward into the Arabian desert. As seen from the W. side of the Jordan it looks like a purple wall.—Of the four lakes of Palestine, the northernmost is Phiala, 5 miles E. of Banias, nearly round, about a mile in diameter, and of unknown depth, occupying apparently the crater of an extinct volcano. It is some 3300 feet above the sea, is not, as was anciently supposed, one of the sources of the Jordan, has neither inlet nor outlet, and abounds in frogs and leeches. Merom (now *Huleh*), 10 miles S. of Banias, in the midst of an extensive papyrus marsh, from 100 to 150 feet above the sea, is a triangular lake, with its apex pointing southward, about 5 miles long, nearly 4 miles across its base, and 15 feet deep. Ten miles farther down is Gennesaret, 12¼ miles in length, 6¾ in its greatest breadth (at Magdala), 165 feet deep, and 653 feet below the level of the Mediterranean. The Dead Sea, some 65 miles farther S., is 40 miles long, nearly 10 miles broad, more than 1300 feet below the level of the Mediterranean, and more than 1300 feet deep. No fish live in it.—Of rivers, the only one of much importance is the Jordan, which has no considerable tributaries emptying into it from the W., and only two, the Hieromax (now *Yarmuk*) and the Jabbok (now *Nahr ez-Zerka*), from the E. Most of the so-called rivers of Palestine are merely winter torrents, which run dry in summer. Of the few permanent rivers emptying into the Mediterranean, the most important are the Belus (now *Nahr Na'man*, near Acre), celebrated for the accidental discovery of the art of making glass; the Kishon, "that ancient river" (now *Nahr el-Mukatta*, "river of slaughter"), which drains the plain of Esdraelon; the Zerka, just N. of Cæsarea, said to be still haunted by crocodiles; and the Aujeh (not mentioned in Scripture), a few miles N. of Jaffa, which drains the mountains of Samaria, and is, next to the Jordan, the longest permanent river in Palestine. Three permanent streams empty into the Dead Sea from the E. These are the Zerka Ma'in (not mentioned in Scripture), near which are the four hot springs of Callirrhoë; the Arnon (now

Mojib), the northern boundary of the Moabites and the southern boundary of the Israelites, about halfway down the sea; and the Zered (now *el-Ahsy*), at the S. E. corner of the sea.—The fountains of Palestine constitute one of its most characteristic features. First in importance are the three sources of the Jordan. Of these, the fountain at Hasbeiya (not mentioned in the Bible) contributes one-seventh, that at Cæsarea Philippi (now *Banias*) two-sevenths, and that at Dan (now *Tell el-Kady*) four-sevenths, of the whole volume of the river. This last fountain especially reminds the American traveller of Daniel Webster's famous description of eloquence, bursting forth "with spontaneous, original, native force." As an indication of the very great multitude of fountains in Palestine, Robinson enumerates 30 in a circuit of 8 or 10 miles around Jerusalem.—The geology of the country has been studied by Seetzen (in 1805), by Poole (in 1836), by Russegger (in 1836–38), by Anderson (in 1848), by Lartet (in 1864), and others, but not exhaustively. Much still remains to be done. The backbone of the country, on both sides of the Jordan, is hard Jura limestone, full of grottoes and caverns, with sandstone, basalt, and other volcanic rocks, also on both sides of the river, but these last more especially on the E. side. There are many signs of violent volcanic action in the past, and earthquakes are still frequent and severe.—The climate, on the whole, is mild, inclining, however, towards the extreme of heat rather than towards the extreme of cold. There are only two seasons, summer and winter, the former, from April to November, rainless or nearly so; the latter, from November to April, rainy. But between the middle of December and the middle of February there is generally a kind of intermission, separating "the former and the latter rain." The average annual rainfall at Jerusalem is about 60 inches, while on our Atlantic seaboard it is 45, and in California, whose climate is much like that of Palestine, it is only 20. Along the Mediterranean lowlands, and still more in the Jordan valley, the heat of summer is always great, and sometimes exceedingly oppressive, but not so on the higher levels, except when the sirocco blows. At Jerusalem, from June, 1851, to Jan., 1855, according to Dr. Barclay's register, the mean temperature was 66.5°, the highest temperature 92°, and the lowest, on one occasion just before sunrise, 28°. In some years the mean is 62° and the highest 86°. Hermon, nearly 10,000 feet high, and looking down upon the whole of Palestine, is never entirely clear of snow, though late in autumn only slender threads of it are left, as the Arabs say, "like the straggling silver locks on an old man's head." During the winter ice seldom makes, and the ground is seldom if ever frozen in any part of the country. With abundant rains, which may generally be counted upon, Palestine was once very fertile, and might be so again. But in order to this, trees must be planted, cisterns built and kept in repair, and the hills terraced, as of old. The products of the soil still range from peas, beans, wheat, and barley to grapes, figs, olives, apricots, lemons, oranges, and dates. Dr. Thomson praises the apples of Askelon, which he thinks to be the same as the "apples" of Solomon's Song. Dr. Tristram thinks that the apple tree of Solomon was the apricot.—The botany of Palestine, unlike that of Egypt, is richly varied. Not less than a thousand species of plants have been reported, and probably another thousand might be added. No traveller ever forgets the impression made upon him by the flowers of Palestine. For mile on mile, in the proper season, the ground is fairly covered with all the colors of the rainbow. Everywhere one sees the scarlet anemone, which is thought by some to be our Lord's "lily of the field." The ranunculus and the pheasant's eye (*Adonis palestina*) are also very brilliant. The narcissus, the crocus, and the mallow are all candidates for the honor of being considered "the rose of Sharon." Of shrubs, the most abundant and most beautiful is the oleander. The whole country was once well timbered, and still there are groves, and even forests, of pine and oak beyond the Jordan. But on the W. side of the river, from Beersheba all the way up to Lebanon, there are very few trees except on Tabor and Carmel. Since the time of the Crusades the pine forest then standing between Jerusalem and Bethlehem has wholly disappeared. Repeated wars and conquests and dreary centuries of bad government have gradually reduced the country to its present naked, burnt, and desolate appearance. The tree now most common is the oak, of which there are three species. Most abundant of all is the prickly evergreen oak (*Quercus pseudo-coccifera*). The other two species are deciduous. The "oaks of Mamre" were not oaks, but terebinths, the most famous specimen of which is the so-called "Abraham's Oak," near Hebron, 23 feet in circumference.—The wild animals of the country are much the same as in ancient times, except that the lion has disappeared. There are bears, leopards, wolves, jackals, hyænas, wild-boars, antelopes, gazelles, foxes, porcupines, and rabbits. Of domesticated animals, the horse is less used than the ass, the mule, and the camel. The buffalo, introduced probably by the Persians, has in some sections taken the place of the ox, and the neat cattle of the country in general are neither so numerous nor so well cared for as in ancient times. Sheep and goats are abundant, but swine are scarcely ever seen. The dogs are nearly all of one breed (the shepherd), and are outcasts and scavengers, making night hideous, as the jackals do, by their howling. Of birds may be mentioned eagles, vultures, hawks, owls, storks, pelicans, ravens, doves, pigeons, partridges, quails, sparrows, and nightingales. Fish still abound, as of old, in the Lake of Galilee, but the natives employ rude methods in taking them, and very little has yet been done towards ascertaining the number of species. The "great fish" of Jonah i. 17, which swallowed the truant prophet, was not a "whale," as the κῆτος of Matt. xii. 40 is unwarrantably rendered in our version, but may have been a specimen of the great white shark (*Canis carcharias*), still found in the Mediterranean, and sometimes 25 or 30 feet long. There are many species of reptiles, not a fourth part of which have yet been described. The crocodile may still be found in the marshes of the Zerka. Lizards and serpents are very numerous. Frogs are abundant, but all of one species, and only one species of the toad has yet been found.

The earliest inhabitants of Palestine were descended from Canaan, the fourth son of Ham. In the original grant to Abraham (Gen. xv. 19–21) ten tribes are named, two of which (the Kenites and the Kenizzites) were probably S. of Palestine, towards Egypt, one of them (the Kadmonites) on the E. side of the Jordan, and the remaining seven (the Hittites, Girgashites, Amorites, Canaanites, Perizzites, Hivites, and Jebusites) on the W. side. In the time of Moses and Joshua the Ammon-Moab people were on the E. side of the river, but had been crowded down by the Amorites, who held the whole territory from Mount Hermon to the Arnon. Reuben, Gad, and Half-Manasseh took this territory E. of the Jordan. The remaining nine and a half tribes crossed over and occupied the other side. The Hebrew commonwealth reached the summit of its prosperity and power under David and Solomon. Visible decay began (about 975 B. C.) with the secession of the ten tribes. Assyria crushed the northern kingdom of Israel about 720 B. C., and Babylon crushed the southern kingdom of Judah about 587 B. C. Since then the country has been under foreign domination, with hardly more than the shadow of independence at any time. Persians, Greeks, and Romans succeeded one another in the mastery. In the time of Christ, under the Romans, there were four provinces—Galilee, Samaria, and Judæa, on the W. side of the river, and Peræa on the E. side. Since 637, when Palestine was conquered by the Saracens, it has, with little interruption, been under Mohammedan power. The Seljukian Turks seized the country in 1073, and by their barbarous treatment of Christian pilgrims provoked the Crusades. The Latin kingdom, with its nine successive sovereigns, established in 1099, held Jerusalem till 1187, and stayed in Acre till 1291. In 1517 the Ottomans came in, and made the country a part of the Turkish empire. It was snatched from the sultan by Mohammed Ali in 1832, but Europe intervened, and in 1841 it was given back again. It now belongs to the pashalic of Damascus, which includes the three sub-pashalics of Beyrout, Akka, and Jerusalem. As no census is ever taken, the population of Palestine cannot be exactly determined, but is supposed to be well on towards 400,000, which is less than a tenth of what it probably was in the time of Solomon. Of this number only about 18,000 are Jews, residing, 10,000 of them, in Jerusalem, 3000 in Safed, 1500 in Tiberias, and 500 in Hebron (the four holy cities), besides a few scattered here and there in eight other places. The little remnant of the Samaritans at Nablus numbers only about 150. The bulk of the inhabitants are a mixed race, descendants of the ancient Syrians and their Arab conquerors.

Pilgrimages to the Holy Land began with Helena, the mother of Constantine, in 326, and have continued ever since. What was then known of the country may be found in the *Onomasticon* of Eusebius and Jerome. During the Middle Ages the principal topographers of Palestine were ignorant, superstitious, and careless monks, whose identifications of sacred places were largely of the legendary and childish sort. It is only within a comparatively recent period that the true critical method has been pursued. Seetzen was there from 1805 to 1807; Burckhardt in 1810; Irby and Mangles in 1817–18. But no one man has ever done so much for the geography of the Holy Land as Dr. Edward Robinson. Not only was he thoroughly prepared for his task by fifteen years of special study, but he had a

passion and a genius for exact and certain knowledge. During two brief journeys, in 1838 and in 1852, aided by Dr. Eli Smith, one of the best Arabic scholars then living, he fairly swept the whole field clean of ecclesiastical traditions. He was the first to adopt and adhere persistently to the rule of looking for ancient Hebrew names under the disguise of modern Arabic names. Next in rank with respect to the amount and quality of service rendered is Dr. William M. Thomson of Beyrout, for more than forty years an American missionary in Syria and the Holy Land, whose book appeared in 1858. In 1848 the lower Jordan and the Dead Sea were for the first time thoroughly explored and surveyed by Lieut. Lynch of the U. S. navy. In 1859, Johann Gottfried Wetzstein, Prussian consul at Damascus, explored the northern section of the country E. of the Jordan. In 1866 the marsh and lake of Huleh and the upper Jordan were explored by John Macgreggor of Scotland, and in the same year the Lake of Galilee was accurately surveyed by Capt. Wilson of the English Royal Engineers. This last piece of work was done under the direction of the "Palestine Exploration Fund," a society organized in 1865 for the purpose of making an exhaustive exploration and an exact survey of the Holy Land. From 1867 to 1870, Capt. Warren, under the direction of the same society, was making excavations in and around Jerusalem. In Oct., 1870, the American Palestine Exploration Society was organized; and in order that there might be no friction, but only the most generous rivalry, it was agreed that in conducting the joint survey the English society should confine itself to the western side of the Jordan and the American society to the eastern. The triangulation of Western Palestine was begun in the autumn of 1871, by Capt. Stewart, whose health soon broke down, and has since been carried on by Lieut. Conder, who expects to finish his work in the field in 1876. Many places have been identified with more or less certainty, some of them places of no little historic interest, such as the altar of Ed (Arab. *Ayd*), the rock Oreb (Arab. *Ash el-Ghorab*), and the springs of Ænon (Arab. *Aynun*). This last place was found just where Robinson looked for it, E. of Nablus. Besides issuing, since 1869, a *Quarterly Statement*, the English society has published *The Recovery of Jerusalem* (1871) and *Our Work in Palestine* (1873). The map, of which only a small specimen section (Mount Carmel) has been published (Jan., 1875), will be on the large scale of an inch to the mile, and of course more than 12 feet long. In 1873 the American society sent out its first expedition, under command of Lieut. Edgar Z. Steever of the U. S. army, detailed for that service by the secretary of war. A base-line was measured in the desert E. of the Jordan, over against Jericho; the work was carried on through the hottest months of the summer, and more than 500 square miles were triangulated. Prof. John A. Paine, archæologist and botanist of the expedition, in 1874 was sent again into the same region, where he discovered many new species of plants, identified Mount Pisgah, and determined its relation to Nebo. In 1875 a second expedition was sent out under command of Col. James C. Lane, with Rev. Dr. Selah Merrill as archæologist. A rapid reconnoissance survey of the whole Trans-Jordanic territory was made, about 100 photographs of inscriptions, ruins, and scenery were taken, and a skeleton map was prepared as the basis of final work. The society has published three *Statements*, issued in 1871, 1873, and 1875. The finding of the Moabite Stone in 1868 has kindled great expectations in regard to archæological treasures which may yet be found in that part of the common field.

The literature of the subject is of immense extent. Tobler, in his *Bibliotheca Geographica Palestinæ* (1867), enumerates more than 1000 writers in this department of study. To mention only a few of the most important: The *Onomasticon* of Eusebius (c. 330), translated into Latin, with additions, by Jerome (388), edited by Larsow and Parthey (Berlin, 1862); *Descriptiones Terræ Sanctæ*, by writers of the eighth, ninth, twelfth, and fifteenth centuries, edited by Tobler (Leipsic, 1874); *Early Travels in Palestine*, edited by Wright (London, 1848); the *Historica Theologica, et Moralis Terræ Sanctæ Elucidatio* of Quaresmius (Antwerp, 1639), valuable for the traditions; Maundrell's *Journey from Aleppo to Jerusalem at Easter, 1697* (Oxford, 1703); Reland's *Palestina Illustrata* (Utrecht, 1714), a classic; Hasselquist's *Voyages and Travels in the Levant in the years 1749, '50, '51, '52*, edited by Linnæus (London, 1766), valuable for the natural history; Burckhardt's *Travels in Syria and the Holy Land* (London, 1822); *Travels in Egypt and Nubia, Syria and Asia Minor, during the years 1817 and 1818*, by Irby and Mangles, printed but not published (London, 1822); Robinson's *Biblical Researches* (3 vols., Boston, London, and Berlin, 1841); *Later Researches* (1856) and *Physical Geography of the Holy Land* (published posthumously, 1865); Williams's *Holy City* (1845; 2d ed. 1849), defending the traditional sites; Lynch's *Expedition to the Dead Sea and the Jordan* (1849); Stanley's *Sinai and Palestine* (1857), highly graphic; Barclay's *City of the Great King* (1858), valuable for the meteorology; Thomson's *The Land and the Book* (1859); Tobler's *Bethlehem* (1849), *Jerusalem* (1854), and *Nazareth* (1868); Macgreggor's *Rob Roy on the Jordan* (1870); Tristram's *Land of Israel* (1865), *Natural History of the Bible* (1867), and *Land of Moab* (1873); Nutt's *Samaritan Targum and History* (1874); Ritter's *Geography of Palestine*, translated by Gage (4 vols., 1866); Porter's *Damascus* (1855), *Giant Cities of Bashan* (1865), and *Handbook of Syria and Palestine* (revised ed., 1875). Of maps, the best as yet is Van de Velde's (1858; 2d ed. 1865), soon to be superseded by that of the English and American engineers. (For further information see special articles, such as ESDRAELON, HAMATH, JERUSALEM, JORDAN.) R. D. HITCHCOCK.

Palestine, tp. in Bradley co., Ark. Pop. 656.

Palestine, post-v. and tp., Crawford co., Ill., on the Wabash River. Pop. 1988.

Palestine, tp. of Woodford co., Ill., on the Peoria and Warsaw R. R. Pop. 1325.

Palestine, tp. of Story co., Ia. Pop. 732.

Palestine, tp. of Cooper co., Mo., on the Boonville branch of the Missouri Pacific R. R. Pop. 2430.

Palestine, a v. (EAST PALESTINE P. O.) of Unity tp., Columbiana co., O., on the Pittsburg Fort Wayne and Chicago R. R.

Palestine, a v. of German tp., Darke co., O. Pop. 264.

Palestine, post-v. of Darby tp., Pickaway co., O. P. 81.

Palestine, v. (TAWAWA P. O.) of Green tp., Shelby co., O. Pop. 86.

Palestine, post-v. and cap. of Anderson co., Tex., on the International and Great Northern R. R., contains a high school, 5 churches, 1 bank, 1 newspaper, a cotton-factory, and stores. Business, farming, hide, and lumbering. P. about 2200. H. J. HUNTER, ED. "ADVOCATE."

Palestri'na (anc. *Præneste*), town of Italy, province of Rome, on the site of an ancient and powerful city of Latium. This town, 18 miles N. E. of Albano, 22 miles E. S. E. of Rome, is situated on a spur of the Apennines, about 1600 feet above the sea. It covers only a portion of old Præneste, whose strong citadel crowned the height now occupied by the mediæval castle San Pietro. The view from this point (2400 feet above the sea), embracing the Alban Hills, the Campagna, Rome itself, and the adjacent waters of the Mediterranean, is surpassingly beautiful. The church of San Rosalia is richly adorned with marbles and alabaster. The Palazzo Barberini, occupying a part of the site of the vast old Temple of Fortune, was erected in the fifteenth century, and with the garden contains many statues, bas-reliefs, mosaics, and inscriptions, etc. from the ancient city. Among the mosaics is one of great interest representing an Egyptian landscape. Some of the best sculptures found here have been taken to Rome, and a large lion of remarkably fine workmanship now stands on a landing of the great staircase of the Barberini palace in that city. The old walls of Palestrina are an admirable study for the antiquary, as portions of the earliest cyclopean, the later polygonal, the Roman square tufa block, and the brick constructions are all still existing. Traces of the Saracens, too, are not wanting. Palestrina was subject to Alba Longa, and after the ruin of that power by Rome held out a long time against the victors. When it finally became a part of the Roman territory, it was treated with special favor. Sulla, however, inflicted upon it the most cruel punishment for harboring Marius, by putting to death (82 B. C.) more than 12,000 of its citizens. But the town recovered itself, and under the emperors it was a favorite resort of the Roman aristocracy. Augustus had a villa here, also Marcus Aurelius, Hadrian, Pliny, etc. On the fall of the Western empire it became a part of the papal dominions; but the Colonna family afterwards claimed it as their fief, and held it for more than two centuries in spite of papal excommunication. In 1297, Boniface VIII. treacherously obtained possession of the town, and, with the exception of the cathedral, destroyed it utterly. From this time the Colonna never ceased to struggle with the popes, and often with success, for the lordship of the ruined town, until 1630, when it passed by sale to the Barberini. The modern town is in itself of no interest except as the seat of one of the six suburban bishoprics. Pop. in 1874, 6015. CAROLINE C. MARSH.

Palestrina (GIOVANNI PIERLUIGIDA), b. at Palestrina in 1524; studied music in Rome under Claude Gondimel, and published in 1554 a collection of masses which gained the favor of Pope Julius III. in so high a degree that he

was appointed a singer in the papal chapel. This position, however, he lost under Pope Paul IV. because he was married, and he was afterwards appointed chapel-master at various churches in Rome, at last to the congregation of the oratory. But these appointments were small with respect to the salary they gave, and the great composer d. poor at Rome Feb. 2, 1592. His works, comprising masses, motets, hymns, etc., were very numerous, but not half of them were published; the rest are scattered in the libraries of Europe. They produced a revolution in the history of church music. In 1563 the Council of Trent determined to expel profane melodies from the churches, and to have the masses composed not only in a grave and dignified style, but also so simple that the words could be heard and understood. The problem was proposed to Palestrina, and he solved it with a success which was decisive; his *Missa Papæ Marcelli* is still heard with great admiration.

Pa'ley (Frederick Apthorp), grandson of William, b. at Easingwold, near York, England, in 1816; graduated at Cambridge 1838; resided there until 1846, when he became a Roman Catholic; edited Æschylus, Euripides, Hesiod, Homer, and several other classic authors; translated into English the plays of Æschylus (1864) and the odes of Pindar (1875). Author of a *Manual of Gothic Mouldings* (1845) and a *Manual of Gothic Architecture* (1846), and became classical examiner in the University of London.

Paley (William), D. D., b. at Peterborough, England, in July, 1743; graduated at Christ's College, Cambridge, where he became a tutor and lecturer upon moral philosophy and divinity; took orders in the Church of England; rector of Musgrove 1775; archdeacon of Carlisle 1782; published *Principles of Moral and Political Economy* (1785), *Horæ Paulinæ* (1790), *View of the Evidences of Christianity* (1794), and *Natural Theology* (1802). D. May 25, 1805.

Pal'frey (John C.), b. at Boston, Mass., Jan., 1834; graduated from the U. S. Military Academy and appointed brevet second lieutenant of engineers July, 1857; in the civil war served with distinction in his engineering capacity; in constructing fort on Ship Island; in repair of Forts St. Philip and Jackson, La.; at siege of Port Hudson; in Red River Expedition, and in siege and capture of Fort Morgan, Ala., where he was in charge. In Mar., 1865, he was appointed chief engineer 13th Army Corps, with rank of lieutenant-colonel, participating in the siege of Mobile. In 1866 he resigned his commission as captain of engineers to accept the agency of a large manufacturing company in Lowell, Mass.

Palfrey (John Gorham), D. D., LL.D., b. in Boston, Mass., May 2, 1796; was educated at Phillips Academy, Exeter, and Harvard College 1815; studied theology; succeeded Edward Everett as minister of Brattle Square church in Boston 1818; succeeded Andrews Norton as professor of sacred literature in the Cambridge Divinity School 1831; retired in 1839. From 1844–47 was secretary of state in Massachusetts. In 1847 represented the anti-slavery Whigs in Congress; was a leading Republican, one of the creators of the Republican party, a prominent writer and speaker on the anti-slavery side, an able ally of Sumner and Adams; lost his seat in Congress after a fiercely-contested struggle against the "compromise" Whigs; ran for governor of Massachusetts, but was defeated, in 1851; retired from public life and devoted himself to literature. Mr. Palfrey has been a diligent author. His books are: *Evidences of Christianity* (Boston, 2 vols., 1843), *Jewish Scriptures and Antiquities* (4 vols., 1838–52), *History of New England* (3 vols., 1858–64, still in progress), *The Slave Power* (1 vol., 1847). Besides, there are sermons bound and in pamphlet, lectures, a Fourth of July oration, articles in the *North American Review*, of which he was editor from 1835 to 1842, and the *Christian Examiner*. Dr. Palfrey has frequently visited Europe for purposes of historical study in connection with his New England history. While postmaster of Boston he lived in that city, but Cambridge is his permanent residence. His historical works hold the first rank for fulness of research, carefulness of statement, candor of judgment, and scholarly finish of style. O. B. Frothingham.

Palfrey (Warwick), b. at Salem, Mass., in 1787; published the *Evangelical Psalmodist* (1802), shortly after becoming apprentice in the office of the *Essex Register;* was a member of the city council and of the State legislature and senate many years, and ably conducted the *Register* for thirty-three years, from 1805 until his death at Salem Aug. 23, 1838.—His son, of the same name, still (1875) edits that paper.

Pal'grave (Sir Francis **Cohen**), b. in London, England, in July, 1788, originally named Cohen; belonged to a Jewish family; studied law; was employed in 1822 by the record commissioners; edited numerous early historical documents, and wrote a valuable *History of Normandy and England* (4 vols., 1851–64), besides several learned works upon particular periods of English history. D. at Hampstead July 6, 1861.

Palgrave (Francis Turner), son of Sir Francis, b. at London Sept. 28, 1824; educated at the Charterhouse School and at Baliol College, Oxford, where he obtained a scholarship; was elected a fellow of Exeter College; was five years vice-principal of the training college for schoolmasters at Kneller Hall, and has since been private secretary to Earl Granville and filled an important post in the educational bureau of the privy council. Author of *Idyls and Songs* (1854), *Hymns* (1867), *Lyrical Poems* (1871), and of several publications on art, and editor of *The Golden Treasury of English Lyrical Poetry* (1861), a collection made with great care and excellent judgment.

Palgrave (William Gifford), son of Sir Francis, b. at Westminster Jan. 24, 1826; educated at the Charterhouse and at Trinity College, Oxford, where he graduated with first-class honors 1846; served as an officer of the Bombay Native Infantry from 1847 till 1853, when he resigned his commission, joined the Roman Catholic Church, entered the Society of Jesus, studied theology at the Jesuit seminary at Laval, France, took orders as a priest, was sent as a missionary to Syria, resided several years in and near Damascus, obtained an intimate knowledge of Arabic and of Mohammedan theology, and undertook, in 1862, with the approval of his superiors and at the expense of Napoleon III., a daring journey through the Wahabite kingdoms of Central Arabia in the disguise of a physician; returned to Europe 1863; left the order of Jesuits 1864; published his *Personal Narrative of a Year's Journey through Central and Eastern Arabia* (2 vols., 1865); went to Egypt on a special mission for the release of the prisoners held by King Theodore of Abyssinia, July, 1865; was appointed British consul at Soukhoum-Kalé 1866, at Trebizond 1867, and at St. Thomas, West Indies, 1873; published *Essays on Eastern Questions* (1872), *Hermann Agha, an Eastern Narrative* (1872), *Alkamah's Cave, a Story of Nejd* (1875), and began in Dec., 1875, the publication in the *Contemporary Review* of his recent travels in Dutch Guiana.

Pāli is the language in which the sacred books and standard literature of the Southern Booddhists are written. It bears about the same relation to Magadhī, the language spoken in Megadha at the time when Booddha was alive, as ecclesiastical does to classical Latin, and about the same relation to Sanskrit as Italian does to Latin. Immediately after Booddha's cremation (which certainly took place between 400 and 543 B. C., and probably about the former date) a council of 500 of his disciples was held, at which the principal doctrines of the great teacher were repeated and collected into the books of the so-called *Three Caskets*. These were handed down orally from each generation of priests to the next, but in course of time opinions, not so much about Booddha's own attributes as about his ethical teachings, began to differ, or, as Booddhist theologians say, heresies arose. To cleanse the priesthood from these heresies and to settle all points then in dispute, a council was held about 250 B. C. at Pātali-putra (the modern Patna), under the celebrated emperor of India, Asoka the Great, and by that council the Booddhist canon was finally settled. Eleven years afterwards, Asoka's son, Mahendra, introduced Booddhism into Ceylon, and with it the Pāli sacred books, which were handed down orally in that island until about 80 B. C., when they were for the first time committed to writing at Alu-Cue, about 2 miles N. of the present Kachchēri at Mātalē. There is no doubt that the books now current in Ceylon are substantially the same as those then written; but during the intervals of nearly a century and a half since their first promulgation in Ceylon, and of the further period, at least as long, which elapsed between Booddha's death and the council of Pātali-putra, it is possible that changes and additions may have found their way into the original text; on the other hand, however, the example of the Vedas, which, under similar circumstances, were undoubtedly handed down unaltered for many centuries, is sufficient to prevent a too hasty conclusion that none of the original texts can possibly have come down to us. The proper course is to judge each book by such internal or external evidence as we possess: of those, for instance, yet published, the *Dhammapada* and *Sutta Nipāta* are evidently compilations from older books, and almost certainly, therefore, later than the first council of Rājagriha; but no reason has yet been shown why the *Upasampadā-kammavācā* may not have been then compiled.

According to Turnour and Spence Hardy the whole *Three Caskets* occupy in the native manuscript rather less than 5000 palm leaves, which, taking the *Dhammapada* as a fair sample of the rest, would give a total of about 2,000,000 words; allowing, therefore, for the greater length of Pāli words, the *Three Caskets* would occupy, if printed in ro-

man type of the size used in this article, about 1800 pages of this CYCLOPÆDIA, which is much less than has been usually stated. The commentary is nearly the same length as the text itself. Of the text about one-seventh consists of metaphysics, one-fifth of rules and directions for the Booddhist priesthood, and the remainder, about two-thirds of the whole, of hymns, parables, and sermons. Of the *Abhidhamma*, or metaphysics, nothing has as yet been edited in Europe, and of the original text of the *Winaya*, or monastic rules, only one, a small portion, viz. the little work above referred to, an excellent edition of which has been published by Mr. Dickson in the *Journal of the Royal Asiatic Society* for 1874, under the title of *The Upasampadā-kammavācā, being the Buddhist Manual of the Form and Manner of ordering of Priests and Deacons*. Without expressing any opinion on Spence Hardy's theory that Christian monasticism was derived from the Booddhists, it may safely be said that this little work, the English translation of which occupies only six and a half pages of the journal referred to, is probably the oldest form of ritual extant by which men devoted themselves to a life of poverty and chastity. From the vow of obedience and its consequences Booddhism has always been free. The *Pātimokkha*, which is a later collection of 227 of the more important of the monastic rules of this second division of the *Three Caskets*, was published in St. Petersburg in 1867 by Mr. Minayeff, in Sanskrit characters, with a Russian translation and notes. The *Dhammapada* is a similar collection of 432 choice passages from the third or ethical division; but as it has been included among the number of the sacred books, it must have been composed before the council of Pātali-putra. It was edited in 1855 by Mr. Fausböll of Copenhagen, with a Latin translation, extracts from the commentary, and notes, of which edition Prof. Max Müller says (*Buddhaghosha's Parables*, p. 10), "The greatest credit is due to Mr. Fausböll, whose '*editio princeps*' of the *Dhammapada* will mark for ever an important epoch in Pāli scholarship." Prof. Weber of Berlin published a German translation of this work in the fourteenth volume of the *Zeitschrift der deutschen morgenländischen Gesellschaft*, and Prof. Max Müller of Oxford an English translation in the introduction to *Buddhaghosha's Parables*, a translation from the Burmese published by Capt. Rogers, R. E., in 1870. Mr. Childers, professor of Pāli in University College, London, published in the *Journal of the Royal Asiatic Society* for 1869 the *Khuddaka Pātha*, the fifth book of the fifth division of the *Three Caskets*, with an English translation, and has undertaken, in conjunction with Mr. Fausböll, a complete edition of the *Jatakas*, or 550 Booddhist fables and tales, of which the first part has just been published in Copenhagen. Mr. Fausböll has already worked in this field, having published in 1858 in the *Bericht der königlichen preussischen Akademie der Wissenschaften* in Berlin a Booddhist fable called the *Makasa Jātaka* with a German translation; nine more jataka stories, under the title *Five Jātakas*, in 1861; two more, under the title *Two Jātakas*, in the *Journal of the Royal Asiatic Society* for 1870; three more, under the title *Dasaratha Jātaka*, in 1871, and twelve more, under the title *Ten Jātakas*, in 1872. English translations are added to nineteen out of these twenty-seven texts, the study of which, not to speak of their intrinsic interest, affords the best introduction to a knowledge of the Pāli language. Among these old Booddhist stories are many of the fables formerly ascribed to Æsop, and many of those comical and fairy tales which have long been the delight of European childhood.

It will be seen from the foregoing account how small a portion of the Pāli sacred books and commentaries has been published in the West, most of our knowledge of Booddhism being derived from translations and other works in the modern languages of Booddhist countries; to describe them does not come within the scope of this article, and on the subject of Booddhism generally we would refer the reader to our article under that head; but the later Pāli works demand some notice here. Though later, many of them are of great antiquity and interest, and among them the old Sinhalese royal and temple chronicles derive especial importance from the fact that they are the only ancient works existing in India which really deserve the name of histories. The oldest, the *Dīpavansa*, or *History of the Island* (of Ceylon), was written shortly after 300 A. D. in Anurādhapura, and contains in its first eight cantos a sketch of Booddhism in India before its introduction into Ceylon; the best known, the *Mahāvansa*, is the work the publication of the first volume of which in 1837 by the Hon. George Turnour, then of the Ceylon civil service, formed so marked an epoch in Oriental research. The original was written in Ceylon by Mahanāma, a priest, who died about 500 A. D., and commences, like the *Dīpavansa*, with a history of Booddhistic India; a new and complete edition of it is now very much required, as, though Turnour's work was of the greatest historical importance, and the foundation of all Pāli scholarship, yet the text, printed from a single manuscript, is in many places corrupt, and the edition has now become very rare. I have published two more chapters of the *Mahāvansa;* and a further account of the unpublished Ceylon histories will be found in my article on Ceylon inscriptions in the *Journal of the Royal Asiatic Society* for 1874. The only others as yet published are the *Dāthāvansa*, or history of the celebrated tooth-relic still preserved in Kandy, which was written about 1200 A. D., based on an earlier work in Sinhalese, and of which an excellent edition has just been published in London by Sir Coomāra Swāmy; and the *Attanagaluvansa*, a temple chronicle, written about 1300 A. D., and published in Colombo in 1866 by Mr. James d'Alvis. The latter author had published in 1863 a portion of the oldest Pāli grammar in Pāli, that of Kaccāyana, a complete and very excellent edition of which we owe to M. Senart in the *Journal Asiatique* for 1871. Finally, Pāli studies will receive a fresh impulse from the publication of Dr. Kuhn's *Pali Grammatik*, already in the press, and the completion of the *Pāli Dictionary* by Mr. R. C. Childers, to whose industry and scholarship all Pāli scholars are so deeply indebted. T. W. RHYS DAVIDS.

Palia'no, town of Italy, province of Rome, 30 miles N. E. of the city of Rome. This town, 1500 feet above the sea and strong from its natural position, was walled and provided with towers and bastions during the Middle Ages. Like so many other places in the papal territory, its possession was for centuries a subject of bitter contention between the popes and great Roman feudal lords, especially the Colonna. It is reached by a single road, has still its draw-bridge, and the walls are entered by only two gates. The principal buildings are the church, the baronial Colonna palace, and a few others. Pop. in 1874, 5500.

Pali'ci, Lake of (or **Nassia**), a small lake not far from Catania in Sicily, interesting to the geologist for the great quantity of carbonic gas which issues from it, and which throws up the water in jets to the height of six feet. In ancient times this lake was used as an ordeal for accused persons, who, being placed over the mephitic crater, called on the presiding divinity to attest their innocence. If they were able to resist the deadly effect of the vapor during the ceremony, they were released.

Palikao, de (Gen. COUSIN-MONTAUBAN), COUNT, b. in Paris June 24, 1796; served in Spain, and for twenty years in Africa; rose to be general 1851. In the expedition to China (1860) he commanded the French troops, gaining the victory of Palikao, carried the forts of Taku, and marching to Pekin enforced the conditions of peace submitted by the allied powers. He received for these services the cross of the Legion of Honor; was raised to the rank of senator with the title of count. In Aug., 1870, he succeeded M. Ollivier as premier of the French ministry; and acted as minister of war. He published in 1871 an account of the events of his ministry. D. Jan. 8, 1878.

Pal'impsest, a word derived from two Greek words, πάλιν, "again," and ψηστός, "rubbed" or "scraped," is used either absolutely, or as an adjective with the word manuscript, to indicate an ancient writing of which the original ink has been washed away or erased to enable a scribe to use the material again. Another and less universal signification attached to this word is that of a tablet of wax, clay, or other soft substance, of which the writing could be erased at will of the writer. It was thought that the monks of the early Middle Ages had been the first to practise the somewhat discreditable art of erasing valuable classical manuscripts when the supply of material on which to inscribe their theological and philosophical effusions ran short, but Henri Etienne deduces from passages in the works of Plutarch that the Greeks themselves were not unacquainted with the process, and called the result a *palimpsest*. This very word occurs in the phrases ὥσπερ παλίμψηστα, and ὥσπερ βιβλίον παλίμψηστον, in Plutarch; and other passages may be compared in Cicero's letters to Trebatius, and Catullus's epigram *Contra Suffenum*. In the earliest times there is little doubt that extreme dearness and scarcity of parchment, produced by the want of skilled and organized workmen, caused scribes and authors to take refuge in this means of perpetuating their productions to the detriment of others who had preceded them, but it is probable that only writings of an ephemeral and trivial nature were allowed to pass under the scraping-knife of the vellum-seller. In later days, when the dissemination of letters had become general, there is equally little doubt that good, even in some cases unique, classical texts were ruthlessly destroyed for the sake of inserting matters of little or no value. The extensive conquests of the caliph Omar in these days nearly annihilated the manufacture of papyrus, hitherto furnished in great quantity

by Egypt, but destroyed along with the other national industries which fell together with the native rule, and no other means of writing was in existence to supply the deficiency. Parchment, or vellum, always dear and by no means universally plentiful, soon became enhanced in value, and the large styles of uncial and capital writings then in vogue assisted this dearness by reason of the large amount of writing surface required. Hence naturally sprung the adoption of the palimpsest; and from the fortunately imperfect manner of erasing the writing, the good and caustic qualities of the inks, and the manner of almost pressing in the letters into the substance of the vellum, the old writings were frequently left but partially scraped away and visible more or less distinctly under the new sentences. By these means many valuable recoveries of old texts have been achieved, such, for example, as the *Republica* of Cicero by the fortunate labor of M. Mai. Nevertheless, the erasure of manuscripts has been so extensively carried on that the world has without doubt lost on this account a large number of classical works. The works of Anacreon, the *Comedies* of Menander, the *Epics* of Ennius, the lost decades of Livy, the miscellaneous productions of Varro, and hundreds of other authors, which are known to have been extant as late as the seventh century, owe their loss entirely to the scalpel of the vellum merchant and the scribe of this era, which was *par excellence* the worst of all for making palimpsests, because it intervenes between the dispersion of the papyrus manufacture and the rise and general adoption of the productions of the paper-makers. To this era, too, must be attributed the great loss we sustain to-day in classical literature. The widely-felt need of a vehicle for recording writings went beyond attacking vellum only; for, according to M. Natalis de Wailly, a French palæographer of eminence, a palimpsest manuscript on papyrus has been found by him during his researches. Had it not been for the Eastern invention of thick cotton or vegetable paper (*carta bombycina*) in the ninth century, the rage for multiplying theological dissertations would probably have brought about the total destruction of all other older manuscripts. From that period, however, to the thirteenth century, when rag-paper was first employed, the *carta bombycina* gradually extended its use throughout the literary world. In process of time, however, the manuscripts which had been subjected to the process of scraping and obliteration fell under the notice of those who endeavored to restore their original texts. At first the imperfect knowledge of a means of restoring the faded inks and the want of any definite palæographic skill rendered the results unsatisfactory. But in the eighteenth century, Knittel, a German theologian, carefully went through the palimpsests at Wolfenbüttel, and was so fortunate as to identify fragments of the Bible of Ulphilas, translated from Hebrew into Gothic. P. J. Bruns discovered several of them at Rome in the library ceded by Christina of Sweden to the Vatican; his efforts were carried out by means of a chemical formula given by Blagden in the *Philosophical Transactions* for the year 1787, part ii. One of his best discoveries was that of portions of Livy, and Cicero *pro Roscio*, over which had been written a Latin version of the Scriptures. Niebuhr discovered in the same manuscript another work of Cicero, that *pro M. Fonteio*, and published it in 1820. Angelo Mai rendered himself celebrated in deciphering erased texts of palimpsests in the Ambrosian Library at Milan, many of which had originally been deposited in the monastery of Bobbio, some of his most interesting discoveries being diverse pieces of Cicero and the *Letters* of Fronto, over which were written the acts of the Council of Chalcedon. Many curious morsels of antiquity have thus been patiently rescued from oblivion; as, for example, the *Fables* of Hyginus, fragments of Aulus Gellius, Pliny, Sallust, and Tacitus; the *Institutions* of Gaius, which Niebuhr was able to recover almost entire from a palimpsest at Verona; fragments of the *Code* of Theodosius; the *Decretals* of Gratian, found by A. Peyron; portions of the *Phaethon* of Euripides, found by C. Tischendorf beneath the Pauline Epistles, and a considerable portion of the works of the historian Granius Licinianus, read by G. H. Pertz under a Syriac manuscript in the British Museum. Dr. W. Wright, professor of Arabic in the University of Cambridge, gives in his *Catalogue of Syriac Manuscripts in the British Museum* an account of a large number of palimpsests, including Arabic prayers, Coptic Old Testament and Pentateuch, Greek *Iliad*, Euclid, Gospels of St. Luke, and *Catena Patrum*. Some of these are in part doubly palimpsest. Dr. Fridegarius Mone of Carlsruhe published in 1855 a work entitled *De Libris Palimpsestis tam Latinis quam Græcis*. In this work the author indicates at length the state of some of the principal libraries of Europe from the fifth to the tenth centuries, the causes which led to the practice of making palimpsests, the means of restoring faded writings, and he concludes by a list of the Latin and Greek palimpsests which have been identified up to that time, and the progress that has been made towards their restoration and publication. From among these may be cited the works of Cicero, Fronto, Gargilius Martialis, Aulus Gellius. Hyginus, Juvenal, Livy, Lucan, Persius, Plautus, Pliny, Ovid, Sallust, Seneca, Terence, and Virgil, in the Latin list; in the Greek, Euripides, Galen, Aristotle, Hermogenes, Diodorus Siculus, Menander, Iamblichus, Ephræm Syrus, and many others of very great interest and importance in the classical and early Christian ages. W. D. BIRCH.

Pal'indrome [Gr. παλίνδρομος, "running back again"], a line, usually metrical, which reads the same backward and forward; as, "Able was I ere I saw Elba."

Palinu'rus (now *Capo Palinuro*), a promontory on the coast of Lucania, in the Tyrrhenian Sea, between Velia and Buxentum, received its name from Palinurus, the pilot of Æneas, who, according to tradition, was buried here. Some remains of old buildings still bear the name of the tomb of Palinurus. The place was twice the scene of great disasters, two large Roman fleets being wrecked on the rocky shores, one in 253 B. C., the other in 36 B. C.

Palisade', post-v. of Lander co., Nev., on the Central Pacific R. R., so named from the majestic mountain-range, is the point of departure for the White Pine mining district. Pop. 39.

Palisades, post-v. of Rockland co., N. Y., situated on the W. bank of the Hudson River, upon an elevated plateau 200 feet above tide-water, contains some very interesting relics of Revolutionary times, among others the dwelling known as the "big house," in which Gens. Washington and La Fayette often dined. It is now chiefly the summer residence of a number of gentlemen doing business in New York City. Pop. about 400. W. S. GILMAN, JR.

Pal'issy (BERNARD), b. at Capelle Biron, in the department of Lot-et-Garonne, France, about 1510, in humble circumstances; was apprenticed to a potter, and afterwards, on account of his knowledge of geometry, engaged for some time as a land-surveyor, but pursued, in spite of poverty, religious persecutions, and manifold impediments, the art of pottery, enamelling, glass-painting, etc., not only with a natural talent and untiring energy, which made him one of the first artists of the French Renaissance, but also with a truly scientific method in his researches, which led him to new and valuable chemical observations. He was a Protestant; and although exempted from the massacre of St. Bartholomew by special order from the queen, in whose service he stood, he was twice imprisoned as a heretic—in 1557, when he was liberated by the intercession of the constable of Montmorency, and in 1588, when he was thrown into the Bastile and kept there to his death in 1590. The most remarkable of his glass-paintings is a representation of the myth of Psyche, after Rafaello. Of his pottery, vases, ewers, jugs, salvers, etc., generally small in size, but highly finished, collections are formed in several of the Paris museums; and these articles are much valued for their fineness of material, elegance of form, and beauty of decoration. His writings, containing many new and true observations on the formation of springs, on the fertilizing power of marl, on the best means of purifying water, etc., were published in 1777 by Faujas de St. Fond and Gobet, and in 1844 by A. Cap. His *Life* was written by H. Morley (2 vols., London, 1852) and by J. Salles (Nîmes, 1855).

Palla'dio (ANDREA), b. at Vicenza Nov. 30, 1518; studied first sculpture, but was led by his passion for mathematics to the study of architecture, in which art he became one of the greatest masters. He lived and built principally in Venice and Vicenza, where he d. Aug. 19, 1580. His principal buildings are the churches of San Giorgio Maggiore and Il Santissimo Redemptore, and the atrium and cloister of the convent Della Carità in Venice, the Teatro Olympico, and a great number of palaces in Vicenza. He also wrote a work on architecture, first published at Venice in 1570, and subsequently often reprinted; and from this work, as well as from the imitation of his actual constructions, originated the so-called Palladian style.

Palla'dium. The celebrated Palladium of Troy—τὸ μεμυθευμένον Παλλάδιον, as Dionysius calls it—was to the Greek poets and historians what the Holy Grail was to the Arthurian romances. We translate the account of its origin, as given by Apollodorus (Lib. iii. c. 12, 3): "They say that Athene after her birth was brought up by Triton, who had a daughter Pallas. On a day Pallas and Athene, as they were practising warlike games together, came into contention with one another; then, just as Pallas was about to strike a blow, Zeus in fear stretched his ægis before her; but she, being ware, looked up, and fell wounded by Athene. Then Athene made great moan over her and raised a statue to her, and girded round the breasts thereof the ægis which

Pallas had feared, and placing this statue next that of Zeus did honor to it. But afterwards, when Electra, after her ravishment, fled thither, then did Athene cast down the Palladium on to the land of Ilium. But Ilus prepared a temple for it and did honor to it; and such is the tale told of the Palladium." According to an old poet quoted by Dionysius (i. 69), the Palladium was given by Zeus to Dardanus; on the taking of Troy a copy of the statue was exposed by the Trojans, while the real Palladium was hidden away, to be brought afterwards by Æneas to Italy. Dionysius further tells us that the Trojan Palladium was supposed to be preserved in the Roman temple of Vesta. According to the usual account, the Greeks having learnt that Troy could not be taken so long as the Palladium remained in the city, Ulysses and Diomedes stole it away. In a later legend it is related that Diomedes, driven by stress of weather to Italy on his return from Troy, in obedience to the promptings of the gods gave back the Palladium to Æneas. Many cities, both Greek and Italian, pretended to possess the true Palladium—in Greece, Athens and Argos; in Italy, Lavinium, Luceria, and Siris. Pausanias (i. 28 *seq.*) gives a legend that the Athenians took it from Diomedes when that hero on his return, being brought to Attica in ignorance of the country he was in, attempted to plunder the inhabitants. A. H. BULLEN.

Palladium (symbol Pd), a white or steel-gray metal of the platinum group, and usually associated with platinum, discovered by Dr. Wollaston in 1803. It is ductile and malleable, and infusible in an ordinary furnace, but melts at a lower temperature than platinum, and burns with scintillation in the oxyhydrogen flame. It does not oxidize readily, but dissolves in hot nitric acid or aqua regia. It alloys readily with gold, and renders it white if present to the extent of 20 per cent. With silver it forms a ductile compound. The specific gravity ranges from 11.3 to 11.8, and is increased to over 12 if hammered. This metal has been used for the graduated scales of astronomical instruments, for which its color, hardness, and unalterability in the air render it especially suitable. An ingot of pure palladium valued at $9600, and extracted from native platinum and gold of the value of $5,000,000, was exhibited at the Vienna Exhibition in 1873.

W. P. BLAKE.

Palla'dius. 1. RUTILIUS TAURUS ÆMILIANUS, a Roman author, probably from the fourth century of our era, wrote a work on agriculture, *De Re Rustica*, in fourteen books, which was much used during the Middle Ages. Edited by J. G. Schneider in his *Scriptores Rei Rusticæ Veteres Latini*, Leipsic, 1795; translated into English by Thomas Owen, London, 1803.—2. A Christian Father, b. in Galatia in 367 A. D.; bishop of Helenopolis in Bithynia in 400, and of Aspona in Galatia in 420. D. in 430. Wrote the *Historia Lausiaca*, a collection of biographies of hermits, dedicated to Lausus, governor of Cappadocia, published by Meursius (Leyden, 1616), and by Fronto Ducæus in his *Auctarium* (Paris, 1624).—3. A Greek author on medicine, lived probably in Alexandria in the seventh century of our era, and wrote commentaries on the works of Hippocrates, and a book on fevers, edited by Bernard (Leyden, 1745).

Pal'lah [Dutch *roode bok*, or "red buck"], a fine dark-red antelope of S. Africa, the *Æpyceros melampus*. It has a white belly, a black mark upon the croup, and black tufts on the back part of each foot. It has long handsome horns, somewhat lyrate and ringed. Its flesh is good, though dry. It is very swift, but when surprised has the singular habit of trying to steal away undiscovered. It is found in considerable herds in bushy places.

Pallan'za, town of Italy, province of Novara, situated on an elevated promontory of Lago Maggiore. This town, from the extraordinary beauty of its position and its delicious climate, is now much frequented by travellers. Pop. in 1874, 4000.

Pal'las (PETER SIMON), b. at Berlin Sept. 22, 1741; studied medicine and natural science; visited England and Holland; published in 1766 his *Elenchus Zoophytorum* and *Miscellanea Zoologica*, still of value; was invited by Catharine II. in 1768 to Russia as professor of natural science at the Academy of St. Petersburg; made from 1768 to 1774 a journey of exploration through Southern Siberia to the frontier of China; resided for many years in the Crimea, where the empress gave him extensive estates, and partook with great activity in all scientific undertakings in Russia, but returned at last to Berlin, where he d. Sept. 8, 1811. Those of his numerous works best known and still of interest are *Travels through the Southern Provinces of the Russian Empire* (Leipsic, 1799–1801); translated into English 1812; *Flora Rossica* (2 v. fol., 1784–88), not completed, and *Sammlungen historischer Nachrichten über die mongolischen Völkerschaften* (2 v., St. Petersburg, 1776–1802).

Pallavici'no (PIETRO SFORZA), b. at Rome Nov. 20, 1607, of wealthy parents; received a careful education; took holy orders; entered the Society of Jesuits in 1637; was made a cardinal in 1657, and d. at Rome June 5, 1667. He was an accomplished scholar and a copious writer. The best known of his works is *Istoria del Concilio di Trento* (2 vols., fol., Rome, 1656–57), often reprinted afterwards, which was written, to some extent at least, in opposition to the liberal work on the same subject by Paoli Sarpi.

Pal'lee, town of Hindostan, in the dominion of Joodpoor, on the Luny, has an extensive transit-trade in opium and European manufactures. The annual revenue of its custom-house amounts to £7500. It is well provided with water. Pop. 50,000.

Pal'liser (JOHN), b. at Comragh, Ireland, in 1817; went to Canada in early life; spent several years among the Indians of the North-west; published *The Solitary Hunter, or Sporting Adventures in the Prairies* (1853); was British commissioner for the determination of the boundary between the U. S. and the Hudson's Bay territories W. of Lake Superior 1857–60, and prepared important reports upon the topography and resources of the regions traversed, which were published by order of Parliament 1861.

Palliser (Sir WILLIAM), C. B., b. in Dublin, Ireland, June 18, 1830; was educated at Rugby, Trinity College, Dublin, Trinity Hall, Cambridge, and the Sandhurst College; became ensign in the British rifle brigade 1855, and joined the 18th Hussars in 1858; became captain 1859, major, unattached, 1864, and retired from the service by sale of his commission in 1871. He is the inventor of the Palliser projectiles, designed for piercing armor-plated ships; has also invented an improved method of rifling iron wrought cannon for use both in ships and on fortifications, and of converting smooth-bore cast-iron ordnance into rifled guns. He was knighted by the queen Jan. 21, 1873.

Pal'lium [Lat., a "robe"], in the Roman Catholic Church, a band of white lamb's wool, embroidered with black crosses, worn upon the neck by the pope and all ecclesiastics of archiepiscopal rank, including metropolitans and patriarchs. It was once made of linen, embroidered with purple, and was worn by all bishops. At present, the pallium has two pendants, one hanging down the back and one down the breast of the wearer. It is the chief badge of the archbishop's authority; is granted by the pope in person, and is worn only upon very solemn occasions. The pope, however, wears it continually. It is always buried with the wearer, and can never be transferred to another person.

Palm. See PALM OIL, PALM TREE, and PALM WINE.

Palm [Lat. *palma*, "hand"]. Most ancient measures were derived from parts of the human body, originally, no doubt, indicating the actual measuring by the foot, the palm of the hand, etc., but in process of time acquiring a fixed and theoretical value. The Roman *palmus* was of two lengths—respectively of nine and three inches. The *palmus major* is found in the later writers, the common palm being that of four digits (3 inches). The modern Italian measure of *palmo* is derived from this larger palm, but it varies somewhat in the different parts of the country. WILLIAM E. A. AXON.

Pal'ma, one of the CANARY ISLANDS (which see). Area, 330 square miles, with 33,089 inhabitants. It contains the interesting, now extinct, volcano Caldera de Taburiente, produces good timber, and has two fine towns, St. Cruz and Los Llanos.

Palma, town of Spain, the capital of the province of Baleares, on the south-western coast of the island of Majorca. It is surrounded with walls and fortified with thirteen bastions, and has a fine harbor with a mole 500 yards long, and lined on both sides with dockyards, in which very active shipbuilding is carried on. The city is well built, and contains many elegant buildings, both private and public, among which the most remarkable are the cathedral, the exchange, and the governor's palace. It has many good educational institutions and manufactures of silk, soap, brandy, and glass. Pop. 40,418.

Palma (JACOPO), (called IL VECCHIO, "The Elder," to distinguish him from his nephew, IL GIORINE), an Italian artist, b. at Lerinatta, near Bergamo, about 1490; d. about 1560 (dates are confused), occupies a place between Bellini and Titian. He was a gentle, thoughtful painter, excelling in grace and color. His works were numerous; the best are *The Three Graces* at Dresden, the altar-piece of the S. Maria Formosa at Venice, the *Adoration of the Magi* at Milan, a *Holy Family* in S. Stefano at Vicenza. All the European galleries have specimens of his art. England is

rich in them. The famous *Bella di Tiziano* in the Sciarra Gallery at Rome is ascribed to Palma Vecchio.
O. B. Frothingham.

Palma (Jacopo), (Il Giorini), nephew of the above, b. at Venice about 1544; d. 1628; studied in Venice and Rome; an ambitious but hasty artist, coming somewhere between Tintoretto and Veronese: great among small painters, small among great ones. His best pieces are in Venice. O. B. Frothingham.

Pal'ma del Ri'o, town of Spain, in the province of Cordova, stands on the Xenil at its influx into the Guadalquivir, and has 5391 inhabitants.

Pal'ma di Montechia'ro, town of Sicily, in the province of Girgenti, is celebrated for its excellent oranges, figs, almonds, and grapes. Pop. 11,188.

Palmas, Cape. See Cape Palmas.

Palmas, Ciudad Real de las. See Las Palmas.

Palm'er, in mediæval times, a pilgrim returned or returning from the Holy Sepulchre, so called from the fact that he bore branches of palm gathered near Jericho, which were placed upon the church altar after the palmer's return. The palmer also employed the consecrated scrip (a leathern wallet) and staff; and it was further customary for him to visit the holy places of other lands during his return. Thus, after his visit to the shrine of St. James the Less at Compostella, he wore the scallop-shell (*Pecten Jacobæus*), the cognizance of the great apostle.

Palmer, post-v. and tp., Hampden co., Mass., situated at the junction of the Boston and Albany and New London Northern R. Rs., 15 miles E. of Springfield, contains 6 churches, 1 bank, a weekly newspaper, a carpet manufactory, an iron foundry and machine-shops, and 3 hotels. Pop. 3631. G. M. Fisk, Ed. "Palmer Journal."

Palmer, post-v. of Marquette co., Mich., on the Marquette Houghton and Ontonagon R. R., near the Roanoke River.

Palmer, tp. of Putnam co., O. Pop. 434.

Palmer, tp. of Washington co., O. Pop. 671.

Palmer, tp. of Northampton co., Pa., at the confluence of the Lehigh with the Delaware River, includes borough of Easton. Pop. 1444.

Palmer, post-v. of Ellis co., Tex., on the Houston and Texas Central R. R., near Trinity River.

Palmer (Anthony), a gentleman of wealth, who in 1708 removed to Pennsylvania from the W. Indies; was president of the Pennsylvania council and acting governor of Pennsylvania 1747–48. His twenty-one children by his first wife all died of consumption, and his descendants by a second wife long resided in Philadelphia. D. in 1749.

Palmer (Edward Henry), b. at Cambridge, England, Aug. 7, 1840; graduated at the university of that city 1867; was a member of the Sinai Surveying Expedition of 1868–69, and the survey of Moab in behalf of the Palestine Exploration Society 1869–70; acquired a good practical knowledge of Oriental languages, and became professor of Arabic at Cambridge 1871. Author of *The Negeb, or South Country of Scripture* (1871); *The Desert of the Exodus* (1871); of several translations from and into the Persian language, and of a *Persian-English and English-Persian Dictionary* (1875).

Palmer (Elihu), b. at Canterbury, Conn., in 1764; graduated at Dartmouth College 1787; studied theology; became a deist 1791; resided for some time in Augusta, Ga., where he collected materials for Dr. Jedidiah Morse's *Geography;* afterwards became conspicuous at New York and Philadelphia; became blind in consequence of an attack of yellow fever 1793; published a Fourth-of-July oration 1797; *Principles of Nature* (1802), and *Prospect or View of the Moral World* (2 vols., 1804). D. at Philadelphia, Pa., Apr. 7, 1806.

Palmer (Erastus Dow), b. at Pompey, N. Y., Apr. 2, 1817; was for some years a carpenter at Utica; began in 1846 to cut cameos; achieved great success; removed to Albany; began a new career as a sculptor 1852; has produced above 100 works in marble, including several portrait-busts of eminent men; has executed meritorious groups of allegorical and mythological characters, and a group of fifteen figures representing the landing of the Pilgrims, intended for the Capitol at Washington.

Palmer (Frank W.), b. at Manchester, Ind., Oct. 11, 1827; learned the printing trade; practised as a journeyman in New York City; was for ten years editor and publisher of the Jamestown *Journal,* 1848–58; member of the New York Assembly 1853–54; removed to Dubuque, Ia., 1858, where he edited the *Times;* State printer at Des Moines 1860–68; Republican member of Congress 1869–73, after which he established and edited at Chicago the *Inter-Ocean* newspaper.

Palmer (George W.), b. in Hoosick, N. Y., Jan. 13, 1818; became a lawyer; was surrogate of Clinton co., N. Y., 1843–47; was in Congress 1859–63, and in 1866 became a judge of the mixed court at Freetown, Sierra Leone, for the suppression of the slave trade.

Palmer (Innis N.), b. at Buffalo, N. Y., Mar. 30, 1824; graduated from the U. S. Military Academy; served in the Mexican war; subsequently on frontier duty; at the battle of Bull Run, July 21, commanded the cavalry regulars; appointed brigadier-general of volunteers Sept., 1861; transferred to North Carolina Dec., 1862, and participated with Gen. Sherman's army during its operations in North Carolina, receiving the various brevets from lieutenant-colonel to that of major-general for his services. In June, 1868, he attained the colonelcy of his regiment (2d Cavalry), with which he has served on our frontier since the war.

Palmer (Admiral James S.), b. in New Jersey in 1810; entered the U. S. navy as midshipman 1825; was engaged in naval battles in Sumatra 1838; commanded a blockading vessel on the Mexican coast 1846–47, and on the Atlantic coast of the Confederate States 1861–62; became captain July, 1862; led the advance at the passage of the Vicksburg batteries 1862; was Admiral Farragut's flag-captain at the battles of New Orleans and Mobile; commanded North Atlantic squadron 1865; became rear-admiral 1866. D. of yellow fever at St. Thomas Dec. 7, 1867.

Palmer (Gen. John McCauley), b. at Eagle Creek, Ky., Sept. 13, 1817; removed to Illinois 1832; settled at Carlinville 1839; was admitted to the bar 1840; took an active part in politics; State senator 1852–55; was prominent in the organization of the Republican party 1856; delegate to the Peace Convention at Washington, D. C., Feb., 1861; appointed colonel 14th Illinois volunteers in April; accompanied Gen. Fremont in his expedition to Springfield, Mo.; appointed brigadier-general of volunteers Dec., 1861, and made major-general of volunteers Nov. 29, 1862; was in command of 14th corps in Sherman's Atlanta campaign May–Sept., 1864, when he was relieved; subsequently in command of department of Kentucky; resigned Sept., 1866; governor of Illinois 1869–73.

Palmer (John Williamson), M. D., b. at Baltimore Apr. 4, 1825; was well educated, and studied medicine in Philadelphia; was city physician of San Francisco, Cal., in 1849; went in 1852 to China; served 1852–53 as surgeon of the East India Company's war-steamer Phlegethon in the Burmese campaign; has been a large contributor to American periodicals; was active in the Confederate cause 1861–65; became afterwards an editor in Baltimore. Author of *The Golden Dagon* (1853), *The Queen's Heart,* a successful comedy (1858), *The New and the Old* (1859); has translated Michelet's *L'Amour* and other works from the French; compiled *Folk-songs* (1860) and several other volumes of selected poetry; is widely known for his admirable papers on East Indian life.—His wife, Henrietta Lee Palmer, b. in Baltimore in 1834 and married in 1855, is the author of *The Heroines of Shakspeare* (1858) and of translations from the French, etc.

Palmer (Gen. Joseph), b. in Massachusetts in 1718; was a member of the provincial congress of Massachusetts 1774–75; was a member of the committee of safety appointed by that body; was colonel of militia during the operations of 1775–76, and brigadier-general in the Rhode Island campaign of 1777. D. at Roxbury Dec. 25, 1788.

Palmer (Joseph), M. D., b. at Needham, Mass., Oct. 3, 1796; graduated at Harvard College 1820; studied medicine; taught school at Roxbury, and was one of the masters of the Latin school at Boston for some years; resided in Cuba 1829–30, after which he became connected with the Boston press; was a painstaking investigator of the early annals of Massachusetts, historiographer of the Massachusetts Historical Society and the New England Genealogical Society 1856–61, and author of the annual necrology of Harvard College which appeared in the Boston *Daily Advertiser* 1851–68. A volume of his *Necrologies* (1851–63) was reprinted in 1864. D. at Boston Mar. 3, 1871.

Palmer (Ray), D. D., b. at Little Compton, R. I., Nov. 12, 1808; graduated at Yale College 1830; studied theology at New Haven; became pastor of Congregational churches at Bath, Me., 1835, and at Albany, N. Y., 1850, and secretary of the American Congregational Union at New York 1866. Author of many literary contributions to reviews, some doctrinal works, and several volumes of religious poems, among which is the favorite hymn, "My faith looks up to Thee." A collection of his poetical works was issued in 1875.

Palmer (Roundell), D. C. L., Baron **Selborne,** b. at Mixbury, Oxfordshire, Nov. 27, 1812, was educated at Rugby and Winchester schools; graduated at Trinity College, Oxford, 1834, with high honors, obtaining a fellowship at

Magdalen College and the Eldon law scholarship; was called to the bar 1837; entered Parliament 1847; became queen's counsel 1849; knighted and appointed solicitor-general 1861; was attorney-general 1863–66; was counsel of the British government before the Geneva court of arbitration on the "Alabama claims" 1871; became lord chancellor with the title of Baron Selborne of Selborne, Hampshire, Oct., 1872, retiring from that office Feb., 1874. Author of *The Book of Praise, from the best English Hymn-writers* (1862), and well known from his advocacy of the establishment of a law university at London.

Palmer (William Adams), b. in Vermont about 1780; was a member of the Vermont legislature six years; clerk of the courts eight years; elected judge of the supreme court 1816; State senator two years; was U. S. Senator 1818–25; judge of probate and of the county court; member of the constitutional conventions of 1828 and 1836, and governor of Vermont 1831–35. D. at an advanced age at Danville, Vt., in Dec., 1860.

Palmer (William Pitt), b. at Stockbridge, Mass., Feb. 22, 1805; studied medicine; became a teacher in New York City; was employed in the public service; was for some years a journalist, and author of numerous essays and poems.

Palmer's Springs, p.-v. and tp., Mecklenburg co., Va. Pop. 1618.

Palm'erston (Henry John **Temple**), Viscount, and Baron Temple, b. at Broadlands, Hampshire, England, Oct. 20, 1784, a son of an Irish peer of the family of Sir William Temple; succeeded in 1802 to his title; was educated at Harrow and St. John's College, Cambridge, where he passed M. A. in 1806; declined the election to the House of Lords as a representative peer for Ireland; entered Parliament for Bletchingley 1806; represented Newport in Parliament 1807–11, and Cambridge University 1811–31, and after that represented Bletchingley, South Hants, and Tiverton; became a junior lord of the admiralty 1807; was secretary at war 1809–28, under five administrations, having abandoned high tory principles for moderate liberalism; was secretary of state for foreign affairs 1830–34, 1835–41, and 1846–52, attaining great distinction as a diplomatist; secretary of state for home affairs 1852–55; premier and first lord of the treasury 1855–58 and 1859–65; was appointed lord warden of the Cinque Ports 1861; rector of Glasgow University 1863. D. at Brockett Hall, Herts, Oct. 18, 1865, and was buried in Westminster Abbey. (See his *Life* by Lord Dalling, 1870, incomplete.)

Palmet'to, a name properly belonging to *Chamærops humilis*, a small palm tree of Southern Europe, but also given to other small palms. Of these the U. S. has the following: (1.) *Sabal palmetto*, the cabbage palmetto, found as far N. as the Cape Fear River, in sandy soil near the coast. Its timber is useful in constructing piers, since it is durable and not subject to the attack of the teredo. The original Fort Moultrie was built of palmetto logs. The tree sometimes reaches the height of 50 feet. The leaves are largely used in making hats, and the "cabbage," or crown of young leaves, is excellent eating when boiled. The root has been proposed as a tanning material. It is highly astringent. (2.) *Sabal serrulata*, the saw-palmetto, has a creeping stem from 5 to 8 or more feet 6 inches in diameter, with thick clusters of fan-shaped leaves, the abode of many rattlesnakes. (3.) *Sabal Adansonii*, the dwarf palmetto, is stemless and has leaves two or three feet high. It covers dense patches of ground in low coast-regions. (4.) *Chamærops hystrix*, the blue palmetto, is a low palm with long-stemmed fan-like leaves, in the axils of which are sharp needle-like thorns. The roots of the palmettos are in some soils so numerous and strong as to make the ploughing of land very difficult and expensive. Much of the palmetto-leaf of commerce is derived from the Palmyra palm.

Palmetto, post-v. and tp., Pickens co., Ala. P. 581.

Palmetto, post-v. and tp., Campbell co., Ga., on the Atlanta and West Point R. R. Pop. 294.

Pal'mi, town of Southern Italy, province of Reggio, stands on the bay of Gioja and carries on an active trade. Pop. 9140. It was almost entirely destroyed by an earthquake in 1783, but was rapidly rebuilt.

Palmitic Acid. See Oleic Acid.

Palm Oil, the thick oil obtained from the fleshy pericarps of the fruit of *Elais Guineensis* and *melanococca*, a palm tree of Africa, and to some extent from other palms. It is extensively imported and made into soap, candles, and glycerine, and used for lubricating purposes. It is bleached and then pressed, and thus the palmitine is extracted for candle-making, while the elaine is used for lubricating, etc. The fresh oil is of a deep orange-red and a pleasant smell as of violets. It may be used like butter. The oil palm is now naturalized in S. America.

Palm Sunday, the Sunday before Easter, celebrated in the Greek and Roman Catholic and Lutheran churches in commemoration of the triumphal entry of the Lord into Jerusalem (John xii.), on which occasion the multitude cast branches of trees before him. These branches are represented by sprays of palm, or, in countries where the palm does not grow, by those of other trees, as of the yew, willow, box, and fir. These branches are blessed by a priest and distributed to the congregation, who wear them for the rest of the day. The custom prevails, at least locally, of gathering and preserving the "palms," which are afterwards burned, the ashes serving for use upon Ash Wednesday, the ashes of consecrated wood and of the old altar linen being also employed. It was another ancient custom that palmers returning from the Holy Land should bring with them leaves of the palm for service on Palm Sunday.

Palm Tree, a general term applicable to any individual member of the natural order Palmeæ which assumes the arborescent form. This order is, perhaps with the exception of the grasses, the most important in the vegetable kingdom for its varied uses. Its members are mostly trees with upright cylindrical trunks prolonged by a terminal bud and crowned by a few large clustered, fan-shaped, or pinnate leaves. These, as in the case of ferns, are called fronds. They are sometimes 50 feet long and 8 or 10 feet wide, and are in all cases stalked. The flowers are small, either perfect or polygamous, and with a double perianth of six divisions. The stamens are inserted in the base of the perianth, and usually as many as the petals and sepals together. Fruit a berry or drupe, with fibrous flesh and varying very much in size. Seeds with cartilaginous albumen, often hollow, the embryo lodged in a small cavity by itself. Some of the palms are shrubby and branched, while others, like the rattan, trail often as much as 1000 feet over bushes, climbing by means of hooks. Whatever may be the form, the stem is always woody and the root fibrous. The stem is hardest on the outside, where it is apt to be silicious; often it is extremely hard. Within, the stem is full of fibres, easily separable. The trunk is rough with the dilated sheathing burs of the leaves, which as they fall leave evident scars. In many it is beset with long and formidable spines. It is frequently of great height, as much as 190 feet having been measured. In the imperial gardens at Rio Janeiro there is a celebrated avenue lined on either side by gigantic leaf-crowned palms, the most graceful and picturesque of trees. A palm tree standing alone is equally majestic. The fecundity of the order is astonishing. Humboldt computed the number of flowers on a single palm at about 600,000, and the matured fruit was in equally large proportion. The flowers are borne on a spadix included in a boat-shaped spathe, which in certain species bursts with a loud explosion. The odor of the blossoms is often powerful and attracts vast numbers of insects. Von Martius, who wrote the most extended account of the palms, says of them, "Inhabitants of either world, they hardly range beyond 35° in the southern or 40° in the northern hemisphere. Particular species scarcely extend beyond their own peculiar and contracted limits, on which account there are few countries favorable to their production in which some local and peculiar species are not found. The cocoanut (*Cocos nucifera*) is one of the most widely spread. In America the *Chamærops palmetto* extends from Florida to North Carolina. It is likely that the number of species scattered over the world may be 1000, but not more than 600 are definitely known. Some love the banks of streams, others the shores of the ocean, and some ascend into high mountains; some collect in forests, and others stand singly on deserts or plains."

There are certain plants so useful to mankind, so closely connected with the uses of particular nations, that it would seem that without them these nations would cease to exist. The palm trees furnish a striking instance of this relation. The stems are used for constructing dwellings, the leaves for thatching and for making fans, while various weapons are constructed from different parts of the trees. Cordage, fishing-lines, mats, oars, walking-sticks, masts, sails, etc. are made from them. The young bud is often eaten as a sort of cabbage, while the fruits, as the cocoanut (*Cocos nucifera*) and the date (*Phœnix dactylifera*), are most delicious articles of food. Refreshing drinks and liquors, as arrack, are manufactured of the juices, and sugar is separated under the name of jaggery. Oil is also obtained, while sago, vegetable ivory (*Phytelephas*), and the betel-nut are other well-known products. Medicines and wax are derived from certain species; and indeed there is scarcely a conceivable use to which this splendid order cannot be applied.

W. W. Bailey.

Palm Wine, or **Toddy,** an alcoholic beverage prepared from the saccharine sap of various species of palm. It yields by distillation a stronger drink called arrack. Palm wine is extensively used in India and other parts of Asia; it is made in Chili, and is almost the only fermented liquor made in Africa. (See Johnston's *Chemistry of Common Life.*) C. F. CHANDLER.

Palmy'ra, one of the noblest of the palm trees, the *Borassus flabelliformis* of India and Ceylon. Its fruit is a valuable food, its timber is excellent, and it furnishes thatch, cordage, material for hats, fans, umbrellas; its leaves are used for writing tablets; sugar and arrack it produces abundantly. The young shoots are boiled and eaten, the seeds are edible, and the fruit yields a useful oil. This most useful tree is from 20 to 60 feet high and very beautiful, and its leaves are very large. Palmyra-wood is the commercial name of this and of various other palms.

Palmyra, an ancient city of Upper Syria, situated in an oasis, 120 miles N. E. of Damascus, was founded or enlarged by Solomon (1 Kings ix. 18; 2 Chron. viii. 4), and formed at that time a bulwark against the Bedouin hordes of the desert. Under the wars between the Romans and the Parthians it acquired great importance, developed a vast commercial activity, and became a splendid city. In the third century of our era, Odonathus, a native of Palmyra, established an independent Palmyrene kingdom, which was further extended, comprising the whole of Syria and parts of Mesopotamia, and brought to great prosperity by his widow, Queen Zenobia. But when the queen refused to acknowledge the authority of the Roman emperor, Aurelian defeated her army, dissolved her empire, and captured her capital in 273. A revolt, during which the Roman garrison was slain, occasioned its destruction shortly after, and it never recovered, though in 527, Justinian rebuilt its fortifications and endeavored to restore it. In 633 it was devastated by the Saracens, and again in 744. In 1400, Tamerlane completely destroyed it, and at present it is only a vast field of ruins. A small village, *Thadmor,* inhabited by a few Syrian shepherds, is situated close by. The ruins, among which some tombs with inscriptions in the old Palmyrene language and characters, and a temple of Baal, are very remarkable, were first visited by English merchants in 1691, and explored by Wood and Dawkins in 1751. (See St. Mart, *Histoire de Palmyre* (Paris, 1823), and Vogüé, *Syrie Centrale* (Paris, 1869).)

Palmyra, tp. of Lee co., Ill., on Rock River and Illinois Central R. R. Pop. 1109.

Palmyra, post-v. and tp. of Macoupin co., Ill. Pop. 2400.

Palmyra, tp. of Knox co., Ind., 5 miles E. of Vincennes. Pop. 1269.

Palmyra, post-v. and tp., Warren co., Ia. Pop. of v. 226; of tp. 1347.

Palmyra, tp. of Douglas co., Kan. Pop. 2431.

Palmyra, tp. of Somerset co., Me., on the Maine Central R. R. Pop. 1322.

Palmyra, post-v. and tp., Lenawee co., Mich., on Lake Shore and Michigan Southern Railroad. Pop. 1757.

Palmyra, post-v. of Liberty tp., cap. of Marion co., Mo., 6 miles W. of the Mississippi River, and on the Hannibal and St. Joseph R. R., at the junction of the Quincy branch, is in an agricultural region, has considerable trade and manufactures, and 2 weekly newspapers. Pop. 2615.

Palmyra, post-v. and tp. of Otoe co., Neb., on the Midland Pacific R. R. Pop. 886.

Palmyra, post-v. and tp., Wayne co., N. Y., on the Erie Canal, and near the New York Central and Hudson River R. R., is a trade and manufacturing centre, and has 2 weekly newspapers. Pop. of v. 2152; of tp. 4188.

Palmyra, post-v. and tp., Halifax co., N. C., on the Roanoke River. Pop. 2345.

Palmyra, post-v. and tp., Portage co., O. Pop. 848.

Palmyra, post-v. of Londonderry tp., Lebanon co., Pa., on the Lebanon Valley branch of the Philadelphia and Reading R. R.

Palmyra, tp. of Pike co., Pa., on the Delaware Lackawanna and Western R. R. Pop. 570.

Palmyra, tp. of Wayne co., Pa., on Honesdale branch of the Erie R. R. Pop. 2481.

Palmyra, post-v. and tp., cap. of Fluvanna co., Va., on the Ravenna River. Pop. 1979.

Palmyra, post-v. and tp., Jefferson co., Wis., on the Milwaukee and St. Paul R. R., 42 miles W. of Milwaukee, has a graded school, 4 churches, a water-cure, 1 newspaper, 1 wagon and carriage manufactory, several mills, and a number of stores and shops. Principal business, farming and dairying. Pop. of v. 703; of tp. 1621.

O. P. DOW, ED. "PALMYRA ENTERPRISE."

Pa'lo Al'to, county in the N. W. of Iowa. Area, 576 square miles. It is pleasantly diversified with lakes and undulations of land. It is fertile and highly productive of wheat and corn. Cap. Emmettsburg. Pop. 1336.

Palo Alto, tp., Jasper co., Ia., on Indian Creek. P. 1064.

Palo Alto, b. of North Manheim tp., Schuylkill co., Pa., 2 miles E. of Pottsville. Pop. 1740.

Palo Alto, in the southern extremity of Texas, between Matamoras and Point Isabel. Gen. Taylor, having taken up his position on the left bank of the Rio Grande, was in camp opposite Matamoras when informed of the design of the Mexican general Arista to attack his dépôts at Point Isabel. Leaving Major Brown, 7th Infantry, in command, he moved out May 1, 1846, and reached Point Isabel the next day. On the 7th he started on his return, with 2300 men, for the relief of Major Brown, who had been attacked at Fort Texas (afterwards called Brown in honor of its defender), when, on the 8th, he found the army of Gen. Arista, some 6000 strong, interposing to prevent his return. A battle of five hours' duration ensued, resulting in the hasty retreat of the Mexicans with a loss of 100. The American loss was less than 50.

Pa'lo Pin'to, county in the N. of Texas. Area, 974 square miles. It is traversed by the Brazos River, is somewhat hilly, and deficient in timber. Coal is found. It is principally a cattle and sheep range. Cap. Palo Pinto.

Palo Pinto, post-v. and tp., cap. of Palo Pinto co., Tex., on Texas Pacific R. R., near Brazos River.

Pa'los, post-v. and tp., Cook co., Ill., on the Des Plaines River and Chicago and Alton R. R. Pop. 853.

Palpitation. See HEART, by PRES. ALONZO CLARK, M. D., and PALPITATION, in APPENDIX.

Pame'lia, tp. of Jefferson co., N. Y., on the Rome Watertown and Ogdensburg R. R. Pop. 1292.

Pamiers', town of France, department of Ariége, was formerly the capital of Foix, is now the seat of a bishop, and has some manufactures of paper, iron, goods, etc. Pop. 8690.

Pam'lico, county of North Carolina, bounded E. by Pamlico Sound. It is quite level, in some parts marshy, and in others sandy. It abounds in pine forests. It has been formed since the census of 1870. Cap. Vandemere.

Pamlico, tp. of Beaufort co., N. C., on Pamlico River. Pop. 568.

Pamlico River, the estuary of Tar River, N. C., extends 40 miles W. from Pamlico Sound, almost cutting Beaufort co. into two nearly equal parts. It is deep enough for the craft which navigate the sound.

Pamlico (or **Pamplico**) **Sound,** by far the largest of the sounds of North Carolina, is fenced by long low islands from the open sea, with which it communicates by Ocracoke, Hatteras, Loggerhead, New, and other inlets. It is about 20 feet in average depth, with great areas of very shoal water. It communicates with Albemarle Sound on the N. Its shores are low and often marshy. The fisheries are important. The Neuse and Pamlico are its largest tributary rivers. The tides are very small.

Pam'pas is the name generally given to the vast plains of S. America extending along the rivers of La Plata and Paraguay from the eastern slope of the Andes to the Atlantic, and comprising an area of about 1,500,000 square miles. The soil is light and unproductive, containing much salt and saltpetre, and the violent transition from the wet season, with its moist, mild climate and frequent rain-storms, to the dry season, with its scorching heat, makes it impossible for trees to grow; the vegetation consists only of grass, luxuriant during the wet season, but withered during the dry. Large herds of wild horses and cattle roam in these plains, and their hides, tallow, and flesh form the principal articles of support to the inhabitants, a half-white tribe called Guachos.

Pampas Grass (*Gynerium argenteum*), a reed-like grass from the temperate regions of South America, now much cultivated for ornament. The recurved slender leaves are clustered thickly at the ground. From the middle of the tuft the flowering stems rise six to twelve feet high, and bear an ample silvery panicle. The staminate and pistillate flowers are borne by different plants; the flower-clusters of the female plant are distinguished by their larger size and greater spread; it is therefore the most ornamental. A. GRAY.

Pam'philus, b. at Berytus in Phœnicia about 240 A. D.; embraced Christianity; became a friend and associate of Eusebius; founded a library at Cæsarea in Palestine,

which he bequeathed to the Christian church there, and suffered martyrdom in 309. He wrote an apology for Origen, of which only the Latin translation by Rufinus of the first book has come down to us. Eusebius wrote his *Life*, but the book is lost.

Pamphyl'ia, an ancient district of Asia Minor, extending along the Mediterranean from Cilicia on the E. to Lycia on the W. It was mountainous, being covered with ramifications of the Taurus Mountains, which formed its northern boundary. The inhabitants were a mixed race, composed of Greek colonists and aboriginal tribes, and their language and institutions exhibited a similar mixed character, half Greek and half barbarian. The country belonged to the Persian empire, and after its fall to the Macedonians. When Alexander died it fell to Syria, and became subsequently a Roman province.

Pamplin's Dépôt, post-v. of Appomattox co., Va., on the Southside R. R.

Pamplo'na, the ancient *Pompeiopolis*, a town of Spain, the capital of the province of Navarre, situated on the Agra, is fortified and defended with a very strong citadel; is well built, and has a magnificent aqueduct on 97 arches, and manufactures of silk and leather. Pop. 22,702.

Pamun'key River, formed in Virginia by the confluence of the N. and S. Anna rivers, flows S. E. and at West Point joins the Mattapony to form the York River. It is now navigable some 12 miles to White House. Navigation by vessels of considerable draught once extended to Hanover Court-house, more than 60 miles, but the river is now shallow and full of sand-bars.

Pan [Gr. Πάν, probably kindred to πατ-έομαι, to "feed"], the Greek god of flocks and pasturage, a son of Hermes by some nymph. His general aspect was that of the satyrs and fauns, half human and half bestial. He was the inventor of pastoral music and of the syrinx. He was of a lecherous turn and had a loud voice, by which he used to frighten the wayfarer and even put armies to a sudden flight, whence such flight is called *panic*. His name is not improbably identical with that of Faunus.

Pana, post-v. and tp., Christian co., Ill., at the junction of the Illinois Central, the Indianapolis and St. Louis, and the Springfield Illinois and South-eastern R. Rs., has a large trade and 2 weekly newspapers. Pop. of v. 2207; of tp. 3096.

Panama, town of the United States of Colombia, S. America, in the state of Panama, stands on the bay of the same name, an inlet of the Pacific, and has a good though somewhat shallow harbor; large vessels cannot enter, but are compelled to anchor farther out in the bay, where anchorage, though protected by large reefs, is not perfectly safe. It forms the terminus on the Pacific of the Panama railway, terminating at Aspinwall on the Atlantic and connected by lines of steamers with San Francisco and New York; it was opened in 1855, and its traffic, especially its transit trade, is considerable. Pop. 10,000, mostly negroes or mulattoes.

Panama, post-v. of Harmony tp., Chautauqua co., N. Y., 5 miles N. of Panama station, on the Atlantic and Great Western R. R. Pop. 650.

Panama', Isthmus of, formerly called the Isthmus of Darien, extends from lat. 7° 20′ to 9° 40′ N., with a breadth of from 30 to 70 miles, connecting N. with S. America and separating the Pacific from the Atlantic Ocean. The country is mountainous, its highest peak, the Picacho, rising 7200 feet above the level of the sea, while in other places the mountains sink into ranges of low hills. The coast is rocky and lofty along the Caribbean Sea, but mostly low and swampy along the Pacific. The soil is everywhere fertile, and all the products of the tropical zone can be easily raised; cotton of superior quality is indigenous and perennial here. Forests abounding in excellent timber are numerous, and salt, gold, copper, and iron are found. But the climate is very unhealthy, except on the heights. The isthmus forms a state, one of the United States of Colombia, comprising an area of 29,756 square miles, with 175,000 inhabitants.

Panan'ti (Filippo), a Tuscan poet, b. in 1766; d. at Florence 1837. He studied at Pisa, travelled in France, Spain, and Holland, and spent twelve years in England as opera-poet. Returning by sea to Italy, he was captured by pirates and carried as a slave to Algiers. The English consul obtained his freedom, and he profited by this opportunity to visit the African coast, which he has described in his book, *Avventure ed Osservazioni sopra le Coste di Barberia.* His principal poem is a romance entitled *Il Poeta di Teatro.* His *Works* were published in Florence in 1831 in ten volumes.

Panchatantra [Sans. the "five books," or sections], an ancient collection of East Indian fables and tales purporting to have been written by one Vishnusarman for the instruction of the sons of King Amarasakti of Mihilâropya. The fables are in prose, the morals are in verse. It was probably written after 400 A. D. The *Panchatantra* is the foundation of the later Hitopadesa (which see). The *Panchatantra* was translated in the sixth century A. D. into Pehlevi, and thence, 200 years later, into Arabic. From the Arabic it long ago passed into Western literature as the *Fables of Pilpay.* Translations exist in Turkish, Persian, Malay, Pushtu, Tartar, and all the European languages. The Arabic was translated into Greek (eleventh century); then Hebrew into Latin, in which many versions exist. The first German version was from the Latin by Eberhardt, count of Würtemburg (d. 1325); another appeared in 1802; in 1859 appeared Benfey's noble German translation from the Sanskrit with a critical treatise. The first English version from the Latin appeared in 1570. Few books have ever had so wide and remarkable a popularity.

Pancoast (Joseph), M. D., b. in Burlington co., N. J., in 1805; took his medical degree at the University of Pennsylvania in 1828; became in 1831 an instructor in anatomy and surgery; in 1834 physician in chief to the Children's Hospital, Philadelphia, and surgeon to the Philadelphia Hospital; professor of surgery 1838, and of anatomy 1861, in the Jefferson Medical College, Philadelphia; was visiting surgeon of the Philadelphia Hospital 1838–45; has published *Operative Surgery* (1852), *Essays and Lectures;* edited various reprints and translations of European works, and is author of many professional papers and member of various learned societies.

Pan'creas [Gr. πάνκρεας, "all-flesh"], or **Sweetbread,** a gland which in the human being is found behind the stomach, extending across the abdominal cavity. It weighs from two to six ounces, though it seldom exceeds four or five. A small posterior part (lesser pancreas) is sometimes detached. The right extremity is called the head, the left the tail, and the rest the body. In the octopus, a mollusk, the pancreas is a long, convoluted, single cæcum. In other mollusks it is either absent or rudimentary. Some insects have analogous organs. (*Siebold.*) The pancreas of the cod is a cluster of cæcal follicles; in the higher cartilaginous fishes a number of such clusters are bound together into a glandular mass, with several distinct excretory ducts. In the higher vertebrates there is sometimes but one duct (the canal of Wirsung), but there are very often, perhaps usually, two even in man. In the human subject the larger canal usually unites with the common choledic duct. The minute structure and general aspect of the pancreas recall those of the salivary glands. The secretion of the gland (called the "pancreatic juice") is normally alkaline, viscid, and coagulable by heat. It is secreted in abundance only during digestion. Its specific gravity, according to Bernard (who derived his specimens generally from the dog by artificial fistulæ), is 1.040. It contains the principle pancreatine, with other organic matters, and from 6 to 10 parts in 1000 of ash. It converts starch very rapidly into sugar (glucose), turns cane and milk-sugars into glucose, thus fitting them for absorption into the blood, emulsifies liquid fats, so that they may be taken up by the lacteals, and actively assists in the conversion of fibrin and albumin into peptones. It is probable that it does not normally acidify the fats of the food, although it does so in the test-tube. It is thus seen that the pancreas is one of the most important of the organs of digestion. For our knowledge of its uses we are chiefly indebted to Claude Bernard of Paris.

Pan'csova, a town of Austria in the Military Frontier, at the mouth of the Temes, emptying into the Danube, is fortified and contains several military establishments and some manufactures of woollens and leather. Pop. 13,408.

Pa'nda. See Ailurus Fulgens.

Pandana'ceæ, or **Screw-Pines,** a remarkable natural order of endogenous trees and shrubs, nearly all tropical, and in some cases closely approaching the character of palms. Thus the *Carludovica palmata,* and especially the *Phytelephas macrocarpa* (the first producing the material for Panama hats, the last affording vegetable ivory), are often called palms, but are perhaps nearer this order. The screw-pines proper (*Pandanus, Freycinetia,* etc.) send down aërial roots, as if to prop themselves up, while others are decumbent or climbing. Some of the species afford useful fruits and seeds; others powerfully fragrant blossoms. A few have active and even poisonous properties. The leaves of *Pandanus vacoa,* the vaquois of the Isle of France, afford a fibre which is very extensively made into burlaps and exported largely. The roots of the same tree are used for making coarse brushes. The *Nipa fruticans,* a palm-like tree of Tenasserim, affords large quantities of sugar (jaggery), and its leaves are exported for roofing material.

Pan'dects, The [*Pandectæ*, from Gr. *πᾶν*, "all," and *δέχομαι*, to "receive," the "all-containing"], also called the **Digest** [from Lat. *digesta*, "that which is systematically arranged"], the compilation of the Roman civil law made by the order of the emperor Justinian from the writings of eminent jurists, and constituting the most important part of the *Corpus Juris Civilis*. The previous condition of the Roman law, its development through the edict of the prætors and through the commentaries of professional jurisconsults, the changes in its character which had taken place during an interval of more than a thousand years, and the measures inaugurated by Justinian to reduce the whole into a codified form, will be found described under the title Law, Civil. After the *Codex* or code had been completed, and near the end of the year 530 (Dec. 15, 530), the emperor addressed a special constitution or mandate to Tribonian, his *quæstor palatii*, which sketched the plan of the new work and ordered it to be undertaken. This statute commanded Tribonian, with the aid of sixteen commissioners chosen by himself, to select from the writings of ancient jurisconsults those portions which had not become obsolete, and to arrange them in a single volume, which should bear the name *Pandects* or *Digest*, and which should be divided into 50 books, and these again into separate titles, following the order of the code or that of the edict, as should be judged preferable. In respect to the mode of executing this process of redaction, a wide discretion and a large authority were conferred upon the commissioners. They were not to judge an opinion the better simply because it had been adopted by the greatest number of authors; they were not, however, to reject the notes of Ulpian, of Paulus, and of Marcian upon Papinian. The selections thus made were to have the same force and effect of law as though they had emanated directly from the emperor himself. They were to reject whatever was misplaced, superfluous, or mistaken, to leave no antinomy or contradiction between two laws, and no repetitions, to avoid inserting anew the matter already placed in the code, and to omit all that had become obsolete and useless. Finally, an emphatic warning was added, which prohibited all persons from making the text, when completed, the basis of any commentaries, and from obscuring its simplicity by prolix observations, as had been done to the ancient law. This commission, named and presided over by Tribonian, was composed of 16 members: Constantine, *comes sacrorum largitionum*, Theophilus and Cratinus, professors in the law school at Constantinople, Dorotheus and Anatolius, professors in that at Berytus, and 11 prominent advocates. They drew the entire material which composed the digest from the works of 39 jurists. In the actual performance of their labors it seems that certain books were assigned to each member separately, that he extracted therefrom such passages as he thought proper, making the changes which he considered necessary, and arranging the quotations under their appropriate titles. These individual results were then submitted to the whole commission, by whom they were, after further alterations and additions if needed, reduced into an harmonious system. In three years the digest was finished, and was promulgated by an imperial constitution dated Dec. 16, 533, which took effect on the 30th of that month. The text of the Pandects bears no resemblance to a modern code or revision of statutes. It is rather a mosaic-work of fragments taken from the writings of the foremost jurists; but from this very form it preserves more faithfully than could have been done in any other manner the spirit, the genius, and the underlying principles of the Roman law. Of the 39 authors who contributed to its contents, the greatest part lived during the period when the law had attained its highest degree of philosophic development, the fourth and third centuries before Justinian; the earliest, however, Q. Mucius Scævola, from whom a few paragraphs were borrowed, was a contemporary of Cicero. About one-third was taken from the writings of Ulpian; Paulus stands next, one-half of the text being extracted from the various treatises of these two prolific writers. The third in the amount but first in the excellence of his contributions was Papinian. Three millions of lines were thus reduced to 150,000, and 2000 original books to 50. Each of these 50 books is again subdivided into "titles," the total number of which is not the same in all editions, varying from 429 to 440. Under each title are placed the extracts, preceded in every instance by the name of the author and of the works from which it was quoted, technically termed the *inscriptio*; their number is about 9000. Some of them are single sentences, or even parts of a sentence, while others extend through many pages. The original language was Latin, except a few passages from Papinian and a considerable number from Modestin, which were in the Greek. The 50 books which compose the Pandects were separated by Justinian into 7 parts: the first, *Prota*, contained a statement of general doctrines; the second, *De Judiciis*, treated of real actions; the third, *De Rebus*, of contracts, except stipulations; the fourth, *Libri Singulares*, comprised the subjects of marriage and tutorship and other matters; the fifth, also entitled *Libri Singulares*, was appropriated to testaments and legacies; while the sixth and the seventh, without any special designation, embraced the other portions of the law. The extreme rapidity with which the task of compilation was accomplished necessarily detracted somewhat from the scientific character of the Pandects as a perfected work of legislation, and produced a certain confusion in the arrangement and many instances of repetitions, and even of express contradictions between different passages. The gravest fault, however, in the estimation of some moderns, consists in the alterations which the commissioners were permitted to make in the very text of the extracts selected by them, by means of which a doubt is thrown over the whole, so that the reader can never feel assured whether Ulpian, for example, actually said what he is represented as saying, or whether he did not say it, if at all, with such or such restrictions. Tribonian has, therefore, received no little condemnation, and even vituperation, from a school of juridical writers, who forget, however, in their zeal for pure historical truth, that without these very labors of Tribonian it is probable the Roman law would have been entirely obliterated and for ever lost to mankind. In fact, it may be said that, excepting the Holy Scriptures, no books have been so valuable to civilization, to the social development of the human race, as those which contain the *Corpus Juris Civilis*, of which the Pandects are by far the most important.

A tradition was long currently accepted as true that, the Pandects having been entirely lost for several centuries, at the taking of Amalphi, A. D. 1136, a copy, now known as the Florentine manuscript, was accidentally discovered and made public by the emperor Lothair II. Savigny, however, in his great work, *History of the Roman Law during the Middle Ages*, has shown that the *Corpus Juris Civilis* was continuously known and used in Italy from the time of its introduction there during the reign of Justinian. About the year 1100, and as a part of the general intellectual awakening, the study of the Roman law was revived. Commencing at the University of Bologna, and maintained there by a school of expounders to whom the name *glossators* has generally been given, and who were the earliest commentators upon the Pandects and largely aided in settling its text by a diligent examination and comparison of manuscripts, this study soon extended over Italy, Spain, France, Germany, and even for a while into England. Nearly all the existing manuscripts of the Pandects date from the twelfth to the fifteenth centuries, and are due to the *glossators*. There is one, however, much more ancient. During the time of the *glossators* it was preserved at Pisa; when Pisa was captured by the Florentines in 1406, it was removed to Florence, where it may yet be seen. The question has been raised whether this manuscript was the single source from which all the others now in existence were copied, the differences between them being entirely due to conjectural emendations made by the *glossators*, or whether, on the other hand, the manuscripts produced by the *glossators* and still preserved were taken, in whole or in part, from other more ancient originals, which are now lost. The latter opinion was maintained by Cujas; its correctness was demonstrated by Savigny, and is adopted by Puchta. It may be considered, therefore, as settled that the text of the Pandects transmitted to us by the *glossators*, which they called the vulgate text, *litera communis*, was settled by means of the Florentine manuscript and of certain other original manuscripts that have since been lost. The Pandects have of course been frequently printed. The editions which are regarded as the most accurate, the most authoritative, and the most celebrated are the following: the *editio princeps*, with the glosses, of which one part, called the *Infortiatum*, was published at Rome (1475), the second part, the *Digestum vetus*, at Pérouse (1476), the third, the *Digestum novum*, at Rome (1476); the text is throughout the vulgate; an edition published at Nuremberg in 1529 by Haloander, the text of which is composite, chosen from different manuscripts; the edition published at Florence in 1553 by Taurellius, the text of which is exactly reproduced from the Florentine manuscript. To these may be added that of Fradin at Lyons (1510, 1511); that of Heroagius, Bâle (1541), which gives the Greek passages entire; that of Miræus, Paris (1548), and that of Contius, Lyons (1571). To this list should also be added the numerous standard editions of the whole *Corpus Juris Civilis*. (For more detailed information, especially in relation to the contents of the Pandects, the reader is referred to the following works: Hugo, *Histoire du Droit romain;* Ortolan, *Histoire de la Législation romaine;* Falck, *Encyclopédie juridique;* De-

mangeat, *Droit romain;* Savigny, *Histoire du Droit romain au Moyen Age.*) JOHN NORTON POMEROY.

Panderpoor′, town of British India, in the presidency of Bombay, stands in lat. 17° 40′ N., on the Bima, and has a celebrated temple of Vishnu. Pop. 20,000.

Pando′ra [Gr. Πανδώρα, the "all-endowed"], in the old Greek legend, was the first woman on earth, sent by Zeus to mankind in vengeance for Prometheus's theft of the heavenly fire. Aphrodite gave her beauty, Hermes cunning, and each of the gods bestowed on her some fatal gift for the punishment of mankind. Again, it is said that the gods gave her a box full of blessings for mankind, but, prompted by curiosity, she opened the box, and all the blessings flew away, except hope.

Pan′dour [from *Pandur,* a town of Hungary], a foot-soldier of a former corps of the Austrian service. They were a set of irregular light infantry of Slavonic nationality, as much dreaded for their habits of brigandage as for their valor in action. They were useful only as guerilla soldiers, but they were in 1750 put under military discipline, and gradually brought to the footing of the other frontier troops.

Panel. See JURY, TRIAL BY.

Pan′ge Lin′gua ("Proclaim, O Tongue!"), a famous hymn by Thomas Aquinas, sung on the Corpus Christi festival and other eucharistic services. It is in rhymed Latin.

Pangen′esis, the name of a theory of generation propounded by Charles Darwin in his *Variation of Animals and Plants under Domestication* (1868), according to which it is not the reproductive elements nor the buds which generate new organisms, but the cells themselves throughout the body, the physiological units transmitted by the sexual elements only as vehicles. Similar hypotheses have been set forth by Buffon, Bonnet (the so-called *emboîtement*), Owen (*parthenogenesis*), and Herbert Spencer, the difference being in the definition of the physiological unit.

Pan′golin [a name of Malay origin], called also **Badjerkeit** and **Caballaya,** the *Manis pentadactyla,* an edentate mammal of India and the East generally. It is remarkable for its scaly armor. It is five feet long, including the scaly and prehensile tail. It is an ant-eater and can climb trees. When tamed it is affectionate and gentle. There are numerous other species of *Manis,* one of the most remarkable being the phatagin (*M. tetradactyla*) of Africa. Other species are found in China, Java, Africa, etc. They are all slow of motion, and defend themselves by assuming the form of a ball. They are now referred to the order Bruta or Edentata, sub-order Squamata, and family Manididæ.

Pan′ic. The word "panic" is derived from the name of the god Pan, who, from his supposed diversion of issuing from his mountain-fastnesses and frightening passing travellers with the grotesqueness of his appearance, was afterwards credited with causing all sudden alarms. The first thought of the old servant in the *Medea* (1171) on beholding the sufferings of Glauce was that the wrath of Pan had been visited upon her mistress; and in the *Hippolytus* (141) the Chorus tell the love-smitten Phædra that she is possessed by Pan or Cybele. Among the ancients panics were of frequent occurrence: a passing omen on the road would bring upon a whole army instantaneously either despondency or enthusiasm. Plutarch relates how the Greeks under Timoleon, when advancing to give battle to the Carthaginians in Sicily, were met on the way by mules laden with parsley. The hearts of the soldiers sank at the sight; for parsley was the customary adornment for tombs. But crowns of parsley were also the rewards of victors at the Isthmian games; and Timoleon, with great presence of mind, seized some parsley and crowned his head: "See here our Corinthian symbol of victory." The courage of the soldiers was restored by the omen, the march was continued with greater enthusiasm, and though opposed to a far larger force the Greeks gained a complete victory. This is but one of many instances.—In our time the term is used more especially to denote a monetary crisis in which mutual confidence suddenly gives place to general distrust in the sphere of trade. A. H. BULLEN.

Pa′nini, the oldest grammarian in the Sanskrit literature whose works have come down to us, flourished in the fourth century B. C. Of his life very little is known; the biography given of him in *Kathâsaritsâyana* dates from the twelfth century, and is considered by most scholars a work of mere fancy. But his grammar of the Sanskrit language formed for many centuries the foundation of the grammatical study of that literature, and, although in its method and general character it is very different from the works of classic or modern grammarians, it is still admired as something unsurpassed in its kind. (See the preface to Colebrooke's *Grammar of the Sanskrit Language,* Calcutta, 1805; Max Müller, *History of Ancient Sanskrit Literature,* London, 1859; Goldstücker, *Panini,* London, 1860; Benfey, *Geschichte der Sprachwissenschaft,* Munich, 1869.)

Paniput′, town of British India, presidency of Agra, province of Delhi. It is a large city, surrounded by walls and consisting of brick houses, half of which, however, are uninhabited. It had formerly a great trade, being situated on the highway into Hindostan, and has several times been the scene of bloody battles, being the key of the country. Pop. 22,612.

Paniz′zi (ANTONIO), b. at Brescello Sept. 16, 1797; took his university degree at Parma in 1818; was suspected in the uprisings of 1821 and obliged to flee; after spending some years on the Continent and in England was offered the professorship of Italian in University College, London; in 1831 became an assistant in the British Museum, and in 1837 was appointed librarian; thanks, in a great measure, to his activity, the number of printed volumes in the British Museum was increased, between 1837 and 1866, from 225,000 to 527,134; the *Catalogue* and the superb reading-room are also due to him; published (London, 1830) a critical edition of the *Orlando Innamorato* of Boiardo, and of the *Orlando Furioso* of Ariosto. In 1835 his volume, *Sonetti e Canzoni del Boiardo,* appeared.

Panno′nia, province of the Roman empire, was bounded N. and E. by the Danube, which separated it from Germania and Dacia, S. by the Save, which separated it from Illyria, and W. by the mountains of Noricum. It was inhabited by fierce and warlike tribes of Illyrian descent, but was conquered and made a Roman province by Augustus. Frequent rebellions, however, compelled the Romans to build a large number of fortresses in the country, of which Vindobona, the present Vienna, was the most remarkable, and to keep large garrisons in the cities. During the decline of the Roman empire, Pannonia fell into the hands of the Huns, and from them it passed successively to the Ostrogoths, Longobards, and Slaves, till, in the ninth century, the Magyars settled down on it and kept it.

Pano′la, county of N. W. Mississippi. Area, 729 square miles. It is nearly level, very fertile, and is traversed by the navigable Tallahatchie River and by the Mississippi and Tennessee R. R. Live-stock, cotton, and corn are leading products. Cap. Sardis. Pop. 20,754.

Panola, county of Texas, bounded E. by Louisiana and traversed by Sabine River. Area, 788 square miles. It is well timbered and has a fertile, sandy soil, producing cotton, corn, fruit, live-stock, and the other crops of the latitude. Cap. Carthage. Pop. 10,119.

Panola, tp., Woodford co., Ill., on Illinois Central R. R. Pop. 1260.

Panola, a v. of Panola co., Miss., on Tallahatchie River and Mississippi and Tennessee R. R. Pop. 192.

Panora, post-v. of Cass tp., cap. of Guthrie co., Ia., near Middle Coon River in the midst of an agricultural region, has 1 weekly newspaper. Pop. 504.

Panora′ma [Gr. πᾶν, "all," and ὅραμα, "view"] properly designates a painting disposed as if it were the concave side of a whole or half cylinder, with a view to presenting the full effect of a landscape. Good panorama-painting is difficult and requires peculiar modifications of perspective; but if well done, the effect is admirable. Robert Barker (1739–1806) invented the panorama, and first exhibited it at Edinburgh in 1788. Popularly, but incorrectly, any exhibition of large landscape-painting is called a panorama. The best panoramic artist thus far has been Robert Burford, who d. in 1861.

Panormus. See PALERMO.

Pansy. See VIOLET.

Pante′go, post-v. and tp., Beaufort co., N. C. P. 1792.

Pantelleri′a, Pantalaria, or **Pantaleria,** a small island lying between Africa and Sicily, about 47 miles from Cape Bon and 80 miles from Trapani. The soil is volcanic and well suited to the vine, the caper-plant, and to cotton, all of which are cultivated. The donkeys of this island are much prized. The mineral springs have some reputation. The principal town lies on a little bay where a harbor is formed by natural rocks and by a fortified castle, which now serves as a prison. Pantelleria, anciently called *Cosyra,* was used by the Roman emperors as a place of banishment for offenders. Pop. in 1874, 7000.

Pan′theism [Gr., "All-god-ism"], a word first used by Toland at the beginning of the eighteenth century to designate the monistic doctrine, which identifies the totality (*pan*) of being (*natura naturata*) with God (*theos*), *natura naturans.* Not that each thing is God, but that the whole essence or substance proper is God, and the entire phenomena are the necessary phenomena of God's nature. I. It is or is not virtually identical with atheism, as the

old nomenclature made it, just as the term God is defined. "Pantheism," says Schopenhauer, "is a misnomer, for the word God means a personal Creator: it is simply courtly atheism." But under the name pantheism we have a genus, ranging from the low level which, if it were the only one, would justify Schopenhauer's estimate, up to the highest forms, in which it almost seems to present us the personal free God of THEISM (which see), and is anti-theism, rather than atheism. It may be made in its various types the basis of irreligion, or may blend with the most transcendent forms of religionism. (See MYSTICISM and the articles on the Oriental religions—HINDU PHILOSOPHY, HINDU RELIGION, VEDA.) It was originally a religious, not a philosophical, construction, and underlies polytheism and all the systems which are the apotheosis of nature. The view which considers the substance of the world as unconscious till it reaches consciousness in man, and the view which maintains a supreme evolution of consciousness in the universe, in which man is participant as a subordinate member of the whole, certainly do not preclude the religious element to the same degree.

II. The *divisions* of pantheism help to define it, and also to mark its general history, though some of them are vague, and involve what is not properly pantheistic. Some of them, indeed, should be distinguished from it. (1) Psychological pantheism considers God as the soul or vital principle. Matter is the eternal body which God vivifies. (*Hylozoism, Timæus of Locres.*) (2) Cosmologic, ontologic pantheism, in its ancient form in the Eleatic school (the universe and God are identical). (See PARMENIDES, XENOPHANES.) In its modern and subtler form in Spinozism (one only substance, eternal, manifested in extension as matter, in thought as mind). (3) Mystical pantheism, the Hindoo pantheism (all things constitute an essence, of which the real and ideal, the objective and subjective, are but the opposite poles). (4) Idealistic pantheism of the Middle Ages: Erigena (emanation); Amaury de Chartres (nature is the totality of the phenomena and modes of God, without substantial and distinct existence); Bruno (sixteenth century, more than Spinoza the prototype of the most recent pantheism). (5) The materialistic pantheism (a misnomer): Heraclitus (the first Hegel); the Stoics (all-impenetrating fire); David de Dinant. If we can talk of materialistic pantheism, we can subdivide it and speak of atomistic pantheism. Büchner (matter is the original, self-existent, immutable, eternal; the atom is God). (*Natur u. Geist*, 3d ed., 1875.)

A twofold division has been proposed: I. The Oriental type, which loses the world in God—acosmism. There is no coming into being. One only being is, whose modifications are the individual phenomena: the Eleati, Spinoza. II. The Occidental type, which loses God in the world; totally denies the substantiality of God; evolution, not being; process, the absolute in the way to being: (Heraclitus the Stoic), Fichte (deduction of the world from the Ego, God the moral order of the world), Schelling (absolute identity, the absolute is God implicit, the world is God explicit, the absolute is primordial involution, the world is progressive evolution), Hegel (Fichte's method and Schelling's results), for whose school, in one of its developments, may be claimed the most perfect philosophical shape ever given to pantheism.

III. "Pantheism," says Heine, "is the secret religion of Germany." It attracts the subtler, less practical intellects. Materialism is the temptation of physicists and physicians. Pantheism has a charm for metaphysicians. Its dialectic simplicity, which is the power of all monism, but pre-eminently of pantheism, and its seeming consonance with the rise of all the phenomenal world from what we call substance, and its subsidence into it, tempts men to doubt whether that substance, so called, be not a mere mediate thing, a seeming substance to its own phenomena, the real phenomenon to the true substance, and no more than a link to the finality into which it will subside, which is the only true substance, because it depends on nothing, and all depends on it; while the seeming substances (*modi*) of the common illusion are but phenomena, one remove less from the original. The metaphysical dialectics of the case as against pantheism shuts itself up very much to the question whether phenomena can have phenomena. If they can, the total notion of substance is destroyed, and the pantheistic notion with it. If they cannot, the common notion of substance stands, but the pantheistic vanishes. It is reduced to annihilation or to logomachy. But the real "crucible of every philosophical system is found in its ethical principle." The lower forms of pantheism, in their view of moral agency, freedom, and responsibility, are of necessity so deterministic as to make religion and morality impossible; and wherever pantheism accepts an unmistakable principle of morals, it abandons to that extent its logical consistency. (See PHILOSOPHY.)

For literature see Bretschneider, *System. Entwickelung* (4th ed. 1841, pp. 45–52); Pierer, *Univ. Lexik.* (1861, xii. 605); Saisset, *Dictionnaire de Scienc. philosoph.* (Franck., 1875, 1249). CHARLES P. KRAUTH.

Panthe'on [Gr. Πάνθειον, a temple for all the gods], a celebrated Roman temple built in 27 B. C. by Marcus Agrippa, near the centre of the Campus Martius. It is of brick and is in excellent preservation, having been several times restored both in ancient and modern times. In 610, Pope Boniface IV. consecrated it as the church of Sancta Maria ad Martyres. It is known as La Rotonda, or Santa Maria Rotonda. It has a noble dome, the finest in the world, and its portico is equally celebrated. Here are buried Raphael and many other famous men.

Pan'ther [Gr. πάνθηρ], originally applied to an Old-World leopard (*Felis pardus*, L.), but in the U. S. perverted to the puma.

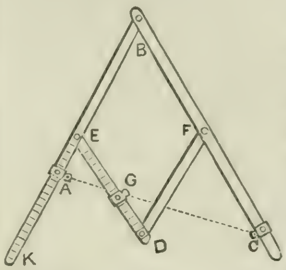
Panther Branch, tp. of Wake co., N. C. Pop. 921.

Panticapæum. See KERTCH.

Pan'tograph [Gr. πᾶν, "all," and γράφειν, to "trace"], an instrument used in copying maps and other drawings, either on the same or on some other scale.

The principle of the pantograph may be illustrated by the engraving, which shows the essential parts of the instrument in common use.

FIG. 1.

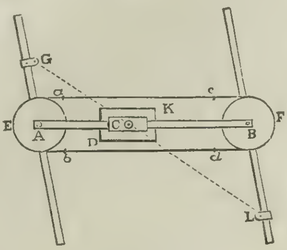


It consists essentially of four brass bars with hinge-joints at B, F, D, and E, forming a rhombus B F D E in every position. The sides B F and B E are extended so that F C and E K shall each be equal to one side of the rhombus. The parts E K and E D are graduated and numbered so that a line A G through two corresponding divisions shall always pass through C. This requires the graduation to be such that E A : E G : : B A : B C. The whole apparatus is supported by delicately-formed castors. Three boxes, each fitted to hold either a pencil or a metallic tracing-point, are fitted to the beams, the one at C being fixed, and those at A and G capable of sliding along the beams, so that they may be set at corresponding points of the bars E K and E D. From the description already given, it is obvious that the three points A, G, and C will always remain in the same straight line, and that we shall always have A G : A C : G C : : A E : A B : E B; hence, if either of these points is taken as a centre of motion, the other two will trace out similar figures, whose homologous lines bear to each other a fixed ratio.

To use the instrument, the boxes A and G are clamped to the bars, so that A G and G C shall have the proper ratio, both being at corresponding points of the graduated scales. A metallic tracing-point is then clamped in the box C, which is taken as the centre of motion; a second tracing-point is clamped in the box corresponding to the drawing to be copied; and a pencil is clamped in the remaining box; the tracing-points and the pencil are all arranged so as to press with proper firmness against the plane of the paper. When thus adjusted, the movable tracing-point is carried along the lines to be copied, and the pencil traces out a similar figure. If the movable tracing-point is at G, the copy is larger than the original; if at A, the copy is smaller than the original. If G is taken as the centre of motion, the movable tracing-point and the pencil being at A and C, the copy will be reversed. In this manner the engraver is enabled to transfer the outlines of a drawing to the surface of the block or plate to be engraved, and which may be either enlarged or diminished in any given ratio. If the box A is at K, and the box G at D, the copy will be of the same size as the original, but reversed. By copying the reversed drawing with the same relation of parts, a result will be obtained equal in all respects to the original.

The pantograph just explained was invented in 1603 by Christopher Scheiner, and was described by him in a pamphlet published in 1623. A more perfect instrument for accomplishing the same object was invented by Prof. Wallace of Edinburgh: this instrument is called the *eidograph*. Its essential parts are shown in the diagram. A B is a brass beam sliding in a rectangular socket C, to which it may be clamped by a clamp-screw; from the lower side of the socket a steel axis projects, which enters a corresponding hole in the heavy mass D K, and around which, as a centre, the beam A B may be made to revolve; the

Fig. 2.



mass D K serves as a base for the whole instrument. At A and B are two pulleys, equal in diameter, and turning around axes which pass through eyes near the extremities of the beam A B: the pulleys are partially enveloped by bands of fine watch-spring *a e b* and *c f d*, and the ends of these bands are connected by steel wires *a c* and *b d*; the bands are made fast to the pulleys at E and F. The pulleys lie below the beam A B, and on the under face of each is a rectangular socket similar to C, and in these sockets are two parallel sliding beams A G and B L; by this arrangement of parts the beams A G and B L remain parallel to each other when A B is turned around its axis of motion C. Sliding boxes, like those already described, are adapted to the bars A G and B L, and by the aid of suitable graduation these may be set so that G, C, and L shall be in a straight line. The beam A B is also graduated so that it may be set in the socket C in such manner as to give to the ratio of A C and C B any required value. A tracing-point is clamped in the box L and a pencil in the box G. The instrument being thus adjusted, it is evident that if the point L is moved along the outlines of a drawing, the corresponding point G will trace out a copy similar to the original, and having its homologous lines in any given ratio to those of the original. W. G. Peck.

Pan'tomime [Gr. παντόμιμος, "all-imitating"], the art of representing thought, sentiment, will, and action by mimicry only, by attitude, gesture, and movement, is a Roman invention, though the name is Greek and originated in the time of Augustus. The Romans, who had more practical acuteness than imagination, had also more sense for virtuosity than for art. The Greek actor, declaiming the sublimest ideas in cadenced numbers, accompanied by harmonized melodies on the cithar and flute, and following the strain of music with rhythmical movements, was too complex a phenomenon to them. They seized on each single element of the representation and enjoyed it separately, the declamation through an elocutionist, the mimical expression through a pantomimist, the dance as a ballet, and the music as a concert. Besides, there were in the Roman life, such as it had developed spontaneously from olden times, certain features with which the pantomime easily combined, and which made it an acknowledged and much cherished institution. Of the old Roman *atellanæ*, a sort of improvised comedy performed at the festivals of the nobles by their own sons and for the sake of amusement only, the mimical imitation of what was awkward and ridiculous and the display of bodily adroitness and skill formed the principal part. In the last times of the republic these *atellanæ* received an artistic form through the *mimes* of Decimus Laberius and Publius Syrus. The *mime* was an imitation of every-day life, in the same manner as the modern comedy; but although the speech was written down and often elaborated with the greatest care, the acting or the mimical representation was still considered a most essential element. Decimus Laberius, who was a knight and who could not enter the stage without losing his social position, was celebrated as a reader in private of his own mimes, and at last Cæsar compelled him, with his compliments, to act publicly, and received him after the performance by returning to him the knightly ring and conducting him to the part of the theatre where the knights sat. In general, mimical expression and imitation were highly appreciated by the Romans. Cicero and Roscius vied with each other as to which could express a certain state of mind best, the one with his eloquence, the other with his mimicry; and under Augustus the pantomime became the reigning fashion. Pylades and Hylas were celebrated pantomimists in the tragical line, Bathyllus in the comical, and of the rivalry between the first two who danced *Agamemnon* and *Œdipus*, Macrobius tells some very amusing stories. Not only in public life, however, in the theatre, but also in private life, at the dinner-party, the pantomime played a very conspicuous part during the time of the first Roman emperors. When Cicero gave a dinner he had an elocutionist, who read to his guests a dialogue of Plato or a tragedy of Euripides. When Caligula gave a dinner he let loose on his guests a menagerie of wild beasts of prey, lions and tigers, whose claws and teeth had been previously extracted. On ordinary occasions a little pantomime with music and dance was enacted before each course—before the roast boar, a hunting scene; before the mutton, Ajax delirious, etc. The social position of the pantomimist was nevertheless very low. Hylas was flogged publicly, at the prætor's request, on account of some blunder he had made on the stage. Augustus forbade such interference of the prætor with the actors, but under Tiberius it became a law that a senator who visited the dwelling of a pantomimist or was seen in his company in the streets should lose his senatorship. The reason for thus throwing contempt on a class of artists who happened to be very fashionable was not the old Roman prejudice against actors and acting, but the character of the art itself. The obscenity and indecency which these pantomimes displayed exceeded all description; that the female pantomimist often danced entirely naked on the stage was not the worst feature. Such representations ceased, of course, when Christianity became a power in society. The companies were dissolved or banished. During the Dark Ages they strolled from town to town, exhibiting themselves in the market-place as acrobats. Later they were now and then employed at the performance of the mysteries, and by associating themselves with the *commedia dell' arte* their representations assumed the form under which we now know them. They borrowed the masks Harlequin, Perrot, Columbine, and Pantalone from the *commedia dell' arte*, formed a loose plot, mostly of comical elements, and filled out the scheme in a manner half acrobatic, half ballet. Clemens Petersen.

Pan'ton, post-v. and tp., Addison co., Vt., on Lake Champlain and Otter Creek. Pop. 390.

Pany'asis [Πανύασις], placed by the canon of the Alexandrian grammarians in the rank of distinguished epic poets, was, according to Suidas, son of Polyarchus and a native of Halicarnassus; other authorities make him a Samian or a Thurian; flourished about B. C. 480. Panyasis sought to revive epic poetry, which had had its blooming period, and had given way to the lyric and tragic. He composed two poems—the *Heraclea*, an account of the exploits of Hercules, in 14 books, in heroic verse; and the *Ionica*, in 7000 verses, in pentameter verse, and treating of Codrus, Neleus, and the Ionian settlements. Suidas states that he was ranked by some next to Homer, by others after Hesiod and Antimachus. Was put to death by the tyrant Lygdamis about B. C. 457 (Clinton, *Fast. Hell.*). The few fragments remaining are found in Gaisford's *Poet. Græc. Min.*, vol. iii., in Düntzer's *Epic. Græc. Frag.*, and in Tzschirner's *Panyasis* (Breslau, 1842). Henry Drisler.

Pa'ola, town of Southern Italy, province of Cosenza, pleasantly situated near the Tyrrhene Sea. It has a considerable coasting trade, about 800 small vessels entering its ports annually. The town is commanded by a castle and small fort of the time of the lower empire. Pop. in 1874, 8458.

Paola, city and tp., cap. of Miami co., Kan., near the Marais des Cygnes River, and at the junction of the Osage division of the Missouri Kansas and Texas with the Missouri River Fort Scott and Gulf R. R., has 3 weekly newspapers, and is a trade-centre for a rich agricultural region. Pop. of city, 1811; of tp., exclusive of city, 624.

Pao'li, post-v. and tp., cap. of Orange co., Ind., 10 miles S. of Orleans, has 1 weekly newspaper. Pop. of v. 628; of tp. 2350.

Paoli, post-v. of Willistown tp., Chester co., Pa., on the Pennsylvania Central R. R., noted for the action of Sept. 20, 1777, usually called the "Paoli massacre," which is commemorated by a monument.

Paoli (Pasquale), b. near Morosaglia, Corsica, in 1726; was educated at Naples, whither his father took refuge, having been exiled in 1739 from the island for participation in the revolt against Genoa; returned to Corsica in 1755 as leader of the party which strove to expel the Genoese; defeated their army and even their fleet in several engagements, and deprived them of nearly all their strongholds in the island, at the same time bringing the agriculture, commerce, and industry of the country to a flourishing state by his wise and energetic administration. His success was almost complete, and excited great sympathy in Europe; but in 1767 the Genoese sold their claims on Corsica to France, and in 1769 Paoli was driven from the island by a French army of 22,000 men. In 1792, when Corsica was formed into an independent department, the French government appointed Paoli chief both of the civil and military administrations. But the anarchical state of the government soon occasioned collisions. He again placed himself at the head of a revolution; drove the French garrison and party, to which belonged the family of Bonaparte, from the island in 1796, and proclaimed George III. king of Corsica. The English now took possession of the island, but disagreements soon arose between

them and Paoli. He once more left his native country, retired to England. D. near London Feb. 5, 1807. (See Boswell, *Account of Corsica* (Glasgow, 1768), and *Biographies* by Arrighi (Paris, 1843), Klose (Brunswick, 1853), and Bartoli (Ajaccio, 1867).)

Paolo, Fra. See Sarpi (Pietro).

Paolo Veronese. See Cagliari (Paoli).

Pa'pa, town of Western Hungary, has many educational and benevolent institutions and some manufactures of stone-ware and pottery. Pop. 14,223.

Papacy. See Papal States and Pope.

Pápagos, a tribe of Indians in Sonora, called by themselves **Papapootam,** classed by H. H. Bancroft in the Pueblo family, nearly related to the Pimas, and hereditary enemies of the Apaches. They were partially civilized at an early period by Jesuit missionaries; were afterwards under the care of the Franciscans, and still remain Catholics. They were usually at peace with the Spaniards, became citizens of the Mexican republic, and were in 1874 assigned a reservation on the river Santa Cruz, between Tucson and Tubac. They are agriculturists, live in small villages of dome-shaped houses, possess a few cattle and horses, and number about 5000.

Papal Infallibility. See Infallibility.

Papal States, The, occupied the central part of the Italian peninsula, and extended, though with a very irregular shape, from the Adriatic to the Mediterranean, bounded S. by Naples, and N. by Tuscany, Modena, and the Austrian possessions. They comprised an area of 15,289 square miles, with 3,124,668 inhabitants, had Rome for their capital, and yielded (in 1859) a revenue of 14,453,325 scudi. The temporal power of the pope was in its origin a natural consequence of his spiritual supremacy, and the formation of the papal states is to be traced as following hand in hand with the development of the idea of the spiritual authority of the pope. Constantine the Great had endowed the episcopal see of Rome with large landed possessions; and when the Roman bishop assumed the title of *papa* and rose as the primate of the whole Christian Church, he was able to act with that munificence and surround himself with that splendor which form a most powerful support for any claim of superiority. In the centuries after the fall of the Roman empire, when the barbarians pushed forwards to Rome and the Byzantine emperors showed themselves unable to defend their possessions in Italy, the so-called exarchate, it was quite natural that the people of Rome should look on the pope not only as their head, but as their leader; and the first step towards the establishment of the temporal sovereignty of the pope may be said to have been taken by Gregory III. in 726, when, after a quarrel with the emperor Leo the Isaurian, he declared Rome independent of the Byzantine crown and called on Charles Martel for help against the Lombards. Charles was willing to help, but both he and Gregory III. died in the same year. His son, however, Pepin le Bref, fulfilled his promise. He defeated Aistolf, the king of the Lombards, and compelled him to yield up to the pope, Stephen II., the exarchate of Ravenna, comprising, besides the so-called Pentapolis or the five cities of Rimini, Pesaro, Fano, Sinigaglia, and Ancona, seventeen other cities, mostly situated on the coast of the Adriatic, and thus the foundation of the papal states was laid. Pepin's son, Charlemagne, confirmed and enlarged the donation. In 1053 the pope obtained the duchy of Benevento by aid of the Normans, and in 1102 the countess Matilda of Tuscany left all her fiefs, consisting of Parma, Modena, Mantua, and Tuscany, to the pope, who secured the possession of them, though only after a long strife with the German emperors. The chief difficulty attending the establishment of the temporal sovereignty of the pope lay in the vague and undefined relation in which he stood to the German emperor. Pope Leo III. had crowned Charlemagne emperor of the Romans, and the emperor had given Leo III. the exarchate of Ravenna, Rome, and other Italian possessions. But what did this really mean? The title of Roman emperor was inherited by the German successors of Charlemagne, and they evidently meant to transform the title into a real authority. Hence the severe struggles between Gregory VII. and Henry IV., and between Innocent III., Henry VI., and Otho IV., and it was not until 1278 that Pope Nicholas III. succeeded in compelling the German emperor, Rudolf I. of Hapsburg, to acknowledge him as a free sovereign, thereby establishing the papal states as an independent empire. The territory of this empire was increased under Julius II. by Pesaro, Rimini, Faenza, and Reggio; in 1598 by Ferrara, Comacchio, and the Romagna; in 1623 by Urbino, and in 1650 by Romiglione and the duchy of Castro. It underwent some changes during the wars of Napoleon, being at one time entirely incorporated with France, but in 1814 it was restored to the pope with nearly its former boundaries. The miserable administration, however, of the papal government, especially during the reign of Gregory XVI., caused a great fermentation in the population. Revolutions broke out in 1831 at Bologna and other places, and Gregory XVI. depended entirely on Austrian troops for the maintenance of his sovereignty. Pius IX. made some attempts at reform, but failed. In 1848 the revolution broke out in Rome, and the pope fled in disguise to Gaëta. He was restored by French soldiers, who held the city of Rome from 1849 to 1870. Meanwhile, one part of the papal dominions after the other emancipated itself from the papal sceptre, and united, through unanimous popular votes, with the kingdom of Italy; and when the French soldiers left Rome, Aug. 21, 1870, King Victor Emmanuel simply took possession of the city, declaring it the capital of Italy, and thereby abolishing the temporal power of the pope.

Clemens Petersen.

Papavera'ceæ [from *Papaver*, "poppy," one of its genera], a natural order of polypetalous exogenous plants, herbaceous (with a single Californian exception), distinguished by having a milky, yellow, or red, and acrid or narcotic juice; the parts of the flower in twos or some multiple of two, rarely in threes, but never in fives; the petals always at least twice as many as the sepals, and in two sets, the latter falling when the flower opens, and the former usually at the close of the day; the stamens indefinitely numerous, and the compound pistil with two or more many-seeded parietal placentæ. The qualities and useful products of the order are best represented by the poppy and its inspissated milky juice, Opium (which see), but acrid poisonous properties prevail in the prickly poppy (*Argemone*), the "fico del inferno" of the Spaniards, and in the celandine; as also, along with other useful medicinal qualities, in the *Sanguinaria* or blood-root of the U. S. The seeds of all are said to be innocent, abounding in a bland fixed oil. That of the common poppy is an article of commerce, and is even used as an adulteration or substitute for olive oil. Several poppies and other plants of the order are widely cultivated for ornament; among others, *Eschscholtzia* of California (remarkable for wanting the milky juice, and for the calyx falling off whole in the form of a candle-extinguisher), which has become one of the commonest ornamental annuals of the garden. Asa Gray.

Papaw' [Malay, *pâpaya*]. (1) The fruit of the *Carica papaya*, a small South American tree of the order Papayaceæ. This fruit is eaten, but is not very palatable. It has an acrid quality, and when boiled with meats renders them tender. The juice, at least before the fruit is ripe, contains a remarkable albuminous substance resembling or identical with fibrine, is anthelmintic, and has detergent powers. The root has an offensive odor. (2) In the U. S. the name papaw, or pawpaw, is given to *Asimina triloba, parviflora, grandiflora*, and *pygmæa*, handsome shrubs, or the former a small tree, of the order Anonaceæ. The pulpy fruit of the first mentioned is edible and not unpleasant, but if eaten in any considerable quantity is liable to cause nausea and other unpleasant symptoms.

Pa'pe (Johann Georg Wilhelm), a distinguished Greek lexicographer, b. at Culm in Prussia, Jan. 3, 1807; appointed assistant in 1828, promoted 1831, made professor 1837, in the Gray Cloister Gymnasium in Berlin; published *Etymologisches Wörterbuch d. griechischen Sprache* (Berlin, 1836), a preparation for his greater work, *Handwörterb. d. griechischen Sprache*, in 3 vols. (Brunswick, 1842; 2d ed. 1849–50), the 3d vol. devoted to proper names; added a *Deutsch-griechisches Wörterbuch* in 1845. An enlarged edition (the 3d) of the "Proper Names" was published under the care of Benseler (1863–70). D. Feb. 23, 1854. (See *Gelehrtes Berlin im J. 1845.*) Henry Drisler.

Pa'penburg, town of Prussia, in Hanover, was founded in the beginning of the last century, and is connected with the Ems by a canal. It has manufactures of sailcloth and ropes, a school of navigation, and an active trade in corn and wood. Pop. 6198.

Pa'per [Lat. *papyrus*, from Gr. πάπυρος and Egyptian *papu*, "a reed"]. The earliest known attempt at the production of an article similar to the paper of later or modern times was made in Egypt many centuries before the Christian era—some writers affirm 2500 years B. C.; the oldest manuscript in existence is on papyrus, and is supposed to bear date 1552 B. C. We have accounts of manufactories of paper for exportation at Memphis 700 B. C. The lower part of the stem of the papyrus-plant is, under its rough pellicle or skin, composed of thin layers of much cohesive power. These, being carefully separated, were laid side by side with edges overlapping, and on being subjected to pressure became a sheet of considerable tenacity. The number of these layers regulated the thickness of the sheet; they were made more solid and firm by beating, and were

susceptible of a degree of polish. This rude kind of paper was not improved for very many centuries, and seems to have met the wants of its consumers until about 450 B. C., when parchment was first used for books and valuable documents. At the beginning of the Christian era the use of parchment in Rome and Greece became very extensive, but not to the exclusion of papyrus, which was still exported largely from Egypt for many centuries. Toward the end of the first century the Chinese had, it is believed, begun to manufacture paper from silk and other fibres, but by what process is unknown. Two or three centuries later they were using cotton fibres for this purpose, and the art was either independently discovered or learned from the Chinese by various nations. The Persians and Arabs are known to have made paper from these fibres from the sixth to the seventh century; in 700 A. D. paper was made from cotton at Mecca. The art was introduced into Spain by the Moors, to whom modern civilization is so deeply indebted; and here it was first discovered that linen and cotton rags were more suitable for the manufacture of paper than the raw materials, owing to the hardness of the fibre being partly overcome by wear and use, making the reduction to pulp less difficult. From the twelfth century, Spain appears to have been the principal paper-producing country, Italy ranking second. During the fourteenth century the art was in use in France and Germany to a moderate extent, and in the next century these two countries had become the largest paper-producers; but during the fifteenth century Holland made rapid progress, and soon exported large quantities, England receiving her supplies mainly from Holland, France, and Italy. Toward the end of the fifteenth century—about 1490—the first paper-mill in England was built at Hertford, but the second mill was not established until fully fifty years later, being soon followed by three or four others. From this time forward the trade did not increase much for a period covering more than one hundred years, the country depending on the European continent for supplies. In France the art had flourished, paper being made there of superior quality, and it was exported to all European markets. About the end of the seventeenth century the manufacture in England received an impetus from the immigration of French refugees (driven from their native country by the Revocation of the Edict of Nantes by Louis XIV. in 1685), who introduced the improvements of the French manufacturers. The materials for some centuries were reduced to pulp by macerating them in water in a vessel resembling a mortar. A great step forward had been the introduction in the twelfth century of stamping-mills. The method of grinding by knives placed around a cylinder was invented in Holland, but not until the early part of the eighteenth century. This gave an impetus to the art.

FIG. 1.

Illustration of a paper-mill of the sixteenth century, from Jost Amman's *Panoplia omnium liberalium mechanicarum et sedentariarum Artium Genera continens*, etc. (Frankfort, 1564).

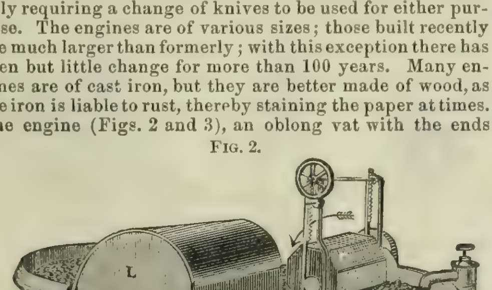
The great increase in the manufacture and consumption of paper did not begin until after the invention of the paper-machine. The original inventor, Louis Robert of Essonne, France, received in 1799 a patent for fifteen years and a premium of 8000 francs from the French government. It was introduced in 1802 by Leger Didot into England, where it was nearly perfected and brought into practical use by the Fourdriniers, whose name it bears, they having purchased the patent and rights of the original inventors. They expended large sums of money in their improvements—so large, in fact, that it ruined them financially, their only recompense being the honor of introducing one of the most wonderful pieces of mechanism ever devised, without which the demand for paper for the last fifty years could not have been met. The main principles of this machine, as it was put into operation by the Fourdriniers seventy years ago, have not been varied. Many improvements have been made in the working and form of the various parts, but the essential principle remains the same; and the same may be said as to the other principal piece of machinery requisite for paper-making—the engine for washing and beating—invented in Holland, and long called the Hollander. With this pulp-engine of the last century and the Fourdrinier machine of seventy years ago paper was made not much inferior to the product of the modern mills.

Cotton and linen rags were first used in Europe for making paper about the end of the eleventh century, and for a period of 700 years no other material was employed. The want of new material seems to have been felt with increased consumption, and active minds were constantly occupied in devising means of converting various substances into white paper, but with no practical result until within about thirty or forty years. Among the earliest of inventors on record was Bladen, who in 1682 took out a patent for making paper from cotton, linen, hemp, flax, cordage, silk, woollen, and all sorts of materials. It would seem his invention was not directed especially toward any new material, but about 100 years later we learn that white or partially white paper was made from wood in Germany. About the same time attempts were made to use straw for the same purpose, but with no practical result. The first invention that has been of any real advantage and worked in a practical manner was that patented by Mellier (about 1854) for the treatment of straw and other vegetable fibres by boiling at a pressure of 80° or over in caustic alkali of 4 per cent. This was rapidly followed by other inventions and improvements, and the result is now seen in a very large production of printing paper made almost solely from straw, and in some cases from straw alone, but the result is better with a moderate admixture of rags; and from this material can be produced white paper at a lower cost than from any other known substance. Almost simultaneously with this invention came a like method of treating wood chemically, and by nearly the same means, reducing it to a condition so that it could be bleached and used for white paper. The patents to Watt & Burgess were issued in 1854, and improvements were patented by Ladd, Keene, Dixon, and others. The result, after years of experiment and expenditure, was the erection in 1865 of extensive works at Manayunk, Pa., where the business has been continued on a large scale with more or less profit, but recently has been put in operation elsewhere. The fibre from wood, though softer and more pliable than that from straw, being wanting in strength as compared with that of esparto-grass or of the softest rags, is valuable when mixed with rags, and proves a great addition to the supply of paper-stock. Other patents have been issued for improved processes for the treatment of wood and straw chemically, but as yet none have been put in operation in a large way. The use of wood for white paper has not increased in proportion to the consumption of straw for the same purpose, the cost being greater. About the same time came Voelter's invention for reducing wood to fibre by machinery, without the use of chemicals. The wood is ground on stones rotating at high speed, the fibres being literally torn apart or separated; but they have very little power of cohesion, and consequently scarcely any strength. Mixed with rags, they increase the bulk of the paper. When 25 to 40 per cent. of ground wood is mixed with rags, they produce a cheap white paper. The wood retaining its natural color, the paper in which it is used is of inferior color, but, owing to its cheapness, the demand is large and increasing. In the U. S. 200 stones are now grinding it; their product, 15,000 to 20,000 tons yearly, being used mainly for newspapers, though in Germany it is used in the lower grades of writing papers. About two years later the conversion of esparto-grass into white paper was attempted. This material is found in large quantities in Spain, on the coasts of the Mediterranean, Algeria and Tunis exporting it largely—from Algeria a fair quality and in considerable quantities; the best qualities and largest supplies have been obtained from Spain. The principal consumption of it has been in England. It is only within a few years it has been used by French paper-makers. The first

patent for its use was issued to Routledge in 1856, and to him belongs the credit of its introduction. Unsuccessful for a long time, he finally worked out the problem, and the result now is a consumption of 120,000 tons yearly in England for white and fine papers, much of it being used for writing papers; as it yields from 45 to 50 per cent. of fibre, it furnishes stock for 50,000 tons of paper per annum. The value of this material is shown by the fact that twenty years ago it was worth barely the cost of gathering and transportation; the better grades now sell in England at £9 to £10 per ton, occasionally above £10. Straw without bleaching is largely used for ordinary grades of wrapping paper and straw boards. Jute, old ropes, bagging, waste from cotton factories, all kinds of old papers, paper clippings, all kinds of old waste material of vegetable fibre, are used by the paper-makers. Old newspapers and printed books are boiled in alkali to discharge the printer's ink, and used for making white paper. A printed newspaper will produce two-thirds its weight in clean white paper.

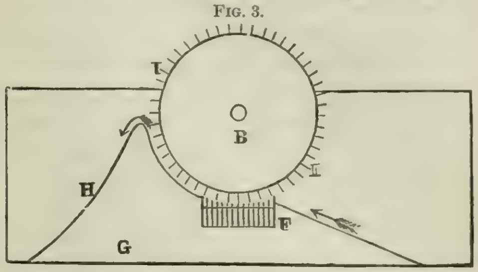
The first stage in modern paper-making is the careful sorting of the rags. This is done by hand (women being employed) on tables with bottoms of coarse wire-cloth, which allow a portion of the dust to fall through. On this part of the work, to a great extent, depends the cleanliness of the paper. It is necessary to take from the rags all pieces, however small, of metal, bone, or leather, above all of rubber, woollens, colored papers, and to dislodge all the dirt that is easily removed. The rags are also sorted into various qualities for the different grades of paper; then cut into small pieces. For very fine papers this is done by hand by the sorters, on a scythe or long knife fastened in a horizontal position on their tables; for the finest grades the seams are either cut off or cut open to exclude concealed dirt. Rag-cutters are used except where the finest qualities are made. The machine for cutting the rags usually has two rapidly-revolving blades coming in contact with a third or bed-knife, which is stationary, much like the hay-cutters, but of great strength. By these the rags are cut quite small, and are then carried on moving bands or belts to the duster, a large wire-cloth covered cylinder having a shaft inside with arms, the outlet end being lowest. This is revolved rapidly, giving the rags a thorough tossing and tumbling, whereby the dust is dislodged and falls through the wire cloth; after which they are ready for the boiling process. Where very fine hand-cut rags are used, they are sometimes boiled in chests or vats with little or no pressure, but in most mills the boiling is done in large, strong rotary boilers containing from 3000 to 4000 pounds of rags, and boiled from twelve to eighteen hours under a steam pressure of 20 to 60 pounds per square inch, varying with the quality of stock under treatment. Usually, they are boiled in a solution of lime, but for many grades soda-ash is added. This boiling softens or dissolves all grease, loosens the dirt, and prepares the rags for the thorough washing process which ensues. The washing and beating engines are much alike in form and construction—in fact, only requiring a change of knives to be used for either purpose. The engines are of various sizes; those built recently are much larger than formerly; with this exception there has been but little change for more than 100 years. Many engines are of cast iron, but they are better made of wood, as the iron is liable to rust, thereby staining the paper at times. The engine (Figs. 2 and 3), an oblong vat with the ends

FIG. 2.



rounded, is from 12 to 24 feet long, from 5 to 8 feet wide, $2\frac{1}{2}$ to 3 feet deep. The size mostly in use, and herein referred to, is 15 feet $\times$ $6\frac{1}{2}$ feet, capacity 300 to 400 pounds. A partition, called the "midfeather" (A), runs lengthwise of the middle of the engine, but not the entire length, being distant from each end half the width of the engine. This partition forms an endless passage-way for the pulp, half the width and the whole length of the engine; and through this passage-way the pulp is continually moved by the action of the engine-roll B. The roll is the same in length as the distance from the midfeather to the side of the engine, or nearly equal to half the width of the engine. This roll is

FIG. 3.



on a heavy iron shaft extending across the width of the engine and beyond for a bearing and driving pulley or gear; the end of the shaft on which the roll-block is secured also extends beyond the side of the engine, and the bearing D is on a long lever C, which, being raised or lowered by a screw, raises the roll from contact with the bed-plate F, or lowers it in closer contact with it. This bed-plate F is placed in a solid block G, which fills up the width between the midfeather A and the side of the engine. The front part of this block slants down to the bottom of the engine, thus allowing an easy approach of the pulp to the roll and knives of the bed-plate. From the back of the bed-plate, this block G is made to conform in shape to the curve of the circumference of the roll—near it, but not in contact. This part of the block is called the "backfall," H. From the top its shape is a curved descent to the bottom of the engine. The roll B is a solid wooden or iron cylinder securely fastened on a heavy iron shaft; lengthways on its surface, and parallel with the shaft, are equidistant grooves, 3 or 4 inches deep, and usually 2 to $2\frac{1}{2}$ inches apart. The roll-bars I are steel plates, the same in length as the face of the roll, 6 to 8 inches broad, about half an inch thick, hammered quite thin on one edge, having a notch or slot on each end. They are placed in the grooves, and are wedged tightly in their places; a heavy iron ring is driven tightly and firmly into each end of the roll; this ring fits into the notches in the end of the roll-bars; then the whole is tightly wedged, the bars extending $2\frac{1}{2}$ to 3 inches above the periphery of the roll. The bed-plate F, composed of a number of bars of steel with strips of wood between, firmly bolted together, is of the same length as the roll-bars; the form that has been the longest in use is called the elbow-plate (Fig. 4). Another form of bed-plate now much used is made of a large number of thin steel blades zigzag in form (Fig. 5); after each a thin layer of wood, all bolted together. The face of the bed-plate is curved to fit the sweep of the roll. The straight bars of the roll, running at high speed, come in contact with these diagonal knives or bars of the bed-plate, and grind, tear, and macerate most effectually the fibres of the material.

FIG. 4.

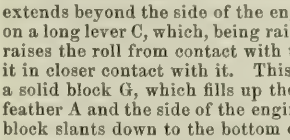
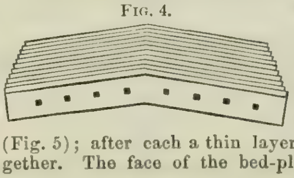


FIG. 5.



In the washing-engine are one or two cylinder-washers, K, which are lowered into, and partly submerged in, the mass of stock, and raised when their work is completed. They are round or octagonal cylinders of framework, with solid ends, but covered with fine wire-cloth on their periphery. When immersed in the stock, which is floated in a full supply of water, they revolve, and the dirty water passes through the wire cloth, is taken up by a series of scoops on their inside, and discharged through an opening in their shafts or journal. From the boiler the rags are placed in this first or washing-engine with a plentiful supply of water. The roll, revolving rapidly (130 revolutions a minute), draws toward and under it the floating rags; they are violently thrown over the top of the backfall H, and with them a volume of water. This action continuing, the rags are forced along, and soon the whole mass of rags and water is steadily moving in endless journeys around the engine and under the roll. The cylinder washer K is lowered and partly submerged in and revolves with the mass, continually discharging the dirty water, while a full supply of fresh, clean water is added during the whole operation. This washing continues from three to five hours, by which time the rags are thoroughly washed and rinsed by the passage through them of so much clean water. Over the roll is placed the curb, a box covering it, without which

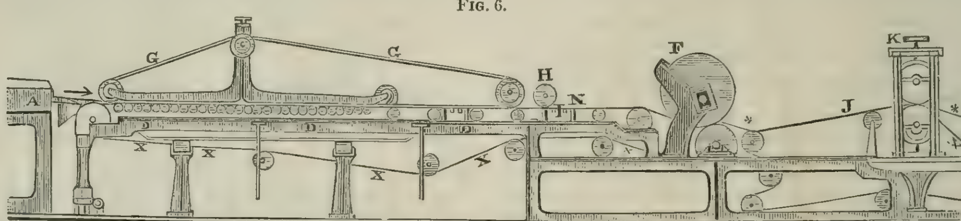
the roll by its rapid revolutions would throw out of the engine the rags and water. Clean, pure water is much desired for washing and all paper-making processes, since on its purity depend greatly the color and clearness of the paper. During this washing the rags have been partially ground and disintegrated, and are known as "half stuff."

The rags are now ready for bleaching, which is done by adding to the mass of half stuff in the engine a solution of chloride of lime, and later a small portion of sulphuric acid, which quickens the action of the chlorine. By raising a valve in the bottom of the engine the half stuff is emptied into a steep-chest in a room below; these steep-chests will contain many engines of half stuff. The half stuff remains in the steep-chests until the chlorine has fully acted on it—one to three days. The water is then drained off, and it is next taken to the beating-engine. In Europe an intermediate engine is used, in which, after washing, the rags are placed for bleaching; but in the U. S. the chlorine solution is added to the half stuff in the washing-engine. The beating-engine is substantially the same as the first or washing-engine, and is provided with a cylinder-washer, but with roll-bars and bed-plate less blunt, and usually with more rapid revolution of roll. The cylinder-washer is used for a short time, only to wash out the chlorine liquor, which is done by rinsing and changes of water, as in the washing-engine. If not fully washed out, the chlorine is neutralized by the use of an anti-chlorine solution. The lever C, sustaining the end of the roll-shaft, is now lowered, bringing the roll-bars in close contact with the bed-plate; the roll, revolving at high speed, produces a thorough grinding and beating of the pulp, which passes under the roll in endless motion for many hours until the fibres are thoroughly separated. This beating usually continues from three to ten hours, according to the quality to be produced. For bank-note paper twenty-four to seventy-two hours are often required, in which case the roll is not lowered in close contact with the bed-plate.

The half stuff is now ready for the paper-machine, and is emptied into stuff-chests, and more water added until it is of a semi-liquid consistency. It is here kept in constant agitation, that it may be thoroughly mixed with the water. Until the invention of the Fourdrinier machine, about the year 1800, this pulp was made into sheets of paper by hand—a process now but little used. A quantity is placed in the vat, a wooden tub; the quantity of water added regulates the thickness of the sheets of paper to be made. The mould is a light, flat wooden frame covered with wire cloth; if laid or water-mark paper is required, coarse wires on this would cause corresponding marks in the paper. A thin frame, called the deckle, is placed on the mould; the inner area of this deckle forms the size of the sheet to be made. The vatman, holding the mould with both hands, dips it into the pulp in the vat, and slowly raises it level and flat; the deckle or frame around the edges of the mould is somewhat higher, and retains a sufficient quantity of pulp on the mould to form the sheet of paper. The vatman carefully, with a peculiar slow shaking motion in both directions, raises the mould; the water runs through the wire cloth; the shaking motion of the half-liquid pulp causes the loose floating fibres to knit and adhere together. Soon the water has drained through this sieve-like mould, leaving a wet sheet of paper perfectly formed, but too wet and pulpy to be handled. The vatman slips off the deckle on to another mould, passing the first mould, with the sheet of paper on it, to another workman, the coucher (*accoucher*), who, after letting it stand in an inclined position a short time to drain, reverses the mould, laying it on a woollen blanket or felt, to which the pulpy sheet of paper adheres, leaving the mould (which goes again to the vatman). On this sheet is laid another felt, which in turn receives its sheet of paper, until 120 to 150 each of alternate sheets of paper and pieces of felt are piled up. This pile, called a "post," is now placed in a press and pressure applied to squeeze out as much water as possible. The sheets, although wet, can be handled, and after another pressing and stripping are hung up in the loft to dry. When dry the operation of sizing follows. If for writing papers, this is performed by dipping the dry sheets in animal sizing, a weak solution of glue. Again the sheets are hung up to dry, after which they are pressed, calendered, or hot pressed, and otherwise manipulated as their quality may require.

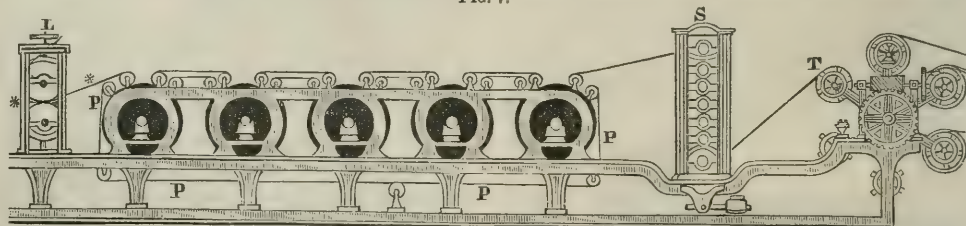
Under a microscope the vegetable fibre is seen to be a cylinder, but the early mortar and the later stamp-mill process having pounded and flattened it, the edges become rough and ragged; and the shaking motion given by the vatman with the mould brings these ragged

Fig. 6.



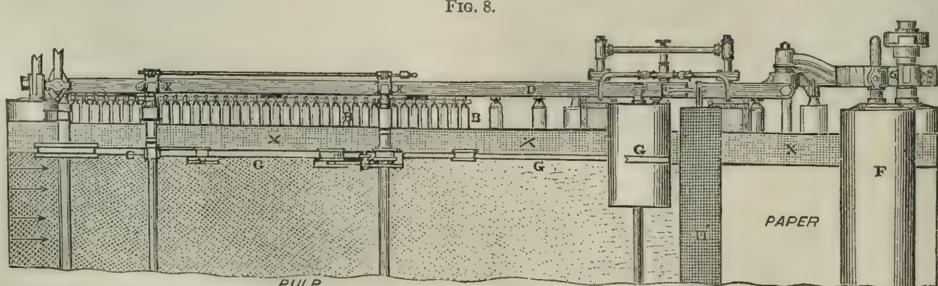
fibres into contact, when they become entangled and the sheet of paper is formed. It is by the imitation of this motion, given to the mould by the vatman, that the sheet of paper is so successfully formed by the Fourdrinier ma-

Fig. 7.



chine (Figs. 6, 7). In the stuff-chest, agitators in constant motion mix the pulp thoroughly with water, uniform consistency being necessary to form sheets of uniform thickness. The pulp is afterward pumped to the Fourdri-

Fig. 8.

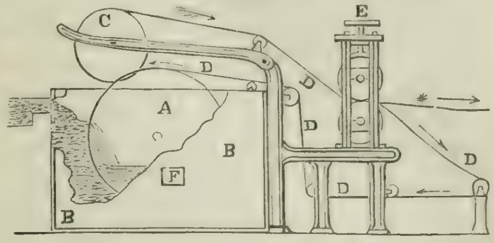


nier machine-room above, passing through a valve which regulates the flow in accordance with the thickness of the sheet required. Then it passes through a fan-pump with a large addition of water, the action of this pump mixing

it thoroughly. From the pump it passes in a broad stream on the screen, a wooden frame of the same width as the machine, covered with smooth brass plates, in which are long and very narrow slits. This screen has a rapid vertical jolting motion or shake given to it, which causes the pulp to pass through to the vat beneath. The knots, lumps, and much of the dirt remain on the screen, and are removed at intervals. From the lips of the vat A the pulp passes, much diluted, on an apron, in a very broad thin stream, on to the Fourdrinier wire or mould. This is an endless wire cloth (X) about 33 feet long and of the width of the machine (some are now made 8½ feet wide, usually about 6 feet), running horizontally, and although a very thin wire cloth is used, it must run flat and level (Fig. 8). For this purpose it is supported by, and runs on, a number of copper or brass tube-rolls B, small in diameter and as near together as can be without contact. Below the tubes is a long, wide, shallow trough, the "save-all" C, to catch the water passing through the wire and the small portions of pulp carried through by it. The side-frame D supporting the ends of the tube-rolls is given a violent lateral shaking motion; the semi-liquid pulp while floating along on the wire cloth is by this motion shaken together, and the fibres become closely interlaced, the water passing through the wire cloth; and this process continues nearly the distance run by the wire cloth to the couch-rolls F. The pulp is prevented from spreading out over the sides of the wire cloth by the deckle-straps G, endless rubber straps, 1¼ inch thick or high, which run one on each side and on top of the wire cloth, and thus determine or form the width of paper. They continue about two-thirds the distance on the mould, by which time the paper is formed, although still in a wet and pulpy condition. About this point is placed the dandy-roll H, a cylindrical frame covered with wire cloth, which, running on the pulpy paper, presses the fibres closer together. If a laid mark or any design is required, it is made on the surface of this dandy-roll with coarse wire, and by running it on the wet paper the design is transferred to it. The wire cloth now carries the still wet paper over one or more suction-boxes, I, with perforated brass plates on the upper side next the wire, to which a suction-pump is attached, forming a vacuum in the boxes and drawing more of the moisture from the paper. The wire cloth now passes with the paper between the couch-rolls F, which are heavy metal rolls covered with thick woollen jackets. Their pressure expels much of the remaining water, and the paper, now somewhat free from moisture, is conveyed from the wire to the felt J of the "first-press" rolls K, two iron rolls with an endless woollen felt (J) between. The upper roll being weighted, more moisture is pressed out, and the paper passes to the "second-press" rolls * (L, Fig. 7), also on a felt, where still more moisture is pressed out; and it is now ready for the drying-cylinders M, copper or iron cylinders filled with hot steam; they are 2½ to 3½ feet in diameter, and from five to ten are used, occasionally a larger number. Moving with them, and covering three-fourths of their circumference, is a cotton or woollen felt P. The wet paper is introduced between the surface of the dryer and felt, the latter holding it firmly to the surface of the dryers until it has passed along with it and over all the dryers. Leaving them a continuous sheet of dry paper, it is then passed between a series of polished iron rolls S in stacks of two or more, to give the paper a surface. In modern mills in the U. S. chilled iron rolls, eight to twelve in a stack, with pressure applied by screws or levers and weights, are now used, and quite a high surface is the result. From these rolls the paper is usually wound on reels, T, to be afterward super-calendered if very high surface is wanted; then passed through the cutter, a machine with a revolving knife coming in contact at each revolution with a stationary knife; between them the paper passes and is cut into sheets, the speed of the revolving knife being regulated according to the length of sheet wanted.

The wire cloth on the Fourdrinier machine is rather costly, and wears only a few weeks. And the flow of water through the wire is so great, carrying with it some of the very finely-ground fibre, that although by the use of the "save-all" most of the water is caught and used again to mix with the pulp, a considerable waste of fibre is inevitable. The cylinder machine (Fig. 9) costs much less, and can be operated more economically. The cylinder A is a frame of metal 2½ to 3½ feet in diameter; its length is equal to the width of the paper-machine; its surface is formed of rods of brass quite close together. Over this is placed a jacket of coarse wire cloth, and over this a jacket of fine wire cloth, both tight and smooth, without wrinkles. The outer or fine wire cloth corresponds with that of the Fourdrinier. This cylinder is placed in the vat B, its ends fitting closely to

Fig. 9.



the sides. The vat is a square tank nearly filled with diluted pulp of the required consistency, with which it is kept supplied by a regular flow. The open ends of the cylinder are in close contact with the sides of the vat, and with a packing to prevent a leakage of water between the ends of the cylinder and the sides of the vat. The vat has an opening in each side below the centre of the cylinder, near its periphery; through these openings flows the water that passes through the wire-cloth covering of the cylinder. Above the cylinder, in contact and revolving with it, is the "couch-roll" C, of 1½ to 2 feet diameter, and of the same length as the cylinder. Between the couch-roll and the cylinder runs an endless woollen felt D, which, after contact with the cylinder, passes around the couch-roll down to and between the first-press rolls, E. The practical operation is as follows: The machine starts—the vat filled with diluted pulp and with a constant supply flowing in—the water inside of the cylinder running out through an opening in the side of the vat; the water in the vat outside of the cylinder passes through the wire-cloth; and this continuous flow of water draws with it the pulp, which, however, is arrested at the surface of the cylinder by the wire-cloth covering, and the pulp forms a film on the submerged surface of the cylinder. This film is the paper in a pulpy condition. The cylinder revolving, this film of pulp adhering, it is lifted out of the liquid of the vat; the movement, continuing, brings it in contact with the soft woollen felt between the cylinder and the couch-roll, and it adheres to the felt. The couch-roll bearing with some weight on the cylinder, much water is pressed out. The movement continuing, the felt carries the paper between the first-press rolls, where more water is pressed out; then through the second-press rolls and over the dryer between calender rolls, the same as in the Fourdrinier machine. Beyond the first-press rolls the Fourdrinier and cylinder machines are alike. As the volume of water mixed with the pulp is very much less than on the Fourdrinier, and nearly all being carried back and again mixed with the pulp, there is less waste on the cylinder machine; but as there is no shake or lateral motion given to the pulp as it goes to the wire cloth of the cylinder, the fibres run mostly in one direction, and the paper is not as strong in both directions as that made on the Fourdrinier machine, where the fibres fall in all directions; and for the same reason the cylinder paper is not as bulky for the weight. Cylinder machines are extensively used in the U. S. for making wrapping papers, straw and binders' boards, hanging papers, and occasionally for the inferior kinds of news-print, while a few are employed for making writing papers. There are (1876) 700 cylinder machines in the U. S., and 350 Fourdriniers.

Sizing.—Paper in its natural state is porous and absorbent, and cannot be written on until it is sized. Paper made by hand is, after drying, dipped, a few sheets at a time, and passed through animal sizing, a weak solution of glue; it is then hung up to dry, afterward pressed, calendered, etc., the glue sizing also tends to harden and stiffen the paper. On the Fourdrinier and cylinder machines the paper after leaving the dryers passes through a shallow vat containing this glue or animal sizing, then between the "size-rolls," which press out the superfluous liquid sizing; it then passes to a machine which cuts it in sheets and lays them in a pile; it is then hung in the drying loft, and when dry stripped, pressed, and calendered. In England there are used in most mills, for drying paper after animal sizing, a series of cylinders covered with wire, over which the paper passes. Inside of each cylinder is a circular fan revolving rapidly, forming currents of cold air which dry the paper; often 50 or 60 cylinders with fans are used. Various other machines are used for the purpose of drying the animal sizing slowly, but the air-dried papers are always the best and most perfectly sized. Engine sizing is used where strong sizing is not necessary and for printing papers. In many parts of Europe the papers for writing purposes are sized in this way: The engine sizing is made of rosin and alkali; the solution is

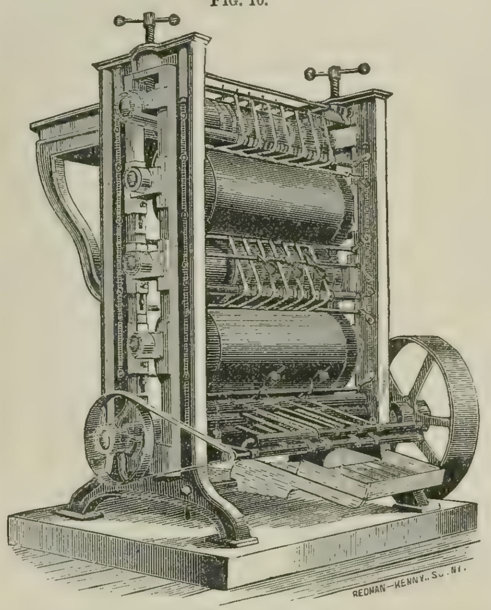
* Fig. 7 is a continuation of the paper-machine, all on the same level, but represented in two parts, on account of the width of the page.

put in the beating-engine and mixed with the pulp. For colored papers the dyes are mixed with the pulp in the beating-engine; also clay and terra alba for adulteration. Starch is often added to stiffen the paper and improve the surface. To overcome the yellowish shade of white paper a small portion of ultramarine is added.

Plating-Machines.—Paper hung up to dry comes down very rough. The early paper-makers pressed this between metal plates, and a moderately smooth surface was obtained. A later improvement was pressing between heated plates. Paper so treated was called "hot pressed." The plating-machine was the next improvement, still used almost exclusively in Europe, except in England, where calenders are also used. This machine is simply a pair of heavy and strong iron rollers in a stout iron frame. Great pressure is applied by weights and levers or by screws. The paper is placed between thin sheets of copper or steel, and passed between the rolls until the required surface is obtained.

Calenders.—The calenders (Fig. 10) now in use are five

FIG. 10.



to eight rolls in a stack, in strong iron frames, screws at the top pressing the rolls together, the alternate rolls being of highly polished iron and rolls covered with paper. The paper rolls are made by passing a heavy iron shaft through a hole in a great number of sheets of linen or manila paper. The paper, subjected to hydraulic pressure, becomes nearly a solid mass; it is then secured in its place by iron collars, turned round, and highly polished. The sheets are fed between the two upper rolls, and kept in position and carried through the set by tapes, carrying the paper after leaving one pair of rolls to the point of contact of the next pair. This process is repeated until the desired surface is obtained. In web-calendering, for calendering paper from reels before it is cut into sheets, one end is passed between the two upper rolls, and it is carried through the whole stack by the tapes and delivered at the bottom, where it is again reeled into a roll, this operation also being repeated until the surface is as required.

Clean white cotton or linen rags yield 65 to 80 per cent. of their weight; clean, sound colored rags make 55 to 60; while low-grade colored or very dirty white rags, containing more pieces of woollens and rubbish, will yield but about half their weight of paper. Paper shavings and clean waste papers yield 75 to 80 per cent.; old printed white papers are used in making white paper, the ink yielding to boiling in soda-ash, and producing 60 to 70 per cent. of paper; straw produces 30 to 40 per cent. of its weight of white paper, while, made into wrapping paper, without bleaching, its yield is twice as much. Dry poplar-wood chemically treated, yields 30 to 33 per cent. One cord of wood ground mechanically yields fibre for nearly 1000 pounds of paper.

Statistics.—Lockwood's tables for 1872 for the U. S. give the number of paper-mills at 812; value, $35,500,000. Fourdrinier's machines, 299; cylinder machines, 690; engines, 3296, employing 13,427 men, 7700 women, and 922 children. Total wages, $9,500,000; yearly product, 317,637 tons of paper; value, $66,500,000, of which there were 22,970 tons of writing, value $12,000,000; 91,446 tons of book, rag, print, value $25,000,000; 14,000 tons of straw print, value $3,000,000; 39,177 tons of manila, value $8,500,000; 39,597 tons of straw-wrapping, value $3,000,000; 19,700 tons of wood-pulp, value $2,000,000; remainder, straw and other boards, hanging, roofing, and sheathing papers, including 3800 tons for paper collars. Since 1872 about 80 mills have been put in operation, adding 25,000 tons to the yearly product, but the value is no higher, prices being much lower. The production of ground wood-pulp has been largely increased; about 200 wood-grinding machines are in operation, making about 20,000 tons of pulp yearly.

Rudel's tables for 1873 for the world, excluding the U. S., give mills, 1497; machines, 2042; tons, 880,000. Adding the U. S., the total is 2309 mills, 3031 machines, and 1,198,000 tons. The largest consumption is that of the U. S., the *per capita* being about fifteen pounds; Great Britain ranks next. C. E. O'HARA.

Pa'per-Hangings, or **Wall-Papers,** are reported to have been made in Spain and Holland before 1555, but their manufacture has only in recent time become a leading industry. The choicest wall-papers are made of good material, but for the low grade large quantities of woollen, hempen, and jute waste are employed. The paper is made of any desired length. It was formerly all printed by hand, either by the process of block-printing or stencil. Of late, cylinder-printing is used, identical in principle with the processes employed in CALICO-PRINTING (which see). But some choice styles are still hand-printed, and some striped papers are colored by a simple process which cannot be called printing, the colors being imparted through apertures, underneath which the paper is rapidly drawn. Flock-printing is done by printing the pattern in with varnish and then sprinkling on colored *flocks,* in powder, the flocks being the shearings of woollen cloth. Satin papers are finished with powdered steatite, and polished.

Paper, Mulberry. See MULBERRY PAPER.

Paper Nautilus. See ARGONAUT.

Paphlago'nia was a district of Asia Minor extending along the southern shore of the Euxine Sea from Pontus to Bithynia, and bounded S. by Galatia. It was inhabited by wild and warlike tribes belonging to the Semitic race, and it was celebrated for the excellent horses it produced. Originally, it formed an independent state, but it was conquered by Crœsus, and subsequently incorporated in the Persian empire. After the death of Alexander, it became independent once more, but was conquered by Mithridates, and after his fall it was made a part of the Roman province of Galatia.

Pa'phos was the name of two ancient cities of the island of Cyprus. One of them, the present *Kukla,* was often called *Palaipaphos* (Old Paphos), and was famous for its temple of Aphrodite, who was said to have been born here from the foam of the waves. The other, the present *Baffa,* was called *Neopaphos* (New Paphos), and was the place where St. Paul preached to the proconsul Sergius.

Pa'pias, a Christian Father of the second century, bishop of Hierapolis in Phrygia; suffered martyrdom at Pergamus during the persecutions of Marcus Aurelius about 163. Of his Λογίων Κυριακῶν Ἐξήγησις only eleven fragments have come down to us. (See *Reliquiæ Sacræ* of Routh (Oxford, 1814; 2d ed. 1846).) He was a very strong millenarian.

Papier-Mâché [Fr., signifying "mashed" or "pulped paper"], the name of an industry which, although comparatively modern in the Western World, seems to have been previously in use in China and the East. In its original sense, of paper moulded into required forms, *papier-mâché* is found to have been used in the construction of the ceilings of some of the Elizabethan mansions. The *carton-pierre* now used is a combination of stucco and papier-mâché. Early in the last century snuff-boxes are found made of papier-mâché, and there seems some reason to consider that, notwithstanding its French name, it is of English origin. In 1772, Henry Clay of Birmingham took out a patent for a process in which papier-mâché was made by pasting together sheets of spongy paper over metal moulds. He was a man of foresight, and claimed that his invention was applicable for panels, mantelpieces, trays, card-tables, and every other species of elegant furniture. Clay reaped a princely fortune, became a county magistrate and high sheriff of Warwickshire. A sedan chair presented to Queen Charlotte gained him royal patronage. The principal seat of the papier-mâché industry is still at Birmingham, and both the pulp and Clay's process of making the blanks are in use. The former is the cheaper, and much of the work now turned out is made from material so prepared. The superiority of the articles made from sheets of paper pasted together is due to the evenness of the material.

The decoration to which papier-mâché has been subjected has varied considerably in character. It may be doubted whether the simple lines of bronze, gold, black of the earlier specimens have been exceeded in point of good taste and effect. Copies of paintings have sometimes been introduced, and for a time subjects in gold-size and colored bronzes were common. Some of Morland's rustic pictures were copied in this manner. Some imitations of Chinese and Japanese ornament have been produced. Pearl-shell inlaying was patented in 1825. The ornament was painted on the pearl with varnish, and the unprotected part eaten off with acid. The thin laminæ of shell are simply fastened to the partially-prepared papier-mâché by copal varnish. Electro deposition and photography have also been used in the decoration of this article. Aluminium has been applied to it. There is also a process by which colored designs on tracing-paper are transferred. This was patented in England in 1856, and it depends nearly upon the principles of the well-known diaphanie process. The vice of the manufacture at present is a tendency to excessive ornamentation, and that not simple or chaste in character. The best articles are made from sheets of soft gray unsized paper, fastened together by glue or paste, and stretched on a metal surface adapted to give the desired form; then exposed to heat of 100° F., and rasped. Succeeding sheets are added until the required thickness is attained; they are immersed in oil and spirits of tar, and placed in another drying-stove with a heat of more than 200°. After smoothing and planing, they are placed in the varnisher's hands, who adds tar, varnish, and lampblack, and they are again stoved. The decorator now begins operations, and the articles are finished by a coating of transparent copal varnish. Some articles of papier-mâché are also made from sheets of thick mill-board made from pulp, subjected to great pressure. This block-paper is used alike for the panelling for railway cars and for the production of imitation jet ornaments. (See Timmins, *Birmingham and Midland Hardware District* (1866); *Abridgments of the Specifications of Inventions relating to Paper, etc.*)

WM. E. A. AXON.

Papier-Mâché Process. See PRINTING.

Papilionaceæ. See LEGUMINOSÆ.

Papil'lion, post-v. and tp., cap. of Sarpy co., Neb., on the Union Pacific R. R. Pop. 333.

Pap'in (DENIS), b. at Blois, France, Aug. 22, 1647; studied medicine at Paris and practised for some time as a physician, but devoted himself subsequently to the study of physics and mathematics under Huyghens; visited England, and received in 1687 a professorship in mathematics at Marburg in the present Prussian province of Hesse, where he d. about 1712. His writings are numerous, but are scattered in *Acta Eruditorum*, *Recueil de diverses Pièces*, *Philosophical Transactions*, etc.; they contain many valuable discoveries, most of which, however, were not fully recognized during his lifetime. He was the inventor of the so-called Papin's digester. (See DIGESTER, PAPIN'S.) It also appears that in 1707 he tried on the river Fulda a vessel propelled by paddles operated by a steam-engine.

Papineau', post-v. and tp., Iroquois co., Ill., near the Chicago Danville and Vincennes R. R. Pop. 1064.

Papineau' (LOUIS JOSEPH), b. at Montreal Oct., 1789; studied at the Seminary of Quebec and became an advocate; in 1809 entered the Canadian parliament, and in 1815, and again in 1827, was Speaker of the lower house; but Lord Dalhousie, who had tried in vain to conciliate him with the conservative party, in the latter year adjourned the parliament to prevent Papineau from acting as Speaker. He was after that the acknowledged leader of the Lower Canadian radicals, or French party, and after the breaking out of the rebellion of 1837 (which he did not approve) was accused of high treason and escaped to the U. S., and thence in 1839 went to France. In 1847 he returned to Canada; and though sent to Parliament and highly popular with the French element, he never again assumed the leadership. D. Sept. 23, 1871.

Pa'pinsville, post-v. of Bates co., Mo.

Papinia'nus (ÆMILIUS PAULUS), b. about 170 A. D.; held high and influential positions under the reign of Septimius Severus, but was put to death in 212 by Caracalla. His works—37 books of *Quæstiones*, 19 of *Responsa*, 2 of *Definitiones*, etc.—were considered the highest authority in Roman jurisprudence, and several of the most eminent Roman jurists, as, for instance, Ulpian and Caius, were his disciples. The *Digests* contain 595 extracts from his works, but generally they are very short.

Pap'pus [Πάππος] OF ALEXANDRIA, a distinguished mathematician who flourished in the second half of the fourth century (A. D. 379–395). His most important work was the Μαθηματικαὶ Συναγωγαί ("Mathematical Collections"), explanations of earlier mathematicians, with extracts and his own criticisms on them, in 8 books, of which 6 have been preserved; of value in the history of mathematics. He wrote also a description of the world, rivers of Africa, on the explanation of dreams. Only slight portions of Pappus have been printed in Greek.

HENRY DRISLER.

Pap'ua, or **New Guinea,** a large island extending from lat. 0° 30′ to 10° 4′ S. and from lon. 131° to 151° 30′ E., and comprising an area of about 250,000 square miles, lies immediately N. of Australia and connects the Malay Archipelago with the Polynesian groups. The interior of this vast island is almost entirely unknown to us; we know only that it is mountainous, containing peaks which rise above the snow-line, and that its mountains are covered with immense forests yielding excellent timber and many peculiar vegetable products, as, for instance, the fragrant massay bark, which is largely exported to China and Japan and highly esteemed on account of its medicinal qualities. But even the coast-land has been explored only in a few points. Best known are the northern coast, along the Geelvink Bay and the delta of the Amberno, and the southern coast, along the Torres Strait, which separates Papua from Australia and at its eastern extremity forms a large inlet called the Gulf of Papua. The western shore of this inlet consists of one vast delta, whose mud-banks, extending from 10 to 20 miles out into the gulf and everywhere intersected by broader or narrower, deeper or shallower fresh-water canals, are overgrown with dense forests of camphor trees, iron-wood, sago-palms, cocoanuts, bananas, and oranges, interspersed with wild nutmeg and other spice trees. The eastern coast is lined for a distance of about 150 miles with coral-reefs, which, however, present many openings and afford excellent harbors. The coast itself is steep and bold, its highest summit, Mount Astrolabe, rising 3800 feet and pushing out close to the shore. At some distance behind these mountains a much loftier range is seen, covering the whole south-eastern peninsula and lifting its peaks to a height of over 13,000 feet. Both on the northern and southern coasts the mountains consist of a white limestone, but in the interior a brownish sandstone and a reddish clay mixed with blocks of quartz are of frequent occurrence; coal is found. The climate of Papua shows a remarkable difference from that of Australia. It is rather moist, water is everywhere abundant, while its scarcity in Australia makes many parts of that island a naked desert. This difference can be accounted for only by the circumstance that Papua is reached by the monsoons and the southern equatorial current, but the consequence is that the ground is covered with a most luxuriant vegetation. The indigenous animals, on the contrary, show only a few species. The wild-boar and the kangaroo are frequent; also the bird of paradise, the crown-pigeon, and the parrot. The inhabitants, the Papuans or Papua negroes, seem on a closer acquaintance not to be so homely and savage as formerly reported. They are of smaller stature than the African negroes, and characterized by a lateral compression of the head, an almost disappearing chin, and excessively thick lips and broad nostrils. They have only a very vague idea of a supreme being, by whose will they live and die, and have no forms of worship. They go almost naked and paint themselves hideously, but they build neat houses and good vessels with double lateen sails of matting. They marry early, and their marriages are monogamous and indissoluble. A fried banana is divided between bride and bridegroom; they eat it with joined hands, and the marriage ceremony is over. The tribes of the interior, however, are reported wilder, more warlike, and more savage; cannibalism is said to exist among them. Papua was discovered in 1511 by the Portuguese, and visited in 1615 by the Dutch. In 1828 the latter built a fort on Triton Bay and claimed the island as a possession of the Netherlands; and although the fort was finally abandoned on account of the insalubrity of the climate, they have in later years made several exploring and surveying expeditions to the island, and a trade has sprung up, the natives giving massay bark, tortoise-shells, pearls, and birds of paradise in exchange for European and Chinese tools and fabrics.

CLEMENS PETERSEN.

Papy'rus, a kind of reed or cyperus, supposed to be the *Cyperus antiquorum* formerly cultivated in Egypt for various purposes. Its Egyptian name was *papu*, from which *papyrus* is derived, or *tsut*, and when manufactured it was called *tama*, the Coptic *gômi*, by which it was known to the Hebrews. It was cultivated at the remote period of the fourth dynasty in the delta or Lower Egypt, and continued till some centuries B. C., but no longer exists there, although still existing in Lake Merom in Palestine, the Niger, and the Euphrates. The reason of its extinction

is unknown. The flowers were used for crowns, the pith or pulp for wood, the roots for fuel, the whole stem for ropes, matting, sails, boats, boxes, and sandals; but its principal employment was for the fabrication of papyrus, or rather paper, which was manufactured from slices of its stem. For this purpose the ends were cut off, and about twenty pellicles or philyræ under the rind of the prismatic stalk peeled from the whole length by a fine knife or needle. These varied in quality, the finest being inside. A number of these were laid close to one another vertically on a board, and over them another set close to one another horizontally. They were then moistened with water of the Nile, to which gum may have been added, hammered, pared, smoothed, and bleached in the sun. The papyri were made in long rolls, sometimes reaching 120 feet, but the breadth varied from about eight to fifteen inches at different times, according to its employment. Even before use it was rolled up into a cylindrical form like paper for walls, silks, and other fabrics. On this paper all the Egyptian books were written by a reed frayed and black ink made of animal carbon and oil and rubrics of red paint. The larger compositions are divided into short pages about eight or nine inches long, and from ten to fourteen lines to a page; and when the material was scarce these were written on both sides of the roll. Small documents, such as letters, had seals of clay attached to them. The subjects of the papyri comprise the circle of Egyptian literature, such as the *Book of the Dead*, or *Ritual*, when complete, in 165 chapters in the hieroglyphic and hieratic character; hymns to Ammon, Ptah, and the Nile; the *Lamentations of Isis;* the *sâi-en-sin-sin.* Solar litanies, representing the passages of the deceased in the sun's boat through the hours of the night, are also found. Besides these historical compositions, of which the expulsion of the Hyksós and the dotation of Rameses III. to the temples of Egypt, the campaign of Rameses II. against the Khita, letters, romances, Greek letters, plaints, accounts, the *Iliad* and orations of Hypereides, Phœnician or Aramaic compositions, Coptic religious works, and Arabic passports have also been discovered in the tombs, placed in jars or on the mummies. Egyptian papyrus was in use in Greece, although expensive, and not common till the age of Alexander the Great, at which time it came into general use at Rome; and the plant is said to have been raised in S. Italy. But it was probably imported from Egypt, although subsequently prepared by sizing and other processes for the Roman market. Many kinds were known, distinguished by their size and fineness, as the Augusta, Livia, Fanniana, Claudia, named after persons or emperors; the Saitica, Memphitica, Thebaica, and Carica, after the places where produced; the regia, from its quality: it varied from nine to fourteen inches in breadth, and was sold in quires; scaphi, of ten or twenty pages. The writers used Egyptian or Carian reeds like the Egyptian, but with an ink made of vegetable carbon, and a red earth for the rubrics. Blind lines, or lines ruled with lead, were employed to guide the scribe, and each roll, called *volumen*, was rolled on a cylindrical stick, *umbilicus*, with a projecting knob, *cornu*, the edges colored black, and the title written on a parchment strip, *lorum.* A great trade flourished at Alexandria; and papyrus was used in Europe till the twelfth century A. D. The papyri of Pompeii were blanched by the volcanic eruption, but those of Herculaneum only charred like burnt paper, the writing slightly darker and more glossy. By a careful unrolling of these charred fragments, under a process discovered in 1758, several of these papyri have been copied and several published, but they are unfortunately chiefly works of philosophers of the Epicurean sect, and of no great interest. Papyri occupied much more space than modern books; it required above forty for the works of Homer alone, and the large public libraries of Alexandria and Rome scarcely amounted in their contents to 10,000 modern books. There are probably in Europe alone 4000 Egyptian papyri and fragments which have been unrolled, and there ought to be at least as many more in the sepulchres of Egypt. In Herculaneum, 1067 papyri and fragments were discovered. The Egyptian are generally damped to be unrolled, then laid down on drawing-paper and glazed. SAMUEL BIRCH.

Para', in Turkish countries, a small coin generally of copper, worth one-fortieth of a piastre, or from about one-thirty-second to one-thirty-sixth of a cent.

Para, the largest province of Brazil, extends along the Amazon, bounded N. by Guiana and S. by Matto Grosso, and comprising an area of 532,000 square miles of the richest and most productive soil on earth. It consists of a low plain of alluvial soil, covered with primitive forests or presenting rich pasture-ground. But its inhabitants number hardly 350,000; that is, one man to one and a half square miles. During the revolutionary wars between 1830 and 1840, this province suffered very much; the best part of the population, the most industrious and intelligent, the Portuguese, were driven away, and the Indians, negroes, and mestizoes remained. In the last ten years, however, the province has begun again to advance. Coffee, rice, and cotton are cultivated. Coal, iron, gold, and diamonds are found, but mines are not worked.

Para, or **Belem,** town of Brazil, the capital of the province of the same name and a place of considerable commercial importance, with an excellent harbor on the right bank of the Para. It is well built and has several elegant buildings and beautiful promenades, and its climate is healthy even for Europeans. In 1819 it had 24,500 inhabitants; in 1840, after the revolutionary war, it had only 9052. It has risen rapidly, however, since the war, and its present population is variouly estimated at from 25,000 to 35,000. The value of its exports rose from £399,333 in 1858 to £665,196 in 1860, and that of its imports from £414,967 in 1858 to £529,863 in 1860.

Para, the southern and most frequented branch of the Amazon, South America, 40 miles broad at its entrance into the Atlantic, 200 miles long, and navigable throughout its whole length for the largest vessels, though not without a pilot. It is in this arm of the Amazon that the famous *bore* is formed.

Par'able [Gr. παραβολή, a "comparison"], a short fictitious narrative intended to illustrate some point in moral or religious teaching. Parables abound alike in the teaching of Christ and in the Jewish Talmudical writings; but the parables of Christ (not used by him in the beginning of his ministry, but only after he had encountered opposition) immensely surpass all others.

Parab'ola [Lat. *parabola;* Gr. παραβολή], a plane curve having one or more infinite branches, but no asymptote. The general equation,

$$y^n = a^n x^m, \text{ or } y = a x^{\frac{m}{n}}, \qquad (1)$$

represents a family of curves passing through the origin of co-ordinates; the curves of this family are parabolas when m and n are whole numbers having the same sign, and they are hyperbolas when m and n are whole numbers having contrary signs. If $m = 1$ and $n = 2$, equation (1) represents the common parabola when referred to a diameter and the tangent at its vertex; its equation is then of the form

$$y^2 = 2px. \qquad (2)$$

If the diameter of reference is the principal axis, the tangent at the vertex is perpendicular to it; in all other cases the co-ordinate axes are oblique.

It is a property of the common parabola that every part of the curve is equally distant from a fixed point and from a given straight line. The fixed point is called the *focus*, the given line is the *directrix*, and a straight line through the focus perpendicular to the directrix is the *principal axis*. Any line parallel to the principal axis is called a *diameter*, and from the equation above given it may easily be shown that every diameter bisects all the chords of the curve that are parallel to the tangent at its vertex. The principal axis is therefore a line of *right* symmetry, and every other diameter is a line of *oblique* symmetry. The breadth of the curve through the focus is called the *parameter* of the curve; it is also called the parameter of the principal axis. The parameter of any diameter, including the parameter of the principal axis, is equal to four times the distance from the focus to the vertex of that diameter. The subtangent on any diameter is bisected at the vertex of that diameter, and the subnormal is equal to one-half the parameter of that diameter. These properties give rise to many useful constructions, for which the reader is referred to any of the numerous treatises on the conic sections.

The common parabola may be cut from any conic surface having a circular base by a plane parallel to one of the elements of the surface. The cutting plane intersects all the elements of the cone, except the one to which it is parallel, and all the points of intersection lie on one nappe of the cone; hence, the curve has but one branch, and that branch extends to an infinite distance; the two parts of the branch approach parallelism as they recede from the vertex, and at a comparatively short distance from the vertex they become sensibly parallel to each other and to the principal axis. If the cutting plane is revolved about the tangent at the principal vertex of the parabola which it determines, and through an infinitesimal angle in one direction, it will cut out an ellipse; and if revolved through an equal angle in the opposite direction, it will cut out an hyperbola. These three curves are sensibly coincident at, and in the vicinity of, their principal vertices, and for

this reason the parabola is said to be the common limit of the ellipse and hyperbola. This principle enables the astronomer to regard an elliptical orbit of very great eccentricity, or an hyberbolical orbit of very small eccentricity, as a parabolic orbit—an assumption that greatly facilitates the operation of determining the preliminary orbit of a comet or of a stream of meteors. If the plane which cuts a parabola from a cone with a circular base is moved parallel to itself and towards the vertex, the corresponding parabola will become more and more acute until it passes through the vertex of the cone, when it will reduce to a straight line. If the parallel motion is still further continued, the parabola will pass to the second nappe of the cone, and will then open out, becoming continually more and more obtuse.

A discussion of the general equation of the second degree between two variables shows that the parabola has five particular or limiting cones, two parallel straight lines, one straight line, and two imaginary parallels. The geometrical view of the question leads to the same result; for if we suppose the vertex of the cone to be at an infinite distance from the base, the cone will become a cylinder with a circular base, and the sections of that cylinder by planes parallel to an element will be two parallel lines, one line, or two imaginary parallels, according to their distances from the axis of the cylinder.

If $m = 3$ and $n = 2$ in equation (1), that equation represents a *semicubic* parabola referred to its principal vertex. This curve is the evolute of the common parabola, and is noted as being the first plane curve that was ever rectified. The semicubic parabola is composed of two symmetrical branches having their convexities turned towards the axis; these branches are tangent to each other at the principal vertex, forming a cusp at that point. If $m = 3$ and $n = 1$ in equation (1), that equation represents a *cubic* parabola, which consists of two infinite branches, one above the axis and the other below it—one on the right and the other on the left of the principal vertex; the two branches are tangent to each other at the origin, forming a point of inflection.
W. G. PECK.

Parab'oloid [Gr. παραβολή and εἶδος], a volume bounded by a surface of the second order whose plane sections in certain directions are parabolas. The surface itself is also spoken of as a paraboloid. There are three principal varieties of paraboloids—viz. *elliptical, hyperbolic,* and *parabolic*—each of which has two particular cases. None of the paraboloids have centres except in certain particular cases, in which they have an infinite number of centres. Elliptical paraboloids are those in which all sections parallel to a straight line called the axis are parabolas, and in which all other sections are ellipses. If the sections perpendicular to the axis are circles, the surface is a paraboloid of revolution; if the vertex is at an infinite distance, the parabolic sections are parallel lines and the surface is an elliptical cylinder; hence, the paraboloid of revolution and the elliptical cylinder are particular cases of the elliptical paraboloid. Hyperbolic paraboloids are warped surfaces of double generation, such that all sections parallel to any two elements of the first and second generation are hyperbolas, and all other sections parabolas. The particular cases of this class of surfaces are two intersecting planes and the hyperbolic cylinder. In the parabolic paraboloids all plane sections are parabolas; the particular cases of this class are two parallel planes and the parabolic cylinder.
W. G. PECK.

Paracel'sus, the assumed name of Philippus Aureolus Theophrastus Bombastus von Hohenheim, b. at Einsiedeln, Switzerland, in 1493; was the son of a physician; read the works of the alchemists and magicians, and travelled on foot far and wide collecting information regarding the healing art from barbers, blacksmiths, and wise women; spent much time in the mines of the Tyrol; took the degree of doctor in medicine; served for a time as a military surgeon in Denmark, the Low Countries, and Italy, and then resumed his wanderings. Œcolampadius procured him a professorship of medicine and surgery at Bâle (1526), but he was soon compelled to leave the place (1527) by the Galenic physicians, for he openly burned Galen's books and denounced the Arabian masters, then so generally studied. Erasmus was one of his patients. If we may believe his adversaries, Paracelsus was almost always drunk and was guilty of gross irregularities; certain it is that he had to resume his wandering life, and that after many strange vicissitudes he was thrown from a window and killed by the servants of a physician at Salzburg, Sept. 23, 1541. He left six professional treatises, besides a large number of works which bear his name, some of which were written by his enemies to injure his reputation, and others by fanatical admirers. His lectures also were delivered with great rapidity and published by his hearers in a very imperfect state. Paracelsus, though he displayed many traits of the charlatan, lived a most useful life. The profession of medicine at his time needed reformation quite as much as the Church did. He destroyed the humoral pathology, broke the tyranny of Galen and his Arabian followers, and introduced many new and valuable remedies. His empiricism was based upon precisely those principles of careful observation now so universally recognized. He paid great attention to diet, condemned the use of strong evacuants and the abuse of mercury, avoided the excessive mixing of drugs, and strove to reduce the overdosing then so prevalent. He is called an alchemist, although he condemned the search for the transmutation of gold, and an astrologist, although he opposed the study of astrology. A curious work regarding spirits is ascribed to him, and the strange jargon regarding sylphs, pygmies, undines, gnomes, salamanders, and other "elemental spirits" is commonly thought to have been invented by him; so that believers in the existence of such beings are called Paracelsists; but it is probable that he never wrote the work (*Liber de Nymphis*, etc., Bâle, 1590), for he elsewhere ridicules all such ideas. He taught a singular theosophy and was a person of erratic character; but in spite of the quackeries he was guilty of, he must be placed among the great and useful men of his age, when great men were not few.

Par'achute [Fr.], a machine first successfully employed by Blanchard at Strasbourg in 1787, and designed to enable aëronauts to descend safely to the ground from a balloon. It is shaped like an umbrella, and is taken up in a collapsed or closed form. The car is first attached beneath the parachute, and the balloon above the whole; a rope passing through the hollow stem of the parachute attaches the balloon to the car; this rope is cut at the proper time, the car falls rapidly, and the parachute is expanded by the action of the air. The car's downward motion is thus checked, and it descends slowly towards the earth. In practice, the parachute is not to be depended upon. It is liable to very dangerous oscillations, which have frequently proved fatal to the aëronaut.

Paraclif'ta, post-v. and tp., Sevier co., Ark., on the Cassalot River. Pop. of v. 45; of tp. 579.

Par'adise [Gr. παράδεισος; Sans. *paradesa*] signifies a garden or pleasure-ground, and is used by the Septuagint to express the Hebrew EDEN (which see). Metaphorically, it is often used synonymously with *heaven*, denoting the future bliss which awaits the righteous.

Paradise, post-v. and tp., Coles co., Ill., on the Illinois Central R. R. Pop. 1220.

Paradise, post-v. and tp., Grand Traverse co., Mich., between Grand Traverse and Manistee rivers, at the junction of the Traverse City with the Grand Rapids and Indiana R. R. Pop. 266.

Paradise, post-v. and tp., Lancaster co., Pa., on the Pennsylvania R. R. Pop. 2193.

Paradise, tp. of Monroe co., Pa., on the Delaware Lackawanna and Western R. R. Pop. 622.

Paradise, tp. of York co., Pa. Pop. 1300.

Paradisi'idæ [from *Paradisia*, relating to Paradise], a family of birds distinguished by their curious plumage, and closely related to the Corvidæ. The bill is moderately elongated, strong, slightly decurved, compressed, and with the tip emarginated; the base of the bill, as well as nostrils, is covered to a greater or less extent by short feathers; the wings are long and rounded; the tail diversiform; in addition to the ordinary plumage are developed feathers of various forms and styles, divergent from the shoulders, sides, and caudal region; the feet are robust; the tarsi stout; the toes three before and one behind, all with long curved claws. The species are numerous in the island of New Guiana, and their number has been greatly increased by the researches of recent naturalists. D. G. Elliot (in *A Monograph of the Paradisiidæ, or Birds of Paradise*) enumerates 38 species, distributed among 19 genera. (See also BIRDS OF PARADISE.) THEODORE GILL.

Paradox'ure (*Paradoxurus*), a genus of carnivorous mammals of the family Viverridæ. (See VIVERRIDÆ.)

Par'affine [*parum affinis*, "little affinity"], a beautiful white waxy solid which occurs native in the mineral wax ozocerite, found in Moldavia, Wallachia, and elsewhere, and in petroleum, and also found in coal and shale oil, and the products of the destructive distillation of many other organic bodies, as oil, fats, wax, wood, peat, albertite, grahamite, etc. It was discovered by Reichenbach in 1830 in wood-tar.

Preparation.—(1) Paraffine is obtained from ozocerite by distillation, cooling and pressing the product, and purifying it by treatment with sulphuric acid and caustic soda, washing and pressing. It is also purified by repeatedly melting it with petroleum naphtha and subjecting it

to pressure. (2) By similar means it is prepared from the heavier portions of coal oil and petroleum, which solidify on cooling, owing to the crystallization of the paraffine.

Composition.—Paraffine is generally a mixture of two or more members of the paraffine series of hydrocarbons, $C_{27}H_{56}$, $C_{28}H_{58}$, $C_{29}H_{60}$, $C_{30}H_{62}$, etc. $C_{27}H_{56}$ contains carbon 85.26 and hydrogen 14.74; $C_{30}H_{62}$ contains carbon 85.31 and hydrogen 14.69.

Properties.—A colorless, translucent solid, odorless and tasteless, resembling spermaceti. Its specific gravity is about 0.870; it melts at from 113° to 149° F., and forms a colorless oil which solidifies into a crystalline mass. It boils at about 600° F., and may be distilled with but little decomposition, especially if the distillation is aided by a current of superheated steam. That obtained from ozocerite has the highest melting-point, and is consequently preferred for the manufacture of candles. It is insoluble in water, but dissolves in 2.85 parts of boiling alcohol, separating almost completely on cooling, in crystals. It is more soluble in ether, oils, and naphthas. Acids, alkalies, and chlorine have little effect upon it; whence its name. By the long-continued action of nitro-sulphuric acid it is converted into paraffinic acid. Heated with sulphur, it yields impure sulphuretted hydrogen.

Uses.—Paraffine has numerous important applications in the arts. Beautiful candles are made from it, but when the more fusible varieties are employed the candles are liable to droop and lose their form. The crystalline structure also interferes with the manufacture of candles, but this is met by the use of small percentages of wax, etc., and by chilling the moulds, after the melted paraffine is poured into them, by placing them in cold water. It is extensively used for waterproofing fabrics, cloth and leather for shoes, even dress silks, which are thus protected from the stains which result from spilling liquids upon them. The goods are immersed in a warm solution of paraffine in refined petroleum naphtha. It is used for waterproofing or protecting from rust or decay, and putrefaction, meat, fruit, timber, metals, cartridges, pills, etc.; for making tight the stoppers of acid bottles; as a substitute for sulphur in the manufacture of matches; for oil-baths of constant temperature; for refining alcohol and spirits, by passing the vapor during distillation through melted paraffine, which abstracts the fusel oil; considerable quantities are used for chewing-gum, which supplies material for a disgusting habit too common among children; 70,000 pounds were purchased by one manufacturer of this article in a single year. (See PARAFFINES and PETROLEUM.) C. F. CHANDLER.

Paraffines, the first and simplest series of hydrocarbons, having the general formula C_nH_{2n+2}. (See HYDROCARBONS.) (For a table of the paraffines see article PETROLEUM.) The first number of the series is MARSH-GAS (which see), or methane, CH_4. The next two members are gases at ordinary temperatures; then follow about twenty liquids, and the series finally terminates with solid waxy paraffines. The paraffines occur in nature in the fire-damp of coal-mines, the gas from stagnant pools, petroleum, and ozocerite or solid native paraffine. They are also found among the products of destructive distillation, in coal-gas, tar, coal and shale oil, etc. They may be produced (1) from the salts of the fatty acids by heating them with alkaline hydrates. Thus, marsh-gas is produced from acetates:

$$\underset{\text{Sodic acetate.}}{NaC_2H_3O_2} + \underset{\text{Sodic hydrate.}}{NaOH} = \underset{\text{Marsh-gas.}}{CH_4} + \underset{\text{Sodic carbonate.}}{Na_2CO_3}.$$

There are other methods for preparing them: (2) By the action of zinc and water on the alcoholic iodides; from ethyl iodide ethane C_2H_6 is formed, $2C_2H_5I + Zn_2 + H_2O = Zn(OH)_2 + ZnI_2 + 2C_2H_6$. (3) By the action of zinc alone on alcoholic iodides; from ethyl iodide quartane (C_4H_{10}) is produced, $2C_2H_5I + Zn = ZnI_2 + C_4H_{10}$. Generally, in this reaction the paraffine is split up into a paraffine with half the number of carbon atoms and the corresponding olefine,

$$\underset{\text{Quartane.}}{C_4H_{10}} = \underset{\text{Ethene.}}{C_2H_4} + \underset{\text{Ethane.}}{C_2H_6}.$$

(4) By the electrolysis of the fatty acids, $2C_2H_4O_2 = 2CO_2 + C_2H_6 + H_2$. (5) From the olefines by the action of bromine, and subsequent treatment with potassic iodide, water, and metallic copper. (6) By the dry distillation of acetates, butyrates, etc. (7) By the destructive distillation of coal, etc. (8) By distilling alcohols, as amylic, with zinc chloride. (9) Marsh-gas may be produced synthetically by passing a mixture of carbon disulphide and hydrogen sulphide over red-hot copper, $CS_2 + H_2S + Cu_4 = 4CuS + CH_4$.

Properties.—Methane, ethane, propane, and quartane are gases at ordinary temperatures; most of the others are volatile liquids, regularly increasing in specific gravity, viscidity, boiling-points, and vapor-density as they become more and more complex. Those containing 20 carbon atoms or more are white crystalline waxy solids. The paraffines are saturated hydrocarbons, and are distinguished by their chemical indifference, and are incapable of uniting with other bodies, such as chlorine, bromine, sulphuric acid, etc.; whence the name "paraffine," from *parum affinis*, "little affinity." They form substitution-products, however; thus, $CH_4 + Cl_2 = CH_3Cl + HCl$. In the same manner CH_2Cl_2, $CHCl_3$, and CCl_4 may be formed. CH_3Cl is the chloride of the radical methyl (CH_3), which exists in METHYL ALCOHOL (which see), and the paraffines are often called hydrides of the alcohol radicals, marsh-gas being the hydride of methyl (CH_3H). The paraffines are scarcely attacked by oxidizing agents at ordinary temperatures; when heated they are either wholly burned to water (H_2O) and carbon dioxide (CO_2), or they may yield in addition small quantities of other oxidation-products, as acetic acid, etc. They are also oxidized by the long-continued action of air or oxygen gas. (See article on the oxidation of petroleum, by W. P. Jenney, in the *Am. Chemist*, Apr., 1875.) By exposing the heavier paraffine oils to temperatures near their boiling-points they are split up into simpler lighter paraffines and olefines. (See PETROLEUM.) C. F. CHANDLER.

Paraguay′. The republic of Paraguay is situate between the rivers Paraguay and Parana, above their confluence at 27° 32′ S. lat., and extending northward to the Rio Apa, its extreme northern limit being 22° 20′. Previous to the late war the territory claimed and occupied by it extended as far N. as 21° 20′. On the E. and N. it is bounded by Brazil, and on the S. and W. by the Argentine Republic and Bolivia. Its population at the commencement of the late war, though claimed by the government to be over 1,350,000, did not exceed 800,000, of whom not more than 80,000 were alive at its conclusion. Since then the return of prisoners and fugitives, together with the influx of foreigners, has added 80,000 more to the resident population. It has been claimed that the number of inhabitants is now 200,000, but nothing like an accurate census of the people has ever been taken.

The southern part of Paraguay consists almost entirely of swamps and jungles, so that the land is practically of no value. Farther to the N. it is more elevated and very fertile, finely diversified into hills and valleys, the former of which are covered with timber. The country is well watered, and has several small rivers—the Tibicuari, Ypane, Aquidaban, Apa, and others—that take their rise in the Cordilleras of the eastern part of the state and flow into the Paraguay. These Cordilleras, so called, are but ranges of hills, none of which exceed 3000 feet in height. There are no high mountains in that part of South America, and the only extraordinary feature of the country is the falls of Salto de Guayra, at a point on the Parana nearly E. of Asuncion, where the river makes a perpendicular descent, and then flows through a wild and picturesque country of broken hills and gorges.

No minerals of any importance have ever been found in Paraguay. During the war some iron ore of low grade was worked at a place near Ibicui, about 70 miles S. E. from the capital.

The climate of Paraguay is warm, but generally healthy. During the summer-time the mercury ranges from 80° to 98° F., seldom going above the one or below the other. During the winter the average is about 20° lower. Snow is unknown there, and frost is almost equally so.

The soil and climate are well adapted to the growth of maize, tobacco, cotton, sugar-cane, the mandioca or *Yucca* root, and all the tropical fruits. It also produces the *yerba mate* or Paraguayan tea (*Ilex Paraguayensis*); this plant or shrub grows in great abundance in the central and north-eastern sections of the country, and is a very important article of commerce. To the people of this and the adjoining countries it affords a beverage preferred above all others. It has all the essential qualities of the tea of China, and has a power of sustaining the strength of the body not possessed by the Eastern herb.

There are no wild beasts peculiar to this country, the animal kingdom being similar to that of the same latitude of Brazil.

The religion of the country is nominally Roman Catholic, though under the first and second Lopez little or no respect or allegiance was shown to the Holy See. The bishops and priests were mere spies of the president, the confessional being used principally as a means of espionage and all its secrets imparted to the government. They enjoyed no immunities by reason of their sacerdotal character, and under the younger Lopez the bishop and nearly all the more intelligent priests were arrested, tortured, and put to death.

The language spoken by the Paraguayans among themselves is that of the Guarani Indians, which the early fathers encouraged the first immigrants to learn instead of teaching Spanish to the natives. The elder Lopez tried to supersede the Guarani by the Spanish, by having it taught to all the children, but, though they learned to read it by

rote, they did not learn to speak or understand it; and as yet but a small proportion of the inhabitants speak anything but a *patois* of mixed Guarani and Spanish.

History.—It is to Sebastian Cabot that the credit is due of being the first discoverer of Paraguay, in the latter part of the year 1526. The great navigator, who, in seeking a more direct route to Peru than was then known, had entered the broad estuary that forms the mouth of the Rio de la Plata, and following the channel of the river, ascended to the confluence of the Paraguay and the Parana. Thence ascending the former till his little fleet reached a place called Angostura, he was attacked by a large force of Payagua Indians, who were repulsed and destroyed in vast numbers. This was the first battle, and consequently the country came to be first known to the Spaniards as the land of the Payaguas, from which, with but little variation, the name Paraguay is derived. In 1535 an expedition was sent out by Pedro de Mendoza—who had come to the mouth of the Plata with a large colony—to ascend the Paraguay and penetrate through to Peru. But he was never heard of afterward, and an expedition that was sent to search for him a year later established a fort and trading-post on the site of what is the town of Asuncion. The colony thus commenced was never broken up, and hence Asuncion takes precedence by 73 years, as a continuous European colony, of Jamestown, the first settlement in the U. S. The government soon fell into the hands of Domingo Martinez de Irala, a man of great energy and courage. He dealt justly by the Indians, and made himself feared and respected. He encouraged his men to take the native women as wives, and to respect both their marital and parental ties. The result was, that the colony increased beyond any subsequent example, and a semi-civilized nation of a mixed breed grew up within the next sixty years in the very heart of South America. As early as 1610 the Society of Jesus fixed upon Paraguay as a field for their labors, and established "reductions" or mission-stations in several places, and by their peculiar policy gained control of most of the Guarani Indians. They succeeded in impressing on the natives the duty and necessity of implicit obedience to authority, and to their teachings may be ascribed that blind submission which subsequently made it possible for a Francia or a Lopez to destroy them at pleasure, as beings incapable of resistance. The Jesuit fathers learned the Guarani language, and permitted no one to enter their precincts who could hear the stories or witness the treatment of the natives, while they published to the world that the novitiates were the happiest of mortals. They were, however, expelled from Paraguay and all the Spanish colonies in 1767, and compelled to leave their splendid churches and palatial residences. The independence of Paraguay was achieved in 1811. While the revolted colonies of Buenos Ayres and Montevideo were engaged in their war for independence from Spain, the Paraguayans quietly assumed that they were independent, and declared themselves a free and distinct nation. The power of the new government soon fell into the hands of that strange character, Dr. José Gaspar Rodriguez Francia. This man, then (1811) at the age of fifty-two, soon became the absolute dictator of Paraguay, and for twenty-nine years ruled the entire country with merciless rigor. The country being accessible only by way of the river, he stopped all ingress and egress, allowing during all this time only some half a dozen foreigners to leave the country, and none to enter it. The shipping then in the river stayed there, rotted, and fell to pieces. He died in the year 1840, and as for nearly thirty years no freedom of expression or thought had been permitted, and the better class of people had generally been destroyed, the nation at the time of his death was left not only without a government, but without its forms. The will of Francia had so long been the supreme law that when he died there was no authority left, no one to give an order, and no one to execute it if given. The soldiers, who had obeyed Francia implicitly, recognized no other ruler, and were glad to disappear from sight. It was not long after the death of the dictator before the people began to realize the necessity of some kind of public authority. After several futile attempts to establish a junta with governmental powers, two consuls—Carlos Antonio Lopez and Mariano Roque Alonso—were chosen by a sort of congress as an executive head of the nation. Lopez, however, soon got the power into his own hands, and at the end of three years managed to have himself declared president, which position he continued to hold till his death, which occurred in Sept., 1862. He was followed by Francisco Solano Lopez, who was killed in 1870. An account of their government will be found in their biographies. Since 1870 the government, though nominally republican, has been completely under the control of Brazil. The treaty of the triple alliance has only been so far respected by the latter power as not to have formally annexed it to the empire. It has ever since maintained so large a military and naval force at Asuncion as to completely dominate the country. The president and his cabinet are only such as are approved by the emperor, and but for the opposition of the Argentine Republic the country would undoubtedly be declared a Brazilian province. Of the Paraguayans living at the beginning of the war, not more than one-tenth were left alive at the time of Lopez's death. During the long struggle the country became almost a desert waste. Since then some attempts at colonization have been projected, and efforts made to start some industrial enterprises by means of a national loan. But the immigrants were glad to get out of the country, and of the money borrowed very little ever found its way to Paraguay. Previous to the close of the war there had never been any public debt, and yet her indebtedness to Great Britain alone is now not less than $15,000,000. Besides this, the allies have charged her with the expenses of the war to the amount of $177,000,000—a sum exceeding by many times the entire value of all the property, personal and real, within the territory. Hence the country is hopelessly and irretrievably insolvent.

CHARLES A. WASHBURN.

Paraguay', a powerful and important river of South America, rises in lat. 13° 30′ S., lon. 55° 50′ W., at an elevation of 9535 feet above the level of the sea; flows southward through the Brazilian province of Matto Grosso, then on the boundary between Brazil and Bolivia, and then through the territories of the Argentine Republic, where it joins the Parana in lat. 27° 17′ S., after a course of about 1800 miles. It is navigable 100 miles above the city of Corumba, and its course is almost entirely free from obstructions. Steamers ply regularly on its waters from Buenos Ayres, on the Rio de la Plata, to the influx of the Cuyaba, one of its affluents.

Paraguay Tea. See MATE.

Parahi'ba, province of Brazil, named after the river Parahiba, which traverses it. It borders on the Atlantic, is bounded N. by the province of Rio Grande do Norte and S. by Pernambuco, and comprises an area of 21,700 square miles, with about 300,000 inhabitants. The ground is elevated, the surface hilly, and the soil eminently well adapted for the cultivation of sugar and cotton. European cattle are very numerous in the province, and much sugar, rum, and cotton are exported.

Parahiba, town of Brazil, the capital of the province of the same name, on the Parahiba, is well built, surrounded with rich coffee plantations, and carrying on an important trade. Pop. 15,000.

Paraje, post-v. of Socorro co., N. M., on the Rio Grande. Pop. 527.

Paralepid'idæ [from *paralepis*, παρά, "near to," and λεπίς, a "scale"], a remarkable family of fishes whose affinities were formerly quite misunderstood. The form is elongate and pike-like; the body covered with deciduous scales; the lateral line straight; head pointed; opercular apparatus with the suboperculum much reduced; mouth with the cleft lateral; the upper jaw with its margin formed by the intermaxillaries, behind which, and closely adherent to it, are the supramaxillaries; teeth on the jaws as well as palate; branchial apertures much enlarged; branchiostegal rays seven; dorsal fin short, far behind, and still farther behind an adipose fin; anal elongated; caudal emarginate; pectorals well developed; ventrals small, inserted below or in front of the dorsal fin. The species were thought by Cuvier to be nearly related to the Sphyrænas, but are now known to be most closely allied to the Scopelidæ and Salmonidæ. There are two genera: (1) *Paralepis* and (2) *Sudis*, the first with species in the Mediterranean, Madeira, and Greenland; the second with a Mediterranean form. THEODORE GILL.

Par'allax, the difference of direction in the angular measurement of a given fixed object as seen from different points. The effect of parallax is very perceptible to the observer who is himself in motion; the objects on either side of him have a parallactic motion in the contrary direction, which is greater as the objects are nearer. The effect is very striking in the rapid motion of a railroad train. The use of the word "parallax" is, however, confined almost exclusively to astronomy, in which science the term expresses the difference of direction of a given celestial object as observed, or supposed to be observed, from the two extremities of a radius of the earth. One of these supposed points of observation is always the earth's centre, and the other some position on the earth's surface. When the object is in the horizon, the radius is at right angles to the straight line drawn to it from the point of observation on the earth's surface; and the parallax is then greatest. It is called the horizontal parallax. When the object is above the horizon, the straight lines

drawn to it from the extremities of the radius are both necessarily oblique to such radius, and the parallax is less. Such a parallax is called *parallax in altitude*, and is always proportioned to the horizontal parallax as the sine of the zenith distance is to the radius.

As for purposes of astronomical computations the directions of bodies are always referred to the earth's centre, it is necessary to correct the apparent altitude of a body by adding the parallax in order to attain the real altitude. For computations of very distant bodies the horizontal parallax is always employed, and is the angle subtended at the body in a right-angled triangle, of which the earth's radius is the perpendicular. The equatorial radius and the equatorial horizontal parallax are commonly used in such computations. The moon's horizontal parallax is larger than that of any other celestial body, and amounts to 57′ 6″ at its mean value. The equatorial horizontal parallax of the sun is about 8.88″; that of Uranus is not as large as half a second. The earth as seen from the fixed stars possesses no sensible magnitude, but the earth's orbit, having the enormous dimensions of more than 180,000,000 miles in diameter, has an angular magnitude large enough to be appreciable as seen from one of these; and this, though excessively minute, amounting in general only to a small fraction of a second, has in a few instances been satisfactorily determined. (See STARS, FIXED.) This parallax, as being connected with the earth's periodical revolution, is called the *annual* parallax; the other, being dependent on the daily rotation, is called the *diurnal* parallax. The fixed stars and all other celestial objects rising in the E. and setting in the W. have an *apparent* parallactic motion enormously great, but this is due not to the change of place of the observer, but to the change of the position of his plane of reference, which is his horizon. Telescopes constructed to move upon an axis parallel to that of the earth are made to follow the stars with great facility, since no change of the position of the tube in declination is necessary; and on this account such telescopes are frequently spoken of as parallactic instruments, but they are more usually called equatorials, because the circle they describe is parallel to the equator.

F. A. P. BARNARD.

Par′allel [Gr. παράλληλος]. In music, parallel or direct motion (*motus rectus*) is that in which two or more parts move in the same direction, viz. upward or downward.

Parallel′ogram [Gr. παράλληλος and γραμμή], a quadrilateral whose opposite sides, taken two and two, are parallel. If one angle of a parallelogram is a right angle, all the other angles are right angles, and the figure is a rectangle. If two adjacent sides are equal, the other sides are also equal, and the figure is a rhombus. The diagonals of a parallelogram mutually bisect each other; conversely, if the diagonals of a quadrilateral bisect each other, the figure is a parallelogram. If the diagonals of a parallelogram are equal, the figure is a rectangle; if they are perpendicular to each other, the figure is a rhombus; if they are equal and perpendicular, the figure is a square. The area of a parallelogram is equal to the product of its base and altitude. W. G. PECK.

Parallelopip′edon [Gr. παραλληλεπίπεδον], a polyhedron bounded by six parallelograms. If the faces are rectangles, the volume is a rectangular parallelopipedon; if the faces are squares, the volume is a cube. In any parallelopipedon opposite faces are equal to each other, as are also diagonally opposite polyhedral angles. A plane through two diagonally opposite edges divides the volume into equivalent triangular prisms. The volume of any parallelopipedon is equal to the product of its base and altitude. W. G. PECK.

Parallels of Latitude, on the terrestrial sphere, are circles drawn around the earth parallel to the equator. Through the centre of each circle passes the earth's axis. The equator itself is the only one of these parallels which is a great circle. The others are smaller circles, whose limits are the great circle (the equator) on the one hand, and zero (at the poles) on the other. The tropics and polar circles are important parallels.

Paral′ysis [Gr. παραλύειν, to "relax"], impairment or loss of voluntary or normal reflex motion through defective nervous excitation. This definition excludes cases in which the voluntary power of motion is lost by reason of injuries or diseases of muscles, bones, joints, etc. Sometimes paralyzed parts are the seat of involuntary (reflex) movements, which may be very extensive and powerful. It is not proper to apply the term "paralysis" to the condition of loss of sensibility. Any part of the body containing muscular fibres, striated or unstriated, may be paralyzed. Thus, we have paralysis of the heart, of the arteries, of the bowels, of the limbs, or of the muscles of the face, the eyeball, etc. Paralyses are classified in two ways, according to their distribution, and according to the morbid conditions causing them. Under the first head there are hemiplegia (palsy of one-half of the body longitudinally), paraplegia (palsy of the legs and lower half of body), general paralysis (palsy of the whole body), glossoplegia (palsy of the tongue), etc. Under the second head are cerebral paralysis (caused by disease of the encephalon), spinal paralysis (produced by disease of the spinal cord), peripheral paralysis (caused by disease of the nerves), functional or reflex paralysis (not caused by material disease of nervous organs), and toxæmic paralysis (induced by the presence of a poison in the blood). E. C. SEGUIN.

Paramar′ibo, capital of Dutch Guiana, S. America, on the Surinam. It is a neat town, the streets broad and lined with rows of tamarind and orange trees. It is the residence of the governor, has barracks, many places of worship, a fine hospital, and a considerable trade; but it is very unhealthy. Pop. 20,000, most of whom are black.

Paramat′ta, town of New South Wales, Australia, on a river of the same name, near its entrance into Port Jackson. It is regularly built and growing rapidly. P. 10,000.

Param′eter [Gr. παρά, "beside," and μέτρον, "measure"], in general, any one of the *elements* or necessarily given numbers or lines by which one curve is distinguished from another of the same species. The radius (or diameter) of a circle is its sole parameter. The major and minor axes of an ellipse are the determining parameters of the particular curve, but other systems of lines can be used. The coefficients of the algebraic (or other) equation which expresses any curve form a system of parameters. The double ordinate at the focus of a parabola is more particularly called the "parameter," since it alone determines the particular parabola to which it belongs; and *this* element is also known as the *latus rectum*. J. G. BARNARD.

Parana′, province of Brazil, bounded W. by the river Parana and E. by the Atlantic. It is traversed from N. to S. by a range of low mountains running parallel with the coast, from which the ground slopes down towards the Parana in large plains. The soil is fertile and the climate healthful. Area, 115,000 square miles. Pop. 120,000. Capital Paranaqua, from which large quantities of Paraguay tea are exported.

Parana, a large river of Brazil, which forms the boundary between the provinces of Parana, São Paulo, and Minas Geraes on the one side, and Matto Grosso and Goyaz on the other. After joining the Paraguay and the Uruguay, it forms the Rio de la Plata.

Paranaphthalene. See ANTHRACENE.

Par′apet [Ital. *parapetto*, "breast-guard"], in fortification, a breastwork, wall, or bulwark of earth, brick, wood, iron, stone, or other material. The battlement around a flat roof or the railing of a bridge is also called a parapet.

Parapherna′lia [Gr. from παρά, "over and above," and φερνή, "dower or dotal portion"] means the clothing and ornaments of a married woman suitable to her condition in life. These may have been obtained by her before marriage, or may have been acquired from her husband or from other persons. When not obtained from her husband, they are deemed to be held to her sole and separate use, and he has no legal interest in them. When derived from the husband he is, to a certain extent, owner, so that he may sell them or they may be seized by his creditors. He is, however, not allowed to dispose of them by will so as to deprive his wife of them if she survive. According to these rules, if a wife's paraphernalia acquired from her husband should be delivered to a carrier for transportation, and he should fail to deliver them, the action for their recovery must be brought by the husband, though under the special laws of some of the States vesting property in married women it has been decided that the wife may, under such circumstances, bring an action in her own name. Statutes in some of our States, in case the wife survives, give the paraphernalia to her in preference to the husband's creditors. An illustration is found in the law of New York, which declares that the clothes of a widow and the ornaments proper to her station shall not be deemed assets of her husband's estate, but shall be included and stated in the inventory of the estate without being appraised. (See also MARRIED WOMEN.) T. W. DWIGHT.

Paraple′gia [Gr. παραπλήσσειν, to "strike beside"], paralysis of the lower limbs, and (usually) of the lower part of the trunk, including the bowels and bladder. There may be anæsthesia (loss of sensibility) or dysæsthesiæ (morbid sensations) in the same parts. Although the limbs are not under the control of the will, they are often the seat of strong movements of an involuntary or reflex character. The cause of paraplegia nearly always is a disease in or

about the spinal cord, in any part below the medulla oblongata; usually, the lesion is in the dorsal or lumbar part of the organ. (See MYELITIS.) The same symptoms may appear, without gross disease of the spinal cord, in consequence of irritation in some external part, of the action of cold upon the body, disease of the bowels, etc. Besides paraplegia in the above strict sense, there are paraplegiform affections and pseudo-paraplegia. The former is typically exemplified by progressive locomotor ataxia, a disease in which, through disease of the nervous organs, there is loss of function in the lower limbs, but without abolition or diminution of voluntary power; or through hysterical loss of sensibility in the feet and legs, or by spasm in the muscles of the lower limbs, a paraplegiform affection is produced. Pseudo-paraplegia may be the result of muscular or articular disease in the lower limbs, of severe pain in the same parts, or in the lower part of the body, or of a delusive conception on the part of the patient. E. C. SEGUIN.

Par'asang [Gr. παρασάγγης; Pers. *parasenq*] is derived by Rödiger (Ersch and Gruber's *Encyclopädie*) from the Persian *seng*, "a stone," and the Sanskrit *pâra*, "end." Thus, he connects the name with the stones which on the highroads in Persia were placed at the end of certain distances. Herodotus (ii. 6, etc.), Xenophon (*Anab.* ii. 2, § 6), Suidas, and Hesychius are all agreed in estimating the parasang at thirty stadia, or about three miles and a half. Afterwards the measure seems to have varied; for in a Byzantine writer, Agathias (circa 530 A. D.), we find the parasang reckoned at twenty-one stadia. Strabo (xi. p. 518) states that it was variously reckoned at thirty, forty, and even sixty, stadia. According to Pliny, the Persians themselves were divided as to its length: "Inconstantiam mensuræ diversitas auctorum facit, cum Persæ quoque schœnos et parasangas alii alia mensura determinent" (*Nat. Hist.* vi. 30). The parasang is still in use among the Persians to-day. Modern travellers concur with Herodotus and Xenophon in fixing its length variously from three and a half to four miles (Kinneird, *Geog. of Persia*, p. 57). A. H. BULLEN.

Par'asites [Gr. παράσιτος], **Animal.** In both the animal and vegetable kingdoms there are countless forms which live at the expense of others, and are dependent upon them for their support. This dependence, however, varies greatly, some being only parasitic to the extent of deriving their food from the bodies of others—as, for example, the leeches, gnats, etc.—while others during their whole life are attached to particular animals, and are indebted to them for their food as well as domiciles.

Types containing Parasitic Animals.—Parasitic animals belong to numerous different types, and it is quite important that the complete dissimilarity of parasitic types *inter se*, and their relation to others, should be appreciated. The classes of mammals, birds, reptiles, and amphibians do not furnish any exclusively parasitic types, although in each there are some parasitic to a slight extent. Thus, the vampire bats live upon the blood of other mammals; the bald eagle depends to a considerable extent upon the fish-hawk for his supply of food, as do the jagers (*Stercorarius*) for their supply on various species of gulls.

Among fishes there are several that are partly parasitic; *e. g.*, the species of the family of Fierasferidæ are generally inhabitants of the intestinal canal of holothurians and other echinoderms; a species of catfish (*Stegophilus*) lives in the mouth of another kind of catfish (*Platystoma*) of the rivers of South America, and depends for its food upon the ingesta of its host; *Apterichthys ocellatus*, an eel, lives in the branchial cavity of the angler (*Lophius piscatorius*) of the Mediterranean Sea, and therein catches a portion of the food taken within the tremendous maw of the host-fish. The species of remoras or Echeneididæ, by their peculiar disks, attach themselves to other fishes, especially to species of sharks, and are thus transported from place to place, and thereby enabled to avail themselves of the pasture-grounds obtained by their active carriers. Other species, such as members of the genera *Ostracion*, *Labrax*, *Caranx*, and *Poronotus*, attach themselves to other animals, more especially in the early part of their lives, and become "free messmates" with them. On the New England coast, *e. g.*, several species of acalephs or jelly-fishes, notably *Dactylometra quinquecirra*, are generally found during the summer harboring under their umbrella-like disks small fishes belonging to the genus *Poronotus*. Finally, the species of lampreys (Petromyzontidæ) and hags (Myxinidæ and Bdellostomidæ) are parasitic for a time on fishes, and burrow sometimes quite extensively into their tissues.

Many of the classes of invertebrates furnish parasites; only a few of the most notable examples of each may be cited here. Among the gasteropod mollusks are the *Entoconcha*, whose exact relationships are undetermined, but which live in the intestinal canal of echinoderms; and *Stylifer* and *Eulima*, which are also parasitic upon echinoderms; and *Cochiolepis parasiticus*, found under the scales of a worm.

Among insects the most interesting examples of forms are furnished by the *Strepsiptera*, which are closely related to, and by some regarded as members of, the order Coleoptera. The true coleopterous types, Meloidæ, Pselaphidæ, and Staphylinidæ, are also to a greater or less extent parasitic.

Of the arachnoids the most noteworthy forms are the Linguatulidæ or Pentastomidæ and Acaridæ; the former in an embryonic condition resemble mites, but become degraded in old age into long vermiform animals inhabiting the frontal sinuses and lungs of certain vertebrates; the latter are well-known ticks and mites, and to this group belong the itch-insect (*Sarcoptes scabiei*); a species which is found in the sebaceous follicles of man, especially about the nose (*Demodex folliculorum*); and numerous species of typical mites and ticks.

Among the crustaceans some even belonging to the highest groups are parasitic to the extent at least of commensalism, such as *Pinnotheres*, *Conchodytes*, etc.; while others are not only parasites, but are modified to an extraordinary degree in conformity with their parasitic mode of life. These are chiefly to be found in the order Ichthyophthira, which includes the lernæans, certain cirripeds, and species of isopods—*e. g. Cymothoa*, etc.

Of the true worms, the most notable are the leeches, already alluded to and familiar to all.

Of rotifers a few species are parasitic—*e. g. Bellatro calvus*, which is found in the interior of certain worms.

The scolices (simple worms with a little-complicated nervous system and with a well-developed water-system) are those which furnish the greatest numbers of parasitic forms. These represent several decidedly distinct types of structure of ordinal value, and which are represented almost exclusively by forms which inhabit the interiors of other animals. Such are the cestods, which comprise the numerous species of tapeworm found in man and other animals; the trematods, to which belong the flukes (*Fasciola*, *Distoma*, etc.) and kindred types; the Acanthocephala, which include numerous species found more especially in birds and fishes, but of which no representatives have been found in man; the Gordiacea, which include species, such as the hairworms, of which some are found in the interiors of animals at some periods of their life, and at other times live freely in streams and damp places; and finally the nematods, some of which are free, and others parasitic: among the latter are especially the species of *Ascaris*, *Trichina*, *Trichocephalus*, and *Strongylus*.

The polyps furnish a number of instances of more or less complete parasitism; of these the most interesting are the *Epizoanthus americanus*, which attaches itself to the hermit crab (*Eupagurus pubescens*) of the New England coast, and *Palythoa*, which infests a peculiar form of sponge (*Hyalonema*), represented in the Chinese and Japanese seas, as well as off the coast of Portugal.

The protozoans also contribute parasitic species, chief of which are worm-like forms known as Gregarinæ, which live in the intestinal canals of many vertebrate as well as invertebrate animals, and are especially abundant in the intestines of insects—*e. g.* beetles, cockroaches, etc.

The number of species of parasitic animals is very large, as may be inferred from the statement that almost all forms act as the hosts of a number of different species, nearly fifty having been found in man alone.

It will be thus seen, even from the few examples cited, that parasitic animals belong to numerous diverse types of the animal kingdom, and that they have, therefore, nothing in common except the physiological character of dependence to a greater or less extent for subsistence upon other animals. It thus becomes evident, too, that their origin is from a number of different sources, and that if the theory of evolution is assumed they have become developed from as many different free-living types as there are independent types of structure.

Degrees and Manner of Parasitism.—There are all degrees of parasitism, from simple attachment for the time being for some purpose or other, to permanent habitation in the interior of another animal. The animals exhibiting these differences have been separated by Van Beneden under the terms "messmates," "mutualists," and "parasites proper."

The messmate "is he who is received at the table of his neighbor to partake with him of the produce of his day's fishing." To this category belong, then, those forms which partake of the nutriment imbibed or provided by the host, but which do not attack directly their host, and which are generally comparatively little modified. Some are free, such as the *Pinnotheres* of mollusks, etc., the *Fierasfer*

and *Enchelyophis* of the echinoderms, and the sucking-fishes or Remoræ. Others are fixed, such as the cirripeds and certain mollusks and polyps.

The mutualists, according to Van Beneden, are those "animals which live on each other, without being either parasites or messmates; many of them are towed along by others; some render each other mutual services; others, again, take advantage of some assistance which their companions can give them; some afford each other an asylum; and some are found which have sympathetic bonds that always draw them together." Such are the Ricinidæ or bird-lice, *Caligi, Arguli,* and other crustaceans.

The parasite, according to the same author, "is he whose profession it is to live at the expense of his neighbor, and whose only employment consists in taking advantage of him, but prudently, so as not to endanger his life. He is a pauper who needs help, lest he should die on the public highway, but who practises the precept not to kill the fowl in order to get the eggs." Of this kind are the typical Entozoa as well as Ectozoa.

Scarcely any portion of the body is free from the intrusion of parasites. The different regions of the exterior are often infested by kinds peculiar to each, while almost every organ and system in the interior has its special parasites. These have been discriminated by Davaine into the following groups: (1) Those forms which are found in a free state in the cavities or passages which mutually communicate with the exterior—*i. e. a,* the respiratory passages, *b,* the digestive passages, *c,* the biliary passages, and *d,* the urinary passages; (2) those which are contained in closed cavities, natural or accidental, such as *a,* the blood-vessels, and *b,* the serous cavities; (3) those which belong especially to some organic system—*e. g. a,* the nervous system, *b,* the muscles of animal life, *c,* the lymphatic ganglia or glandules, and *d,* the interorganic cellular tissue; and (4) those which affect complex organs, such as *a,* the eye, *b,* the genital organs.

Development and Acquisition of Parasitic Habits.—How parasitic animals became developed in the interior of others was for a long time a mystery, and it appears to have been very generally supposed that they were of spontaneous origin or the result of pathological phenomena. It is now, however, well known that their lineage is a legitimate one, and that they are passed from one animal to another. The eggs laid are very numerous, and a portion of these, finding their way into a proper abode, become developed. Many parasites pass through two or more stages, and in different kinds of animals, before attaining their full development. There are, for example, two species of tapeworms which are tolerably common in man—*i. e. Tænia solium* and *Tænia medio-canellata.* These are found in the intestinal cavity in a fully-developed condition and with numerous segments, in which are developed eggs, and which become from time to time detached. In the common hog and cattle are found imbedded in the muscles bladder-like sacs connected with a head. The head in the entozoon of the hog resembles that of the *Tænia solium,* while that in the one of the cattle is similar to the head of the *Tænia medio-canellata.* It is found, further, by experiment and by feeding, that these cysts from the hog are developed into the *Tænia solium,* and those from the cow into the *Tænia medio-canellata.* It is therefore evident that the tapeworms of man are at least mainly derived from these respective animals, and that they are the result of eating the flesh of the hog or beef, *mutatis mutandis,* in a raw or imperfectly cooked state. On the other hand, the hog and the cattle have evidently derived these cysts from having eaten the eggs evacuated from man or some other animal with their food, and these eggs have been taken up by the circulation, and developed in the parts affected in the form of cysts or embryos of tapeworms; in this condition they remain until transferred to a congenial host; and of course a very large proportion fail to be developed.

The doctrine of spontaneous generation, as regards tapeworms at least, received blows successively from Götze, Siebold, and Küchenmeister. Ephraim Götze first noticed the similarity between the head of the tapeworm of the cat (*Tænia crassicollis*) and of the cysticercus of the liver of the rat and mouse (*Cysticercus fasciolaris*). C. T. von Siebold in 1848 suggested that all the Cystica, or sack-bearing Entozoa, were simply the larval forms of tapeworm. Finally, F. Küchenmeister in 1851 verified these statements by experiments. Thus, he gave to a dog the hydatids found in the mesentery of a hare (*Cysticercus pisiformis*), and on dissecting the dog after several weeks found therein the *Tænia serrata* in a transition state between the *Cysticercus* form and the adult *Tænia* form. Later, the *Cysticercus cellulosæ* of the hog was given to a criminal who had been placed at the disposal of Küchenmeister, and it was found on his execution that the *Tænia solium* had been developed. Numerous later experiments have amply confirmed the conclusions thus attained.

Literature.—P. J. van Beneden (*Animal Parasites and Messmates,* 1876), and those of C. M. Diesing (*Systema Helminthum,* 1850–51), C. Davaine (*Traité des Entozoaires et des Maladies vermineuses de l'Homme et des Animaux domestiques,* 1860), T. S. Cobbold (*Entozoa, an Introduction to the Study of Helminthology, with reference, more particularly, to the Internal Parasites of Man,* London, 1864), and Rudolf Leuckart (*Die menschlichen Parasiten, und die von ihnen herrührenden Krankheiten,* Leipsic and Heidelberg, 1864, etc.). See also ASCARIS, CESTOID WORMS, ENTOZOA, HÆMATOZOA, HYDATID, TAPEWORM, etc. THEODORE GILL.

Parasites, Human. The number of parasites which have been discovered in or on the human body, and which are liable to trouble man, is considerable. Probably few, however, are entirely exempt from intrusion. The following are the species which have been recognized by various authors as entozoic or ectozoic:

I. *Entozoa, or Parasites living in the Interior of the Body.*

CLASS ARACHNOIDEA.

ORDER LINGUATULIDA.

Family Pentastomidæ.

Pentastomum tænioides, Rudolphi = *Pentastomum denticulatum,* Rudolphi.

—— *constrictum,* Siebold.

CLASS PLATYHELMINTHES.

ORDER CESTODES.

Family Tæniadæ.

Tænia (*Tænia*) *solium,* Linnæus (adult).

—— (Larva) = *Cysticercus cellulosæ,* Rudolphi. Occurs rarely in the brain and other parts of the body.

—— (*Tænia*) *hydatigera Pallas* = *Tænia marginata,* Batsch = *Cysticercus tenuicollis,* Rudolphi. Larva, only in man.

—— (*Acanthotrias*) *acanthotrias,* Weinland. Larva only.

—— (*Tæniarhynchus*) *medio-canellata,* Küchenmeister. Derived from cysticercus of beef.

—— (*Echinococcifer*) *echinoccus,* Siebold = *Echinoccus hominis,* Rudolphi.

—— (*Diplacanthus*) *nana,* Siebold = *Tænia ægyptiaca,* Bilharz.

—— (*Hymenolepis*) *flavopunctata,* Weinland = *Tænia flavomaculata,* Molin.

—— (——— ?) *lophosoma,* Cobbold.

Family Bothriocephalidæ.

Bothriocephalus latus, Bremser.

Bothriocephalus cordatus, Leuckart.

ORDER TREMATODES.

Family Distomidæ.

Distomum hepaticum (Linn.) = *Fasciola hepatica,* Linn.

Distomum crassum, Busk = *Dicrocœlium Buskii,* Weinland.

Distomum lanceolatum, Mehlis.

Distoma hæmatobium, Bilharz = *Gynæcophorus hæmatobius,* Diesing = *Bilharzia hæmatobia,* Cobbold.

Distoma heterophyes, Siebold and Bilharz = *Dicrocœlium heterophyes,* Weinland = *Heterophyes ægyptiaca,* Cobbold.

Tetrastoma renale, Delle Chiaje. Doubtful; supposed to be the young of a *Polystoma.*

Polystoma pinguicola, Zeder = *Hexathyridium pinguicola,* Treutler. Doubtful; according to Gervais and Van Beneden, a form of *Pentastomum denticulatum.*

Polystoma venarum, Zeder = *Hexathyridium venarum,* Treutler. Doubtful; according to Davaine, the young of *Distomum lanceolatum.*

Distoma ophthalmobium, Diesing = *Distoma oculi humani,* Gescheidt. Doubtful; according to Leuckart, the young of *Distoma lanceolatum.*

CLASS NEMATELMINTHES.

ORDER NEMATODES.

Family Ascaridæ.

Ascaris lumbricoides, Linnæus = *Lumbricus teres hominis,* Tyson.

Ascaris mystax, Rudolphi = *Ascaris alata,* Bellingham.

Oxyuris vermicularis, Bremser = *Ascaris vermicularis,* Linnæus.

Family Strongylidæ.

Strongylus gigas, Rudolphi = *Eustrongylus gigas,* Diesing = *Lumbricus in renibus,* Blasius.

Strongylus quadridentatus, Siebold = *Sclerostoma duodenale,* Cobbold = *Anchylostoma duodenale,* Dubini.

Strongylus bronchialis, Cobbold = *Strongylus longevaginatus,* Diesing.

Family Trichocephalidæ.

Trichocephalus dispar, Rudolphi = *Ascaris trichiura,* Linnæus = *Trichocephalus hominis,* Göze.

Trichina spiralis, Owen = *Pseudalius trichina,* Davaine.

Family Filariidæ.

Filaria medinensis, Gmelin = *Filaria dracunculus*, Bremser = *Dracunculus medinensis*, Cobbold.
Filaria oculi, Gervais and Van Beneden = *Dracunculus oculi*, Diesing = *Dracunculus loa*, Cobbold. Larva.
Filaria oculi humani, Nordmann = *Filaria lentis*, Diesing. Larva.
Nematoideum tracheale, Rainey and Bristowe = *Filaria trachealis*, Cobbold. Larva.

CLASS INFUSORIA.

Paramecium coli, Malmsten.
Cercomonas urinarius, Hassal, Leuckart.
Cercomonas saltans, Ehrenberg, Wedl, Leuckart.
Cercomonas hominis, Davaine = *Cercomonas intestinalis*, Lambl. = *Balantidium coli*, Lachmann = *Paramecium coli*, Malmsten.
Trichomonas vaginalis, Donné, Davaine, Leuckart, Kölliker.

II. *Ectozoa, or Parasites on the Exterior of the Body.*

CLASS INSECTA.

ORDER HEMIPTERA.

Family Pediculidæ.
Pediculus capitis, Degler. The head louse.
Pediculus vestimenti, Burm. The body louse.
Phthirius pubis (Linn.). The crab louse.

ORDER DIPTERA.

Family Pulicidæ.
Pulex irritans. The common flea.
Sarcopsylla penetrans. The chigger of tropical America.

CLASS ARACHNOIDEA.

ORDER ACARINA.

Family Demodicidæ.
Demodex folliculorum, Owen. The pimple mite.
Family Acaridæ.
Sarcoptes scabiei, Degler. The itch mite.

Numerous other animals are more or less parasitic on man—*e. g.* the common bedbug, mosquitoes, gnats—but the present enumeration is only intended to include those that make a prolonged abode on his person. Even of these, several of the Entozoa are doubtful, but all those admitted by Cobbold are given. THEODORE GILL.

Parasol. See UMBRELLA AND PARASOL.

Parcæ. See FATES.

Parch'im, town of Germany, in Mecklenburg-Schwerin, on the Elbe, has some manufactures of leather and soap and large breweries and distilleries. Pop. 7142.

Parch'ment [Fr. *parchemin*] is not really leather: it is merely the well-cleansed and carefully dried skins of hares, rabbits, calves, asses, or sheep. Common parchment is prepared from sheep-skins, but vellum, a far finer variety, is made from the skins of young calves, goats, or still-born lambs. Sheep-skins are often split and made to yield two sheets of parchment. The skins are soaked in water and then subjected to the action of milk of lime. The wool or hair is then removed, the skins are washed, planed with a sharp knife to remove superfluous parts, and then stretched on frames singly and dried in the air. For bookbinders' use the dried parchment is planed to impart a rough surface, capable of being dyed or written upon. The dried parchment is finally dusted over with chalk and rubbed with pumice-stone. Drum-heads are made from calves' skins, heads of kettle-drums from asses' skins, sieves for gunpowder-mills from hogs' skins. Parchment was known long before the invention of paper. The name is derived from the city of Pergamus in Asia Minor. It is now made at Bentheim and Schuttorf in Hanover, at Augsburg, Nuremberg, Breslau, and Dantzic, and in Holland, England, and France. C. F. CHANDLER.

Par'deeville, post-v. and tp., Columbia co., Wis., on St. Paul and Milwaukee R. R. Pop. 205.

Pardessus' (JEAN MARIE), b. at Blois, France, Aug. 11, 1772; studied jurisprudence; became mayor of Blois in 1805; member of the legislative assembly in 1807; professor of mercantile law at Paris in 1810: member of the chamber of deputies 1815–16 and 1824–27, but retired from public life after the revolution of 1830, and d. on his estates near Blois May 26, 1853. By his numerous works, of which the most prominent are *Traité des Servitudes* (1806), *Traité du Contrat et des Lettres de Change* (1809), *Éléments de Jurisprudence commerciale* (1811), *Cours de Droit commercial* (1814–19), *Collection des Lois maritimes antérieures au 18e siècle* (6 vols., 1828–45), *Us et Coutumes de la Mer* (1847), etc., he exercised a great influence on French jurisprudence.

Par'doe (JULIA), b. 1806 in Beverley, Yorkshire, England; produced a volume of poems when thirteen years old, and afterwards novels, volumes of travel, and historical works—*Louis XIV. and the Court of France*, etc. In 1859 she received a civil-list pension. D. Nov. 26, 1862.

Par'don, in law. This as generally understood is an act proceeding from the executive department of a government, which relieves an individual from the penal consequences of a crime which he has committed. A distinction is taken between a reprieve and a pardon. The former is the suspension of a sentence for a time, while the latter entirely removes its effect. A pardon may be considered under two general divisions: I. Its nature and effect; II. The mode of granting and making use of it.

I. The nature of a pardon is to blot out the offence to which it is applied and to treat the wrongful act as though it had never existed. If granted before conviction, it prevents any of the penalties and disabilities consequent upon conviction from attaching; if granted after conviction, it removes the penalties and disabilities and restores the offender to all civil rights. It makes him, as it were, a new man, and gives him new capacity. It does not, however, restore offices forfeited or interests vested in others in consequence of conviction and judgment. (Consult the case of *Ex parte Garland*, 4 Wallace U. S. Supreme Court Reports.) A pardon is, in one sense, an act of grace and mercy, and yet it may be exercised on high grounds of public policy. It may also be resorted to as a mode of alleviating the effects of an imperfect administration of criminal justice. While there is danger that it may be used too freely and arbitrarily, and thus bring about an inefficient administration of criminal law, it is difficult to place any restriction upon the power, since it is impossible to foresee what circumstances may require its exercise. Accordingly, the power to pardon is granted in the U. S. Constitution in the most general and comprehensive terms to the President. "He shall have power to grant reprieves and pardons for offences against the U. S., except in cases of impeachment." (Art. ii., sec. 2.) This power cannot be controlled or limited in any manner by Congress. He alone has the power to pardon offences committed in a territory in violation of acts of Congress. It not only extends to personal punishment, but also to the remission of fines, penalties, forfeitures, and costs in criminal cases. However, if the money had actually been paid into the U. S. treasury before the pardon, it could not be drawn out without an appropriation from Congress. It has even been thought that the President may remit a fine imposed upon a citizen for a contempt in neglecting to perform a legal duty, such as serving on a jury, or for contempt of the process of the U. S. The reasoning upon this point is that the pardoning power, except in the instance of impeachment, is coextensive with the punishing power. This view could not be extended so far as to allow a remission of such pecuniary penalties as do not accrue to the U. S., but to others, as, for example, custom-house officers or informers. It should be added that in the U. S. Constitution the pardoning power is limited to offences, and accordingly cannot be extended to any case of forfeiture, loss, or condemnation not imposed by law as a punishment for an offence.

In some of the States the power of pardon is granted to the governors by the State constitution in the same general way as in the U. S. Constitution. In others there are different provisions, perhaps vesting the pardoning power in a board of pardons, or, if granted to the governor, it is subject to certain restrictions—*e. g.*, obtaining the consent of the senate; the State constitutions should be consulted. In England, while this power is usually exercised by the king, it may be by act of Parliament. In this country, if a constitution delegates it in general terms to a governor or president, it is entirely withdrawn from the legislature. Still, if the legislature make as an attendant upon the conviction for the crime a disability to be sworn in court as a witness, the pardon will not remove the disability, since the legislature has power to establish a rule of evidence. The effect of pardons has been much considered in connection with questions growing out of the late civil war. It has been decided that a full pardon and amnesty by the President for all offences committed by the owner of property seized under the act of Aug. 6, 1861, to confiscate property used for insurrectionary purposes (making property used in aid of the rebellion with the owner's consent subject to confiscation, etc.), relieves the owner from the forfeiture so far as any rights accrue to the U. S. (*Armstrong's Foundry*, 6 Wallace's Reports, 766.) In the same way, whether granted by general proclamation or special letters, it relieved claimants under the "captured and abandoned property act" from the consequences of participation in the rebellion, and from the necessity of establishing their loyalty in order to prosecute their claims. (*Carlisle* v. *U. S.*, 16 Wallace, 147.) The power to pardon may be exercised before trial, after trial, or even after expiration of the sentence. It is granted, in this last case, to remove personal disabilities, such as incapacity to vote or to hold office.

A pardon may either be absolute or conditional. The

claimant under a conditional pardon must make clear affirmative proof that the condition has been complied with. If, for example, the condition were to take a specified oath, the pardon would not be available if a different oath were taken. So, if a pardon had gone into effect, but was to cease on failure to keep a condition, such as to leave the country and not to return, it would become nugatory by a breach of the conditional clause. So the pardoning power may mitigate a punishment established by a sentence of a court, but cannot substitute another and a different one. A pardon does not become effective without acceptance. It may be rejected by a person to whom it is tendered, and a court has no power to force it upon him. If one be in prison when a conditional pardon is offered him, and he accepts it, it cannot be claimed that he is in such a state of duress as to make his acceptance of no effect. It has been held that there may be a constructive pardon without express words, as where an officer of the marine corps under an unexecuted sentence is appointed to a new commission.

II. A pardon may be made either by general proclamation or in a particular instance. The usual form is a deed signed by the executive, with the great seal attached. Publication in newspapers is not necessary to make it operative. It is a deed to which delivery is essential. It is accordingly revocable until it has been actually delivered to the prisoner or issued to the keeper of the prison in which he is confined with intent that it should become available to him. It may accordingly be revoked while it remains in the hands of the U. S. marshal, who is to be regarded as the messenger of the President, and not as the agent of the person pardoned. When a person pardoned desires to avail himself of his pardon, he must bring the fact before the court by some appropriate method, such as a plea or motion. Otherwise, the court will not take notice of it. T. W. DWIGHT.

Paré′ (AMBROISE), b. at Bourg-Hersent, near Laval, France, 1517; was the son of very poor parents; became a barber; studied surgery in Paris; joined the society of St. Côme, and in 1536 entered the army in Italy as a surgeon. His introduction of the ligature for bleeding arteries after amputation was the foundation of modern surgery, and he wrote a work on gunshot wounds which is still of value. His great invention dates from 1536. When the supply of oil failed the army in Piedmont (for up to that time hot oil was used to stanch bleeding), he was obliged to tie arteries with a thread, which he did, expecting that his patients would die; but he soon found that cases where the ligature was employed did much better than the others. From 1552 to 1590 he was surgeon to four French kings. He was a devout Huguenot (although Malgaigne denies it), but his reputation for surgical skill saved him at the massacre of St. Bartholomew and at other critical junctures. His professional works are rather numerous and very much in advance of his times, in spite of the fact that he was only a barber-surgeon, and as such unrecognized by the surgical faculty. One of the most singular of his works is that *On Monsters*, which is replete with the strange superstitions of his time. D. at Paris Dec. 22, 1590.

Paregor′ic Elix′ir (*tinctura opii camphorata*), a well-known anodyne compound, made by macerating together 60 grains each of powdered opium and benzoic acid, 40 grains of camphor, a fluidrachm of oil of anise, 2 troy ounces of honey, and 2 pints of alcohol. After standing seven days it is filtered for use. Liquorice is sometimes added. It is a mild anodyne and antispasmodic.

Pareira Brava [Port.], the dried woody root of some South American climbing plants of the order Menispermaceæ. It is a tonic and diuretic drug, used especially in chronic inflammations of the bladder and the urinary passages. The name is Portuguese for "wild vine." The plant in question has been for more than 100 years supposed to be the *Cissampelos Pareira*, but the late Mr. Hanbury has clearly ascertained that it is *Chondodendron tomentosum* of Ruiz and Pavon, *Cocculus chondodendron*, D.C.

Par′ent and Child, in law. There are many important legal questions growing out of the relation of parent and child. These are inquiries concerning the duties of parents, their authority and control over the actions of their children, and the duties of the children in their turn, particularly towards parents who are infirm and incapable of self-support. A convenient arrangement of the subject is to consider children under two general classes, the legitimate and the illegitimate.

I. *Legitimate Children.*—Under this division may be noticed the duties of parents towards their children, their authority over them, and the obligation of children towards parents. Parents may be said to owe their children maintenance or support, protection from injury by others, and a suitable education corresponding with their means. Only the first of these is strictly the subject of legal enforcement. The duty to protect or to educate is one of imperfect obligation. Much question has been made upon the point whether the obligation to maintain exists at common law or is derived from statute. This is a point of much magnitude and importance. If the obligation exists at common law as a legal duty, and the father without cause refuses to discharge it, it is reasonable that from his duty may be raised an implied contract to repay such persons as supply to the child the necessaries of life. On the other hand, if the duty is created by statute law, there is no other mode of enforcing it than that which the statute points out. The tendency of later English opinion is to hold that the duty is statutory, and that the only theory on which the parent can be made liable to third persons on a contract for necessaries supplied to the child is that of agency voluntarily created by the parent, though such an agency may be inferred from slight circumstances. A statute was passed at an early day in England (43 Eliz. c. 2, § 7) whereby the father, grandfather, mother, and grandmother and children (being of sufficient ability) of every poor, old, blind, lame, and impotent person, or other poor person not able to work, shall at their own charge relieve and maintain every such poor person in that measure and according to that rate as shall be assessed by the justices of the peace at their general quarter sessions. Obedience to the justices' order is enforced by a monthly forfeiture of twenty shillings. Proceedings under this statute are of a criminal nature, and the plain object of it is to cast the burden of maintenance upon the relatives rather than to devolve it upon the public. Similar statutes are found in the States of this country. The prevailing opinion among jurists in this country appears to be that, notwithstanding there may be such a statute, the duty of the parent to supply to his child the necessaries of life is not dependent upon it, and would survive its repeal as being a principle of the common law. Accordingly, if the parent was derelict in his duty, a tradesman might supply necessaries and sue the father upon an implied contract. It would, however, be agreed that this could not be done if the father actually supplied necessaries, even though the tradesman was not aware of the fact, so that he acts at his peril. A husband is under no obligation to support the children of his wife by a former marriage. If he takes them into his family in the usual way, the presumption is that he will make no charge for what is supplied them. He may, however, cause them to leave at any time, when any liability he might be under through an agency which he had voluntarily created in their favor would cease. The same general rule will apply to any children taken into a family by adoption, unless there is some statute regulating the subject. Courts of equity are frequently called upon in special cases to make an allowance to a father from a child's estate for his maintenance. Such an application might be made when the child had sufficient means of its own and there were other claims upon the father's estate, such as the support of other children, perhaps by another marriage, which would make it fit that the allowance should be made. It is common only to make such allowances prospectively. Still, there is nothing to prevent the court, when the circumstances of the case require it, from reimbursing the father for past expenditure in the way of maintenance. The jurisdiction of the equity court is based upon the theory that it represents the king or the protecting power of the state over all that class of persons who, by reason of immaturity or imbecility, are unable to take care of themselves.

The obligation now under discussion does not prevent a father from depriving his child by his will of all share in his estate. The liberty of testamentary disposition is, by the rules of the common law, so complete that the father's property may lawfully be bequeathed or devised to strangers, though this power is sometimes restrained by statute, particularly in the case of the disposition of property to charitable associations. (See, among other instances, *Laws of New York of 1860*.) The wrongful acts of a child, committed without a father's knowledge or consent, impose no liability upon the latter. Remedy in such a case must be sought against the child alone. Thus, a father would not be liable if his minor child should wilfully set a dog upon a person to his injury, unless the parent has some connection with the wrongful act. The remaining obligations of the father to his children may be treated briefly. While it is the moral duty of the father to protect his child, there is no mode provided by law for compelling him to discharge this obligation. The whole matter is left to the promptings of paternal affection. The law looks indulgently upon the acts or passion of the father when caused or aroused by abuse inflicted by strangers upon the child; and if he should take immediate revenge, he would properly be subjected to a less degree of punishment than is usually accorded to similar acts where no such relation exists. He is excused alto-

gether from acts of injury necessarily inflicted by way of defence of his child, even though they might result in taking the life of the aggressor. The same general remark may be made of education. There is no rule of the common law imposing upon the parent the duty to educate his child. In the formation of our system of jurisprudence the idea was prevalent that the whole subject should be remitted to parental affection and foresight. In some instances statute law establishes rules making education compulsory. The laws upon this subject are yet so meagre and transitional that it is scarcely worth while to refer to them. There has been much doubt among jurists whether the mother is under the same obligation as the father to provide the child with maintenance. The law cannot be regarded as settled. There is considerable tendency in modern law to place the widowed mother upon the same footing as the father in respect to duties and corresponding rights. (See the subject discussed with much fulness and the authorities collated in the cases of *Furman* v. *Vansize*, 56 New York Reports, 435, and *Grey* v. *Durland*, 50 Barb. 211.)

The next point to be considered is the power of a parent over the child, or, in other words, the rights of control and management. These rights may be resolved into three: (1) custody, (2) service, (3) discipline.

(1) *The Right of Custody.*—It is a general rule of law that the father has the right of custody as against all persons except the mother. As between the parents, the right will depend, to some extent, upon the circumstances of the case and the mode in which it is presented to the court. There are two modes in which the case may be presented—one, by the writ of *habeas corpus*, and the other, by petition in equity. When the question comes up on *habeas corpus*, the leading inquiry is whether the child is in the right custody. If it is above fourteen, its wishes will be consulted; if under that age, the court inquires as to the person who has the legal right to the control of the child, since it is assumed to be *under a restraint* which the writ is calculated to relieve when it is not under the control of its legal custodian. The English courts have gone very far under these rules in awarding the child to the father. The leading cases are the *King* v. *De Manneville* (5 East's Reports, 220), and the *King* v. *Greenhill* (4 Adolphus and Ellis's Reports, 626). In the last case the father lived in adultery with a mistress, but did not bring her into contact with the children. There being no evidence of cruelty nor of corrupting influences on his part, the custody of the children was awarded to him. Statute law in this country in some cases gives the courts greater discretion when awarding a writ of *habeas corpus* in such instances than exists at common law. An instance of this is found in the law of New York in the case of a voluntary separation of husband and wife. It would, however, be generally true that if a wife abandoned a husband without cause, the custody of the children would be awarded to him, unless there were special reasons to the contrary involving their welfare. When the question concerning custody of children is presented, not upon *habeas corpus*, but by appropriate proceedings in a court of equity, the power of the court is much more broad and comprehensive. This tribunal is considered in England to represent the king in his character of *parens patriæ;* that is, his guardianship of all those persons (including young children) who are unable to take care of themselves. The relation of the parent to the child is here deemed to be a trust, and it is expected that the latter will be brought up with a due education in literature, morals, and religion, and be treated with kindness and affection. When this trust is grossly violated, the court will interfere and appoint a person to act as guardian to take care of the child and to superintend its education. This power exists independently of the possession of the property. The whole subject was thoroughly considered in the case of *Wellesley* v. *Duke of Beaufort* (2 Russell's Reports 20; also 1 Dow and Clark, 162). This case is prominent in English law on account of the questions involved and the high rank of the parties. There are cases in which the court will hold that a father has lost his right to custody by his own act, as where he allows the child to be educated by a relative who has brought him up in a particular manner, and with just expectations as to receiving his estate, when the return of the child to the father would destroy the expectations thus raised by the father's consent. Still, no person can deprive a father of his guardianship by the mere fact of giving him an estate conditioned upon its renunciation. Should the father decline to renounce his right of custody, the provision in the child's behalf must fail.

(2) *The Right to Service.*—This is dependent upon the father's duty to maintain. While that continues he has the right to the child's services and to his wages whenever he is in the service of others. This right is in some States regulated by statute law, providing that the father must notify the employer within a specified time that he lays claim to the earnings. As an incident to the right to service may be mentioned some subordinate rights, such as that of suing for a recompense for injuries causing a loss of service, and for the seduction of a daughter. When a child is injured by the wrongful act of another, the father may maintain a suit on his own behalf for any loss of service which he may have sustained. This action is independent of that which the child may have on his own behalf. The action of the latter would be based on his own injury, including his pain and physical discomfort; that of the father would rest solely upon the ground of the loss of service, and if there were no such loss, no recovery could be had. The right to recover damages from the seducer of a daughter rests upon similar principles. There is a peculiarity in this case, growing out of the fact that, though the daughter may have no action by reason of her own consent, the father may still sue for his own loss. There has been much diversity of opinion upon the point whether an action will lie, notwithstanding the fact that the daughter, though still in her minority, is actually in the service of another. In England the view is that the father in this case has no remedy, unless the daughter has the intention to return to her father (*animus revertendi*). On the other hand, in this country there is strong authority for maintaining that the test of the right of action is the father's power to demand the daughter's services. Accordingly, if he can recall her from her present master, he may sue. But if she were lawfully bound out as an apprentice, he has no action (since his right to demand her services is lost) unless the apprenticeship were entered into by the master with a view to her seduction, in which case he would still have his action. Though the action is grounded on the loss of service, that is not the measure of damages. The right to sue having once been established, the jury may take into account the father's wounded feelings and the injury to the family honor, and give a verdict accordingly. Whether the mother can maintain the action will depend upon the view which may be taken in any State as to her right to demand the daughter's wages or insist upon her services. If this be conceded, the right to sue will follow. Thus far it has been assumed that the daughter was in her minority when the seduction took place. If she had at that time reached her majority, a father or other person claiming to be master could not sue without proving the actual existence of the relation of master and servant. In such a case, either the father or mother or other person standing in the position of master would have a right of action.

(3) *The Right of Discipline.*—The law accords to the father the right to train the child, and to give him a fit education in learning, morals, and religion. To this end he may inflict moderate corporal punishment, and may delegate to schoolmasters and tutors a like power. If the bounds of moderation are exceeded, the father or schoolmaster, as the case may be, is liable in a civil action, and in some instances criminally. There has been much consideration in England of the duty of guardians, after a father's death, to educate the children in the religion which he professed, and in which he would probably have educated them if he had lived. The general rule there prevailing is that the religious education must, in such a case, follow the views of the father rather than those of the mother, and the court of chancery will make an order accordingly, particularly where the child is of tender years and has not yet formed an opinion on points of religious controversy. (Reference may be had to *Re Newberry*, 1 Law Reports, Equity 431, and to *Hawkesworth* agts. *id.*, same series, 6 Chancery Appeals R. 539.) The father has, as such, no right to the estate of the child, except as guardian in socage. (See GUARDIAN.) When appointed guardian, he is required to give bonds for the due and faithful administration of the child's estate, and his duties and responsibilities must be sought under the rules of law applicable to guardians. It only remains to notice the legal relations and duties of the child towards the parent. The domicile of a minor child is that of the father, and it cannot be changed without the latter's consent. No action will lie by common law at the suit of the child if the father be injured or killed by the wrongful act of another. By statutes in many of our States, when a parent is killed by the negligence or wrongful act of another (see NEGLIGENCE), an action may be brought by the legal representatives for the benefit of the children if it can be shown that pecuniary damage has been sustained. It has been asserted by high authority that a child is under no common-law obligation to maintain an indigent parent, and that whenever such a duty exists it must be derived from statute. However, if a child offer in advance to pay one who will maintain his parent, and the maintenance is supplied on the faith of

the proposition, the child is liable on general principles of law appertaining to the subject of the consideration of a contract. (See CONSIDERATION and CONTRACT.)

II. *Illegitimate Children.*—The rules of law governing this class of persons have been sufficiently stated under the title BASTARD, in vol. i. (For further information on the general subject of this article, consult Reeve's *Domestic Relations;* Schouler's do.; *Kent's Commentaries*, Lecture 29; Forsyth's *Custody of Infants;* Hurd's *Habeas Corpus*, and the works of Story, Adams, and Willard (Potter's ed.) *On Equity Jurisprudence.*) T. W. DWIGHT.

Parepa-Rosa. See ROSA.

Par'ga, town of European Turkey, eyalet of Yanina, on a steep cliff surrounded on three sides by the sea, and defended on the fourth by an almost impregnable citadel. It was founded in the last days of the Roman empire, belonged to Venice from 1401 to 1797, and was during the first part of this period a place of considerable commercial importance. After the overthrow of the Venetian republic by Napoleon in 1797, the city came to Turkey by a treaty between Russia and Turkey in 1800, and was placed under the command of Ali Pasha, governor of Yanina. But the inhabitants, at that time numbering about 5000 Christian Albanians, determined not to submit, and all the pasha's attempts at reducing the place were in vain. It became a place of refuge for the victims of Ali's barbarous tyranny, and its prosperity increased. After the Peace of Tilsit (1807) Napoleon refused to recognize the cession of Parga to the Turks, and the city now lived on under a kind of French protectorate, perpetually fighting against Ali Pasha. After the fall of Napoleon (1815) the Pargiotes solicited the protection of England, and obtained it. The English put a garrison in the city, and then, in 1819, they quietly delivered it over to Ali Pasha, after which the Pargiotes dug up the bones of their ancestors and burnt them, left the city, and went into exile. (See Mustoxidis, *Précis des Évènements qui ont précédé et suivi la Cession de Parga* (Paris, 1820).)

Parhelia. See HALO.

Pa'riah [Hind., "mountaineer"], one of the lowest classes in India, so called because generally of the stock of the hill-tribes. The pariahs have woolly hair and thick lips, and are found especially in the S. of India. They are very degraded, are not allowed to approach within many feet of any Hindoo, and have to some extent adopted a system of caste among themselves. Chandalas and outcasts sink to the rank of pariahs. Of late successful efforts are making by missionaries and others to elevate the character and intellect of these wretched beings. They are very numerous.

Parian Chronicle. See ARUNDEL MARBLES.

Pa'rian Ware, a name given to vessels, statuettes, and bric-à-brac made of the same materials as fine English china. The material is reduced to a liquid state and then cast in moulds made of plaster of Paris. Great care must be taken in the firing. It was invented in 1845 in Staffordshire, England, the principal seat of the manufacture.

Pari'etal Bones [Lat. *paries*, a "wall"], the two bones which in men constitute the lateral parts and the roof of the skull. They represent the expanded neural spine of the third vertebra. Each is developed from one centre.

Pari'ma, or **Parime, Sierra,** also called the **Highlands of Guiana,** a mountain-system of South America, occupies the north-eastern part of the country, and separates the plains of the lower Orinoco from those of the Rio Negro and the Amazon. The general character of this mountain-system is that of an elevated plateau, rising 2000 feet above the level of the sea, and traversed by numerous ridges, whose highest peaks, Maravaca and Duida, reach an altitude of about 8000 feet. The western part, extending between lon. 60° and 68° W., and between lat. 2° and 8° N., is much more irregular than the eastern; the surface here has often a completely alpine character. The plateau is generally covered with forests or pasturages; the ridges are bleak, barren, and naked. The mountains nowhere reach the sea, but leave along the shore a broad belt of lowland. The Orinoco, the Essequibo, and the Rio Branco (or Parime), an affluent of the Rio Negro, have their sources in this system.

Parini (GIUSEPPE), b. at Bosisio, a village near Milan, May 22, 1729; was educated for the Church; lived for some time as tutor in a private family, devoting himself with great zeal to poetry; was subsequently appointed professor of belles-lettres at the University of Milan. D. there Aug. 15, 1799. Of his works (6 vols., Milan, 1801–04), the most remarkable is *Il Mattino, il Mezzogiorno, il Vespro, e la Notte*, a satire on the life of the so-called elegant society, which attracted much attention when it was first published, and has been republished often since.

Par'is, the capital and principal fortress of France, with 1,851,792 inhabitants (Jan. 1, 1873), on both sides of the Seine, forming nearly a circle, and surrounded with hills whose tops are crowned with strong forts. As the seat of the central government, the centre of commerce and industry, the vital point in the spiritual life of the nation, the great depositary for historical, scientific, and artistic monuments, it bears absolute sway over the country. The *cité*, situated on the *Île de la Cité* in the Seine, forms the oldest part, the kernel of the city, and around this centre the rest of the city forms three belts. The first belt, the *ville* proper, is bounded by the inner *boulevards*, the most important thoroughfares, the most magnificent streets, constructed by Louis XIV. in 1670 on the site of the old fortifications. The second belt consists of the *faubourgs*, and is surrounded by the outer boulevards, running along the former demarkation wall. Up to 1860 the *barrières* of this wall formed the gates of Paris, but in that year the wall was broken down. The third belt extends to the bastioned wall, beyond which the whole vicinity is covered with villas, gardens, and parks. The Seine traverses the city in a curve, and divides it in a larger part to the N. and a minor to the S. The longest diameter of the city, from Porte Point du Jour in the S. W. to the outermost point of La Villette in the N. E., is about 7½ English miles, whilst its shortest diameter, a line leading through the intersecting point of the Seine in the S. E., by the Tuileries to Les Batignolles, is 5½ English miles long. The whole area comprises about 135 sq. m., and is covered with about 45,000 buildings. The whole city is very finely built, with broad streets lined with large and stately houses, which are generally occupied by several families. The greatest changes and improvements were undertaken by Napoleon III., and are due to the talent of the prefect Hausmann. It is divided into 20 *arrondissements*, but the old names of the old divisions are still in common use, especially in cases in which the quarter has received a certain character from its inhabitants; such as Faubourg St. Germain from the legitimist aristocracy; Faubourg St. Honoré from the diplomacy and the financiers; Quartier Latin from the students; and Faubourg St. Antoine from the workingmen. The most important and the most beautiful streets are the boulevards, of which those situated on the right bank of the Seine surpass the streets of any other city in splendor of architecture and in the luxurious outfit of the stores and cafés. A series of such streets, 4800 mètres long and 30 mètres broad, runs from the Place de la Bastile to the Madeleine church—namely, the Boulevard Beaumarchais, des Filles du Calvaire, du Temple, St. Martin, St. Denis, Bonne-Nouvelle, Poissonnière, Montmartre, des Italiens, des Capucins, and de la Madeleine. But besides these there are numerous other beautiful though less famous boulevards, such as the Boulevard de Sebastopol, de Strasbourg, St. Michel, St. Germain, Hausmann, Magenta, etc. They consist of a macadamized roadway in the centre, and sidewalks paved with asphaltum on both sides; rows of trees are planted between the roadway and the sidewalks. Other elegant streets are Rue Rivoli, Rue Montmartre, Rue de la Paix, Avenue de Vincennes, Avenue des Champs Élysées, Rue St. Honoré, Rue Richelieu, Rue de la Victoire, Rue St. Denis, etc. The most celebrated public squares are—the Place de la Concorde, the largest and finest in the city, 357 mètres long, 217 broad, bounded S. by the quays of the Seine, N. by the Rue Rivoli, E. by the garden of the Tuileries, W. by the Champs Élysées. In 1763 this square was named Place Louis XV., after a statue of this king erected here, but on Aug. 11, 1792, the statue was taken away and melted down into two-sou pieces, a statue of the Goddess of Liberty was placed on the pedestal, and the square was called Place de la Révolution. On Jan. 21, 1793, the guillotine was erected here; among its victims were Louis XVI. and Marie Antoinette, the duke of Orleans, Danton, and Robespierre. In 1799 the name was changed to Place de la Concorde; in 1814, to Place Louis XV.; in 1826, to Place Louis XVI.; and in 1830, again to Place de la Concorde. The Obélisque de Luxor, a present from Mehemet Ali to Louis Philippe, was raised here in 1836. It consists of a rose-colored syenite monolith 23.50 mètres high, weighs 500,000 pounds, and stands on a pedestal 9 mètres high. It is covered with hieroglyphics in praise of the great king Sesostris (1500 B. C.). Two beautiful fountains are constructed beside the obelisk; they are ornamented with statues, and their basins measure 16.50 mètres in diameter. Eight statues, representing the eight largest cities of France—Lille, Strasbourg, Bordeaux, Nantes, Rouen, Brest, Marseilles, and Lyons—adorn the square, which is surrounded with a balustrade with columns and chandeliers. The Jardin des Tuileries, to the E. of the square, and belonging to the celebrated palace of the same

name, contains old and handsome trees, and is adorned with statues of marble and bronze; it is a favorite rendezvous for children and nurses. On the Place du Carrousel, enclosed by the Tuileries and the Louvre, stands the Arc de Triomphe, 14.60 mètres high, 19.50 broad, 6.65 thick, erected in 1806 by Napoleon I. in commemoration of his victories over Austria and Russia. On the Place Vendôme, an octagonal square at the foot of the Rue de la Paix, stands the Colonne Vendôme, modelled after the column of Trajan in Rome, and erected by Napoleon I. in 1806, 144 feet high, and covered with spiral reliefs representing scenes from the campaign of 1805; 1200 cannon, captured in the campaign, afforded the materials for the covering of the column. On the top stood Napoleon in Roman costume. In 1814 the statue was thrown down by the royalists, and a white flag was substituted, but Louis Philippe again placed a statue of Napoleon, though in historical costume, on the top of the column. In 1871 the Commune threw down the whole column, but in 1875 it was again raised. On the Place des Victoires, 78 mètres in diameter, the gilded statue of Louis XIV. was erected in 1686, and the square received the name of Place Louis XIV., but in 1792 the name was changed and an obelisk took the place of the statue. In 1806 the statue of Gen. Desaix was substituted for the obelisk, but in 1814 this statue was removed, and in 1822 the colossal equestrian statue of Louis XIV. by Bosio was erected. The Place de la Bastile was formerly occupied by the fortress of the same name, which was used as a state prison, but on July 14, 1789, the people stormed the fortress, and it was afterward razed to the ground. After the July revolution a bronze column, 50 mètres high and surmounted with the genius of Liberty, was erected in the square. In the interior a spiral staircase of 238 steps leads to the top. The Place des Vosges is a square surrounded by an iron railing, and contains in the centre an equestrian statue in marble of Louis XIII. by Dupaty and Cortot, erected in 1829 in place of a statue of the same king which was destroyed in 1792. The Place du Châtelet contains the Fontaine de la Victoire, adorned with four allegorical figures, and the Colonne de Palmier, on which the names of the victories of Napoleon are inscribed, and on whose top stands a Victory by Bosio. The Place de l'Étoile, from which twelve boulevards and avenues radiate, contains the Arc de Triomphe de l'Étoile, the largest triumphal arch ever erected, 49 mètres high, 45 broad, and 22 thick. It was commenced in 1806 by Napoleon I., and finished after the design of Chalgrin in 1836, adorned with statues commemorative of the exploits of the French army by Rude, Lemaire, Cortot, Seurre, Marochetti, and others. The Champ de Mars is a military parade-ground, situated on the left bank of the Seine, 1000 mètres long, 500 broad, and capable of accommodating 30,000 men drilling and manœuvring. Here the Fête de la Fédération was celebrated July 14, 1790, and here the Exposition Universelle of 1867 took place. The Champs Élysées, laid out in 1616 under Maria de' Medici and formerly called Cours la Reine, is a small English park, about 400 mètres broad and 650 long, and extends from the Place de la Concorde to the Arc de Triomphe. A beautiful avenue, two kilomètres long, and one of the most frequented promenades of Paris, traverses the ground, lined on both sides with establishments for popular amusement. At the entrance stand the two Dompteurs de Chevaux by Courbon, which were brought hither in 1795 from the Château de Marly. The Champs Élysées connect with the garden of the Palais de l'Élysée or Élysée-Bourbon, which was built in 1718, and inhabited successively by the marquise de Pompadour, Napoleon I. during the Hundred Days, the duchess of Berry, and Napoleon III. as president of the republic. A large part of the Champs Élysées is occupied by the Palais de l'Industrie, a building covering 27,000 square mètres, 250 mètres long, 108 broad, and 35 high, and used for a perpetual exposition. The Avenue de l'Impératrice leads from the Arc de Triomphe to the Bois de Boulogne, a beautiful park, comprising an area of 900 hectares, and extending from the line of fortifications to the Seine. The beautiful forest suffered very much during the war of 1870–71, but the park offers still a most charming promenade with its fine trees, lakes, cascades, etc. The northern part of it, comprising an area of about 20 hectares, is occupied by the Jardin d'Acclimatation, a very interesting establishment. Other fine promenades are the Parc de Monceaux, to the N. E. of the Arc de Triomphe, and the gardens of the Palais Royal and de Luxembourg. The river is lined with 27 quays and spanned by 23 bridges, most of which are celebrated and beautiful constructions. Pont Neuf, 328 mètres long, connects on both sides the *cité* with the rest of the city, spanning both arms of the river, and bearing on the centre the equestrian statue of Henry IV.

The city has 65 churches, besides a number of chapels. Of these the most celebrated is the cathedral of Notre Dame, situated in the eastern part of the *cité*. It is a Gothic structure, erected from the twelfth to the fourteenth century, 126.25 mètres long, 48 broad, 33.75 high, with towers rising 68 mètres. Especially grand and beautiful is the front façade, rising in three divisions, of which the middle one is adorned with one large and two minor roses. The chief vault rests on 131 columns. Ste. Chapelle, also situated in the *cité*, is perhaps the most beautiful mediæval structure in existence. It belongs to the Palais de Justice, and was finished by Pierre de Montereau in the reign of St. Louis. The Madeleine, situated near the Place de la Concorde, planned after the model of a Greek temple, 109 mètres long, 46 broad, and surrounded with Corinthian columns, was founded in 1764, but not finished until the reign of Napoleon I. The pediment is by Lemaire, the bronze doors by Triquetti. On the left bank of the Seine the most important ecclesiastical structure is the Panthéon, built by Soufflot, and finished in 1790, in the form of a Greek cross, 112 mètres long, 84 broad, and 83 high, to the apex of the dome. The pediment, by David d'Angers, represents celebrated men of the country, to whom "France" distributes wreaths. The crypt contains the tombs of celebrated men; the most celebrated, however, Voltaire, Rousseau, Mirabeau, etc., have been carried away; the sarcophagi of the two philosophers are empty. St. Germain des Prés is the oldest church in Paris, built 1001–1163, 64 mètres long, 21 broad, 20 high—the lower part Romanesque, the upper Gothic. During the Revolution it was used as a manufactory of saltpetre; 1824–36 it was thoroughly repaired, and 1852–61, Hippolyte Flandrin adorned the interior with frescoes. St. Germain l'Auxerrois, situated in the Rue Rivoli, opposite to the colonnade of the Louvre, is the old parish church of the French kings. It is elegant, but neither grand nor in pure style; the decoration of the interior is modern, containing frescoes by Mottez and Guichard. St. Eustache, also in the neighborhood of the Louvre, built in a mixed style, Renaissance and Gothic, 106 mètres long, 44 broad, and 33 high, is much frequented, and contains many fine frescoes and statues, and an excellent organ. La Trinité, finished in 1866 by Balla in the style of the later Renaissance, 90 mètres long, 30 broad, with a tower rising 60 mètres, is one of the most elegant churches of Paris, and contains pictures by Lévy, Delaunay, Jobé-Duval, and Barrias. Notre Dame de Lorette, in the form of a Roman basilica, 68 mètres long, 32 broad, looks rather severe externally, but is nevertheless exceedingly gorgeous in the interior, radiant with gold and brilliant colors. St. Vincent de Paul, built 1824–44 by Lepère and Hittorf, has also the form of a basilica, 81 mètres by 36. The vault rests on 82 Ionic columns of polished stone. The church has beautiful frescoes by Picot and Hippolyte Flandrin. The Chapelle Expiatoire, erected in commemoration of Louis XVI. and Marie Antoinette, is in artistic respects of small interest. The beautiful St. Jean Baptiste, situated in the Rue de Belleville, the most elevated part of the city, was finished in 1858 by Lassus in Gothic style. St. Sulpice is a rich and important church, of large dimensions, 140 mètres long, 56 broad, 32 high, in the form of a cross, with two unequal towers. It was commenced in 1646, but not finished until about 100 years after. The chapels contain excellent frescoes by Eugène Delacroix, Heim, Vinchon, Lason, Hesse, Guillemot, and others. The pulpit and the organ are noteworthy. Ste. Clotilde, built by Gau and Balla in the style of the fourteenth century between 1846 and 1859, is a fine structure. The chapels contain remarkable frescoes by Picot, Lehmann, and Henri Delaborde, and good sculptures by Pradier, Duret, Guillaume, and others.

The city is still richer in palaces, of which the most celebrated are situated in the centre of the city—the Tuileries, Louvre, and Palais Royal. The Tuileries is now, since the days of the Commune in 1871, mostly in ruins. It formed the western front of a colossal structure, whose eastern part was formed by the palace of the Louvre, while the connecting links originated successively as wings and galleries. It was built in 1564, by order of Catharine de' Medici, by Philibert Delorme, on the site of a tile-factory, and was afterward much enlarged. At the time of its destruction it measured 317 by 33 mètres. The right wing was called Pavillon de Marsan; the left, which was the only part of the palace which escaped destruction, Pavillon de Flore. The central wing, Pavillon de l'Horloge, contained the large Salle de Maréchaux, Salle du Trône, Galerie de Diane, Salon du Premier Consul. The palace was richer in historical remembrances than in monuments of art. It had been the residence of the rulers of France since Feb. 1, 1800; Napoleon III. occupied the wing between the Pavillon de l'Horloge and the Pavillon de Flore. May 20, 1871, the Commune, pressed by the troops of the

government, determined to burn down the palace, together with several other great buildings, and May 22 and 23 they arranged a systematic conflagration. The Louvre is both in architectural respects and as a museum of art the grandest and most interesting building in Paris. Together with the Tuileries, it covered an area of 107,200 square mètres, and the buildings, although erected in the course of centuries and in different styles, formed nevertheless an harmonious whole. On the site of the present old Louvre stood originally a fortress, built by Philippe Auguste (1180–1223), but changed into a palace by Charles V. (1361–80). Francis I. had the whole structure pulled down in 1541, and a new palace erected by Pierre Lescot. Henry IV. finished the gallery commenced by Catharine de' Medici and Charles IX., which, 443 mètres long, runs along the Seine and connects with the Tuileries. Richelieu continued the enlargement of the palace. The eastern façade, with the celebrated colonnade, was begun in 1665 after the design of Perrault. Under Napoleon I. the connection between the Louvre and the Tuileries along the Rue Rivoli was undertaken, and Napoleon III. finished the gallery and lengthened the northern and southern façades to the Place du Carrousel, at an expense of 75,000,000 francs. The old Louvre is used as a museum, the new Louvre mostly for government offices. The southern wing, which is partly used as a museum, suffered somewhat by the conflagration of 1871, but has been restored. The Pavillon de la Bibliothèque, situated on the northern side and facing the Place du Palais Royal, suffered more, though the library, containing 90,000 costly works and many rare manuscripts, was nearly all saved. The museum consists of a combination of fifteen museums, some of which are unsurpassed in historical completeness and æsthetical worth. The Palais Royal, opposite the new Louvre, was built by Richelieu (1629–36), and called the Palais Cardinal. After his death it was inhabited by Anne of Austria, and received its present name. Louis XVI. presented it to his brother, and his son, the Regent, held here his orgies. The grandson of the Regent, Philippe Égalité, surrounded the garden with buildings which he rented out for shops and cafés, and the latter became during the time of the Revolution the established rendezvous of the radicals. The artistic monuments which the palace contains are of small interest. The Palais de Justice, situated in the *cité*, but mostly destroyed by the Commune in 1871, was the residence of the king to the close of the fourteenth century, at which time it was assigned to the Parliament. The great fires of 1618 and 1776 left of the old sombre palace only the four towers—de l'Horloge, du Grand-César, de Montgomery, and d'Argent, but from 1839 to 1869 the palace was fully restored. The Cour de Cassation, Cour d'Appel, Cour d'Assises, Tribunal de Première Instance, and Tribunal de Simple Police sat here, and it contained the celebrated Salle des pas Perdus and Cuisine de St. Louis. The Palais de Luxembourg is also historically interesting, containing an excellent collection of modern sculptures and pictures. It was built for Maria de' Medici in 1615 by J. Debrosse, in imitation of the Palazzo Pitti in Florence, and continued a royal residence up to the Revolution, when it was used first as a prison, and after 1795 as the Palais du Directoire and Palais du Consulat. After the Restoration and under Louis Philippe it was the Chambre des Pairs, and afterward the Palais du Sénat. At present it is occupied by the offices of the Seine prefecture till the restoration of the Hôtel de Ville is finished. The Palais du Corps Législatif, opposite the Place de la Concorde, on the left bank of the Seine, was commenced by Girardini and finished by Mansart for the dowager-duchess of Bourbon, and was called the Palais Bourbon. It has the form of a Greek temple with a Corinthian peristyle, and contains the beautiful Salle de la Paix, decorated by Horace Vernet, and Salle du Trône, decorated by Delacroix.

Other noteworthy public buildings are the Hôtel des Invalides, an imposing pile, crowned by a gilded dome and covering an area of 126,985 square mètres, with a front façade 200 mètres long, built 1671–75 by Libéral Bruant. The dome is 105 mètres high, and immediately under it stands the sarcophagus of Napoleon I. The building contains many trophies of French victories and an interesting museum of artillery; it is inhabited by 300 invalid soldiers. In the Palais de l'Institut, built in a semicircle, crowned with a dome, and situated on the left bank of the Seine, opposite the Louvre, the French Academy holds its meetings. Close by is the Palais des Beaux-Arts, a stately building, erected by Debret and Duban 1820–28. The Mint, with a façade on the Quai Conti, 120 mètres long; the Bourse, in antique style, a parallelogram 71 by 49 mètres, surrounded by a colonnade; the Bazar; the Central Hall, with 3200 stands for vegetables, fish, and poultry, etc. The Hôtel de Ville, the most interesting structure in Paris both in architectural and historical respects, was entirely destroyed by the Commune in 1871.

Of the numerous theatres of Paris, the most prominent are the New Opera, situated on the Boulevard des Capucins, built by Garnier, decorated by Baudry, opened in 1875, and containing seats for 2350 persons; Théâtre Français, in the Rue Richelieu, founded in 1600, at one time managed by Molière, representing only original plays; Théâtre Ventadour or Théâtre Italien, on the Boulevard des Italiens, for Italian opera; L'Opéra Comique, on the Place Boieldieu, for light opera; l'Odéon, near the Luxembourg, the second classical theatre, much frequented by the students; Le Gymnase, Le Vaudeville, Les Variétés, Les Bouffes-Parisiennes, Le Palais Royal, l'Ambigu Comique, Les Folies Dramatiques, Beaumarchais, etc. Good acting is the rule in these theatres; great talents are not uncommon; perfect training is indispensable, and love of art is generally diffused. On the whole, much is done for public amusement. There are a Cirque d'Été, formerly Cirque de l'Impératrice, in the Champs Élysées, containing 6000 seats; and a Cirque d'Hiver, formerly Cirque Napoléon, on the Boulevard des Filles du Calvaire. The concerts of the Conservatoire de Musique have a European reputation, and popular concerts are given in the Cirque d'Hiver and in the concert-halls of Herz, Erard, and Pleyel, not to speak of the numerous cafés chantants.

The institutions of learning and education are grand. At the head stands the Institut de France, the highest authority of science in the country. The Sorbonne, comprising faculties of theology, letters, and sciences, was founded by Robert de Sorbonne, the confessor of St. Louis, in 1250. The Collége de France, founded in 1530 by Francis I., contains 29 chairs, and teaches in public lectures history, law, languages, etc. There are 9 other colleges. The most celebrated are the École de Médecine, École Militaire, École Centrale des Arts et Manufactures, Conservatoire des Arts et Métiers, École Polytechnique, École des Mines, École des Ponts et Chaussées, etc. All these institutions are supported by the state, and make Paris the centre of human knowledge, not only for France, but for the world. The materials for study which the city contains are grand. The Bibliothèque Nationale, probably the largest and richest library in the world, contains 3,000,000 vols., 150,000 MSS., 300,000 maps and plans, besides other scientific treasures, among which is a celebrated cabinet of medals and antiques. Other important libraries are Ste. Geneviève, Mazarine, de l'Arsenal, de l'Université, etc. Of great importance for the study of natural science is the Jardin des Plantes, comprising an area of 30 hectares, and containing an anatomical and anthropological gallery, a botanical garden, etc.

With respect to commerce and industry, Paris occupies a position of the first rank. Characteristic and often unique in their kinds are the articles of luxury, fashion, play, knickknacks, bronzes, leather goods, musical instruments, artificial flowers, shawls, carpets, tapestry, etc., which in taste of execution generally surpass similar products of other countries. The reason is, that in France art and industry walk hand-in-hand. The mechanics study art in Paris, and the government encourages this tendency in every way. The manufacturers, for instance, of tapestry, printed goods, furniture, etc. procure their patterns from the artists, and are not afraid of the increased cost. With this flourishing state of industry the commerce of the city corresponds.

Among its charitable institutions the most remarkable are the Hôtel Dieu, Charité, Pitié, La Riboisière, Val de Grace, Institution des Jeunes Aveugles, Bicêtre, Salpêtrière, etc. A peculiar institution is the Morgue, in which the bodies found in the Seine are exposed for three days. The most interesting among the cemeteries are du Père Lachaise, de Montmartre, and du Montparnasse; the first especially is very famous.

Paris forms the centre of the railway system of France; eight lines, connected by a circular line, issue in different directions. The annual budget of the city amounts to 230,000,000 francs. Provisions to the value of 1 milliard are annually consumed, among which are 3,700,000 hecto. of wine, 1,200,000 of milk, 334,000,000 kilog. of meat, 300,000,000 kilog. of bread, 15,000,000 kilog. of vegetables, etc. Of special importance are the fortifications, begun under Louis Philippe. Besides the *enceinte* with its 94 bastions, they consist of 20 forts built for the purpose of securing the city against the attacks of hostile artillery. During the siege of 1871 it became evident, however, that these forts were not far enough advanced, and immediately after the conclusion of peace the construction of a new line of detached forts was commenced.

Paris is first mentioned in history under the name of *Lutetia Parisiorum.* Cæsar rebuilt it when it had been destroyed by the war, and it became the *urbs vectigalis* of

the province of Gallia. The name of *Civitas Parisiorum* or *Parisia* does not occur until after 358 A. D. In 486 it was conquered by the Franks and called *Paris*. Clovis made it his residence in 508. It continued to be the residence of the Merovingians and Carlovingians, and it increased steadily. In the thirteenth century it was one of the most important cities of Europe, had 150,000 inhabitants, and carried on a considerable trade. Francis I. did much for it, invited many foreign artists, and erected many buildings. Catharine de' Medici and Henry IV. also favored it. But it made its greatest progress under Louis XIV. His concentration of the whole government in the person of the monarch naturally increased the importance of his capital, and his passion for splendor and magnificence gave the city 80 new streets and many monuments, public squares, palaces, and new institutions of science and art. Under Louis XV. all who were rich gathered to his gay court, and numbers of new palaces were built in Paris. Under his successor, Louis XVI., the Revolution broke out—the result, certainly, of a general development which had taken place throughout the whole of France, but which as certainly received its power of explosion from the capital. From this period, and up to the year 1814, Paris was the capital of the European continent. Another brilliant period it had under Napoleon III., who rebuilt it, and whose very successful commercial policy brought great wealth to it. But during the contest between the government at Versailles and the Commune, from March to May, 1871, it suffered much. (For the history of the city see *Les Antiquitez, Chroniques et Singularitez de Paris*, by Corrozet (1586); *Le Théâtre des Antiquitez de Paris*, by Dubreul (1612); *Histoire de la Ville de Paris*, by Félibien (5 vols., 1725); *Histoire de la Ville et de tout le Diocèse de Paris*, by Lebeuf (15 vols., 1754–58); *Histoire physique, civile et morale de Paris*, by Dulaure (7 vols., 1820–22); *Histoire de Paris*, by Lavallée (2 vols., 1857); *Le Nouveau Paris*, by Labédollière (1860).) AUGUST NIEMANN.

Paris, a port of entry of Brant co., Ont., Canada, at the junction of the Great Western and the Buffalo and Goderich branch of the Grand Trunk railways. It has valuable beds of gypsum, great water-power, many mills, foundries, knitting-works, and other industries, and 2 weekly newspapers. Pop. of sub-district 2640.

Paris, post-v. and tp., cap. of Edgar co., Ill., at the junction of the Illinois Midland with the Indianapolis and St. Louis and the Paris and Danville R. Rs., has 2 weekly newspapers, a large trade, and important manufactures. Pop. of v. 3057; of tp. 4522.

Paris, post-v. of Oneida co., Id.

Paris, tp. of Howard co., Ia. Pop. 434.

Paris, tp. of Linn co., Kan. Pop. 1396.

Paris, post-v., cap. of Bourbon co., Ky., on a tributary of the Licking River, at the junction of the Kentucky Central with the Maysville and Paris R. R., has 2 weekly newspapers, is an important cattle-market, and the chief seat of the manufacture of Bourbon whisky. Pop. 2655.

Paris, post-v. and tp., cap. of Oxford co., Me., on the Grank Trunk R. R., 45 miles from Portland, has fine water-power, 2 academies, 5 churches, 1 foundry, a cheese-factory, 2 weekly newspapers, 1 bank, a baby-carriage factory, 4 hotels, and stores. Pop. 2765.

GEO. H. WATKINS, ED. "DEMOCRAT."

Paris, tp. of Huron co., Mich. Pop. 891.

Paris, tp. of Kent co., Mich., on the Grand River Valley division of the Michigan Central R. R. Pop. 1543.

Paris, post-v. and tp. of Mecosta co., Mich., on Muskegon River and the Grand Rapids and Indiana R. R.

Paris, post-v. of Jackson tp., cap. of Monroe co., Mo., on the Missouri Kansas and Texas R. R., 125 miles from St. Louis, has a public-school building, 1 bank, 2 newspapers, 6 churches, the county court-house, 3 hotels, and stores. Coal, timber, and water are plenty in the immediate vicinity. Pop. of v. 895.

MASON & BURNETT, EDS. "MERCURY."

Paris, post-v. and tp., Oneida co., N. Y., on Sauquoit Creek and the Utica Chenango and Susquehanna R. R. Pop. 3573.

Paris, tp. of Portage co., O. Pop. 691.

Paris, post-v. and tp., Stark co., O. Pop. 2625.

Paris, tp., Union co., O., on Springfield branch of Cleveland Columbus Cincinnati and Indianapolis R. R. P. 2838.

Paris, post-v., cap. of Henry co., Tenn., on the West Sandy River and the Louisville and Memphis line of the Louisville Nashville and Great Southern R. R., has 1 weekly newspaper. Pop. 1727.

Paris, post-v., cap. of Lamar co., Tex., near Red River, on the Texarkana and Sherman branch of the Texas Pacific R. R., has 3 newspapers, and is a centre of trade for a rich cotton-producing region.

Paris, tp. of Grant co., Wis. Pop. 907.

Paris, post-v. and tp., Kenosha co., Wis. Pop. 1015.

Par'is, a son of Priam, the king of Troy, and Hecuba, carried off Helen, the wife of Menelaus, king of Sparta, thereby bringing on the war between the Greeks and Trojans. By Homer he is described as shrewd but cowardly; in art he is represented as a youthful and handsome man, though somewhat effeminate in appearance. Being wounded during the siege by a poisoned arrow, he d. before the capture of the city.

Paris (JOHN AYRTON), M. D., b. at Cambridge, England, Aug. 7, 1785; graduated in medicine at Caius College 1808; resided some time in London, and several years at Penzance, Cornwall, where he founded the Royal Geological Society of Cornwall; returned to London 1817; lectured on materia medica and the philosophy of medicine; invented the "tamping-bar," an implement coated with copper for the protection of miners from the perils caused by the sparks emitted from iron bars; published, among other works, a *Memoir* of Sir H. Davy (1810), *Pharmacologia, or the History of Medical Substances* (1819), *A Treatise on Diet* (1826), *Philosophy in Sport made Science in Earnest* (3 vols., 1827), *Elements of Medical Chemistry* (1833), and *Medical Jurisprudence* (3 vols., 1823), in which he was aided by J. S. M. Fonblanque; became president of the London College of Physicians 1844, and retained that position until his death, at London, Dec. 24, 1856.

Paris, de (LOUIS PHILIPPE ALBERT D'ORLEANS), COMTE, son of the late duc d'Orleans and grandson of the late king, Louis Philippe, b. at Paris Aug. 24, 1838; was but four years of age when, deprived of a father by the sad accident of July 13, 1842, he became, after the king, the representative of the House of Orleans. Scarcely ten years of age, the revolution of 1848 occurred, when, with his mother and brother (the duc de Chartres), he witnessed the stormy scenes in the French Chamber of Deputies, where, by advice of M. Dupin and Admiral Bardin, the duchess had presented herself. They escaped with difficulty from thence, from Paris, and from France. In 1849 the duchess, who had first repaired to Belgium, rejoined the royal family at Claremont, England, where, under her care and in Germany, his education was conducted. Her death occurred (May 18, 1858) a year before he attained his majority. Travels in Greece, Egypt, and the East occupied the subsequent year or two, and in Aug., 1861, the prince, with his brother, the duc de Chartres, accompanied their uncle, the prince de Joinville, to the U. S. Though anticipating but a few months' sojourn, they did not fail to avail themselves of the opportunity of acquiring experience of war, and, at the same time, of exhibiting sympathy for the great republic in her hour of trial. Their proffer of services (they declining the receipt of pay) was warmly welcomed by the President and secretary of state. They were attached to the personal staff of Gen. McClellan with rank of captain, but free at any moment to relinquish the service and return to Europe. Of the long years of exile from France the count yet speaks of his ten months' service in the army commanded by Gen. McClellan, for whom he formed a strong attachment, and whose abilities as a general he highly esteemed, as the happiest portion. During their short career in the field no opportunity was lost by either of the young officers to serve on detached expeditions, in which, on more than one occasion, they freely exposed themselves. But it was at the bloody and fiercely-contested battle of Gaines's Mill that they most truly received their *baptême de feu*. Attached for the occasion to the staff of Gen. Porter, the captains "Paris" and "Chartres" were to be seen, now conveying orders and now freely exposing their lives in endeavoring to rally and re-form our lines. During the remaining days of the gravely eventful "seven" the services of the young princes were, if less exposed, equally active and efficient. An imperious necessity compelled them, to the regret of all, to return to Europe, leaving as soon as the army reached James River (July 2, 1862). In 1864 the count wedded his cousin, the princess Isabella, eldest daughter of the duc de Montpensier. On his return to England he devoted himself to the study of the condition of the operatives in the great centre of cotton manufacture, then in distress through the "cotton famine." The results of his protracted labors were made known in papers written for periodicals, which were subsequently embodied in a work on the *Workingmen's Associations in England* (*Associations Ouvrières en Angleterre*). Two other publications, *L'Allemagne nouvelle* (1867) and *L'Esprit de Conquête* (1870), show the count in the broader light of a statesman and profound student of the political "signs of the times." Absorbing as such studies must have been to

one standing in the relation of the count to the politics of Europe, they have not excluded devotion to what would seem a yet more laborious work—a great *history*. He has devoted the half score and more of years since he bore the commission of a captain in the service of the U. S. to writing the *History of the Civil War in America* (*Histoire de la Guerre Amérique*). Americans have cause to congratulate themselves that this work has been undertaken by one who, with personal knowledge, is yet a foreigner and at the same time a soldier, a statesman, and a scholar. Vast as were the operations of our civil war, admirable as were the displays of energy and skill in the organization and equipment, the supplying, feeding, and moving of the great armies arrayed, unquestionable as was the development of new and applicable methods of warfare appropriate to the physical characteristics of the country and to the modern improved weapons, our civil war as a theatre of vast military operations has been sadly depreciated in Europe. An appreciative *History* from the pen of the count of Paris finds readers in every court and in every camp in Europe. Since the removal of the ban of exile the count has resided, with his young family (three children have been born to him), in or near Paris.

J. G. BARNARD.

Paris (MATTHEW), b. in England about 1195; became in 1217 a Benedictine monk at the convent of St. Alban's; wrote a continuation of the *Flores Historiarum* of Roger of Wendover, comprising the period from 1235 to 1259, the whole work, known as the *Historia Major*, having formerly been incorrectly ascribed to him; and superintended the preparation of an abridgment of that work, which under the same title of *Flores Historiarum* was ascribed to a supposed author, "Matthew of Westminster," who probably never existed. The difficult questions of authorship and authenticity were solved by Sir Frederick Madden, who published in 1866 the original manuscript of the abridgment, partly in the handwriting of Matthew Paris. The larger work has been translated by Rev. J. A. Giles (5 vols., 1849–54), the smaller by C. D. Yonge in Bohn's "Antiquarian Library" (2 vols., 1853). Nothing is known of the personal history of Matthew Paris beyond a few unimportant references to his own writings, except the fact that he was sent to Norway in 1248 by Pope Innocent IV. as visitor of the Benedictine order. His stay there was brief. D. at St. Alban's soon after May, 1259.

Paris Green, the popular name, in America, of what is correctly designated as "Scheele's green," having been discovered by the great Swedish chemist of that name. It may also be, and in Germany is, called "Swedish green." It is a compound of oxide of copper and arsenious acid, *arsenite of copper.* White arsenic (arsenious acid), by Scheele's original method of preparation, is dissolved by boiling in caustic potash-ley 11 parts of arsenious acid to 32 of solid potash, and added while hot to a hot solution of 32 parts of blue vitriol, sulphate of copper. The precipitate that falls has a very rich, bright, and peculiar tint of green, which is difficult to obtain by other means. It is hence, as well as by reason of the cheapness of this pigment, that it has passed into use all over the world to an extent which may be called enormous, notwithstanding the fact that it is one of the most deadly of poisons. It is used for coloring wall-paper and other ornamental paper, and paper for binding books, and for innumerable other uses. Children are often poisoned to death by chewing such paper, and arsenical disease is still oftener produced by inhaling the dust from arsenical wall-paper. Paris green is now, from the ease with which it is procured, used with increasing frequency for suicidal and homicidal purposes. It is far more than time that its use for common ornamental purposes, at least in articles of household use, should be banished, and its sale (except under the same restrictions that apply, for example, to *strychnine*) should be prohibited, in paint-shops and the like, by the most stringent legislation throughout the civilized world.

H. WURTZ.

Par'ish [Lat. *parochia*], in England, a certain circuit of ground of which one parson or vicar takes spiritual charge, and in which he has a legal right to levy tithes. In the U. S., where tithes never existed as a legal obligation, the word meant, consequently, only the territorial circumscription of the spiritual charge of a minister; and as the diversity of religious opinions developed and congregations were founded only from similarity of religious sentiment, without reference to residence, the word lost also its territorial signification. In the State of Louisiana it is used instead of the word "county."

Parish, post-v. and tp., Oswego co., N. Y., on the Syracuse Northern R. R., has 1 weekly newspaper. Pop. 1929.

Parish (ELIJAH), D. D., b. at Lebanon, Conn., Nov. 7, 1762; graduated at Dartmouth 1785, and was 1787–1825 pastor of the congregational parish of Byfield, Essex co., Mass., where he d. Oct. 15, 1825. He was a man of decided views, a follower of Hopkins in theology; assisted in the preparation of Morse's *Gazetteer* (1802); wrote a *History of New England* (1809); a *System of Modern Geography* (1810); *Memoir of E. Wheelock* (1811); *Sacred Geography* (1813); *Sermons*, with a *Memoir* (1826).

Parish Grove, tp. of Benton co., Ind. Pop. 193.

Parishville, post-v. and tp., St. Lawrence co., N. Y., on St. Regis River. Pop. of v. 312; of tp. 2241.

Paris Mountain, tp. of Greenville co., S. C. P. 690.

Paris, Plaster of. See GYPSUM.

Park, originally a large and enclosed tract of ground, partly covered with forest, generally situated close to the mansion, and kept for the preservation of game. As this purpose required certain conditions of the ground, such as a running stream, diversity of dense woods, and open glades with greensward for pasturing, etc., and as the presence of deer on the ground and their browsing on the young trees imparted a certain character to the woods, the words "park" and "park-like" came to denote a peculiar æsthetical character of the landscape, in the same manner as "alpine," etc. At present the word is used in the U. S. to signify any kind of public ground laid out and cultivated for the sole purpose of pleasure and recreation, without any regard to the size and situation of the ground or the style of the arrangement. Parks, in this sense of the word, have been formed, or are now forming, in all large cities in Europe and America, and are mentioned in the respective articles on those cities; a special article is given on CENTRAL PARK, New York (which see).

Park, county of Central Colorado, embracing the larger part of the South Park, with its surrounding territory. It is bounded N. and W. by the main range of the Rocky Mountains. It abounds in timber, good lignite, salt, and silver ore. The scenery is grand and the soil of the park fertile. Cap. Fairplay. Pop. 447.

Park, tp. of Scott co., Ark. Pop. 495.

Park, tp. of St. Joseph co., Mich., on Kalamazoo division of Grand Rapids and Indiana R. R. Pop. 1274.

Park (CALVIN), D. D., b. at Northbridge, Mass., Sept. 11, 1774; graduated at Brown University 1797; was tutor and professor there 1804–25; Congregational pastor at Stoughton, Mass., 1826–40, where he d. Jan. 5, 1847. Was the father of Prof. E. A. Park.

Park (EDWARDS AMASA), D. D., b. at Providence, R. I., Dec. 29, 1808; graduated at Brown University 1826, and at Andover Seminary 1831; became in 1831 Congregational pastor at Braintree, Mass.; was 1835–36 professor of moral and intellectual philosophy in Amherst College; held the Bartlet professorship of sacred rhetoric in Andover Theological Seminary 1836–47, and in the latter year became Abbot professor of sacred theology in the same institution; in 1869–70 travelled extensively in Europe and the East; has long been one of the principal editors of the *Bibliotheca Sacra;* author of *Lives* of Hopkins (1852), Emmons (1861), B. B. Edwards (1853), W. B. Homer (1849), (prefixed respectively to editions of their writings); a *Life* of S. H. Taylor; *Discourses and Treatises on the Atonement* (1859), besides numerous published discourses, sermons, essays, reviews, and theological papers; is also an able preacher and distinguished for valuable labors as a hymnologist.

Park (JOHN), b. at Windham, N. H., Jan. 7, 1775; graduated at Dartmouth 1791; became an instructor; studied medicine, and was 1797–1801 a U. S. navy surgeon; edited a Federalist journal at Boston, Mass., 1803–11, and was afterwards for twenty years the successful conductor of a school for young ladies. Published the *Boston Spectator* 1814. D. at Worcester, Mass., Mar. 2, 1852.

Park (MUNGO), b. at Fowlshiels, Selkirkshire, Scotland, Sept. 10, 1771; studied surgery at Edinburgh, and was 1792–93 assistant surgeon on the Worcester Indiaman, under the patronage of Sir Joseph Banks; journeyed up the Gambia and visited the Niger 1795–97, suffering extreme hardships; settled as a surgeon in Scotland; took command in Jan., 1805, of a small military exploring party despatched by the African Association and the British government to trace the course of the Niger. Most of his party died of fever, and before the Niger was reached only five white men were left out of 44. The party set sail down the river from Bammako at first in two canoes, but soon built for themselves a little schooner, with which they descended the Niger some 1500 miles, when they were treacherously attacked by a large party of natives, and Park and all his company perished in the at-

tempt to escape by swimming. A narrative of Park's first African journey and fragmentary accounts of the second have been published.

Park (Roswell), D. D., b. at Lebanon, Conn., Oct. 1, 1807; graduated at Union College and at West Point July, 1831, and until Sept., 1836, served as a lieutenant of engineers; was professor of natural philosophy and chemistry in the University of Pennsylvania 1836–42; took orders in the Protestant Episcopal Church 1843; was an instructor in Connecticut 1846–52; president of Racine College 1852–59; chancellor of the same 1859–63; founded in 1863 a school at Chicago. D. at Chicago, Ill., July 16, 1869. Author of *Pantology* (1841), *Sketch of West Point* (1840), a *Handbook* for European travel (1853), and a volume of original, translated, and selected poems.

Park (Trenor William) was b. in Woodford, Bennington co., Vt., Dec. 8, 1823; received a liberal education, studied law, and was admitted to the bar in Dec., 1846; practised law in Vermont till 1852, when he removed to San Francisco, where he remained till 1863. Returning to Vermont in 1864, he served four years in the legislature of that State. He is president of the Panama Railroad Company, president of the First National Bank at North Bennington, Vt., and a director in several banks and railroad companies in New York. J. B. Bishop.

Parke, county in the W. of Indiana, bounded W. by Wabash River. Area, 440 square miles. It is generally very fertile and abounds in good coal. Live-stock, grain, and wool are leading products. The county is traversed by the Logansport Crawfordsville and South-western R. R. Cap. Rockville. Pop. 18,166.

Parke (John), b. in Delaware about 1750; studied at the University of Pennsylvania; was assistant quartermaster-general in the Revolutionary army, and published at Philadelphia in 1786 a curious work, *The Lyric Works of Horace, translated into English Verse, to which are added a number of Original Poems by a Native of America.*

Parke (John G.), b. near Coatesville, Pa., Sept. 22, 1827; graduated from the U. S. Military Academy July 1, 1849, when he was appointed brevet second lieutenant topographical engineers, serving on duty with his corps until the outbreak of the war in 1861, for many years as chief astronomer and surveyor in locating the N. W. boundary. Appointed brigadier-general of volunteers Nov., 1861, he accompanied Burnside to North Carolina, participating in the various engagements of that expedition, including the capture of Fort Macon, where he was in command; promoted to be major-general Aug., 1862, he served as chief of staff of the 9th corps in the battles of South Mountain and Antietam, and on Gen. Burnside's succeeding to the command of the Army of the Potomac was retained by the latter as his chief of staff, participating in the battle of Fredericksburg; was in command of the 9th corps during its march to Vicksburg, and for a time of left wing of Gen. Sherman's army; in command of a division of the 9th corps on Gen. Burnside's reassuming command, and engaged in Tennessee in siege of Knoxville, etc.; and in Richmond campaign of 1864, again attaining command of the 9th corps before Petersburg (Aug., 1864), which he retained through subsequent operations, terminating in the surrender of Lee's army at Appomattox Court-house. In 1864 he became a major of the corps of engineers, and for several years has had charge of a division in the office of the chief of engineers.

Parke Bar, tp. of Yuba co., Cal. Pop. 250.

Park'er, county of N. Texas, traversed by the Brazos River. Area, 900 square miles. It is fertile and adapted to wheat, cotton, fruit, and corn culture. Timber is quite abundant. Coal is found at several points. Cap. Weatherford. Pop. 4186.

Parker, tp. of Clark co., Ill. Pop. 863.

Parker, post-v. and tp., Montgomery co., Kan., on the Leavenworth Lawrence and Galveston R. R. Pop. 474.

Parker, tp. of Morris co., Kan., on the Neosho River and Missouri Kansas and Texas R. R. Newly organized.

Parker, post-v. and tp., Butler co., Pa., on the Allegheny Valley R. R. Pop. 1309.

Parker (Amasa J.), LL.D., b. at Sharon, Conn., June 2, 1807; removed in 1816 to Greenville, N. Y.; was principal of Hudson Academy 1823; graduated in 1825 at Union College; came to the bar in 1828, and became a law-partner of his uncle, Amasa Parker, of Delhi, N. Y.; entered the legislature in 1833; was chosen a regent of the university 1835; was in Congress 1837–39; became in 1844 vice-chancellor of New York, a circuit judge, and afterwards a judge of the State supreme court; in 1859 was appointed U. S. district attorney; published 6 vols. of law reports (1855–69), and assisted in the preparation of the *Revised Statutes* of 1859 (3 vols.); was one of the editors of the third edition of Judge Tapping Reeve's *Law of Baron and Feme*, etc.

Parker (Edward Griffin), b. at Boston, Mass., Nov. 16, 1825; graduated at Yale in 1847; became in 1849 a lawyer in Boston, and in 1857 political editor of the *Boston Traveller;* served as captain and aide-de-camp to Gen. Butler 1861; in 1862 became assistant adjutant-general, and was afterwards chief of staff to Gen. Martindale; took charge of a literary bureau of reference in New York after the war. D. at New York Mar. 30, 1868. Author of *Golden Age of American Oratory* (1857), *Reminiscences of Rufus Choate* (1860), etc.

Parker (Gen. Ely S.), b. at Tonawanda, N. Y., about 1825, on the reservation of the Seneca Indians, of whom he was one; received a good education at Rochester and other cities; became a civil engineer; rendered aid to Lewis H. Morgan in his work on the *League of the Iroquois;* resided for a time at Galena, Ill., where he made the acquaintance of U. S. Grant; took part in the civil war as a member of Gen. Grant's staff, reaching the rank of brevet brigadier-general; was one of the secretaries of Grant as general of the army; became commissioner of Indian affairs (1869), and retired from that office 1872 to devote himself to his profession.

Parker (Commodore Foxhall A.), son of Capt. F. A. Parker, U. S. N., b. in New York City Aug. 5, 1821; was appointed a midshipman in the U. S. navy Mar. 11, 1837; graduated from the Naval School at Philadelphia June 3, 1843; served against the Florida Indians, on the Coast Survey, and in the Mediterranean squadron; was commissioned lieutenant Sept. 21, 1850; served at the Washington navy-yard as executive officer 1861–62; co-operated with the Army of the Potomac on several occasions in command of seamen (with howitzers); on garrison-duty at Fort Ellsworth (commanding marines) and in building Fort Dahlgren; drilled some 2000 seamen in the exercise of artillery and small-arms, thereby promoting in no small degree the success of Admiral Foote's operations with the Mississippi flotilla; was promoted to commander July 16, 1862; commanded the steam-gunboat Mahaska (1862–63) in active service off Wilmington and Yorktown; commanded the Wabash off Charleston June to Sept., 1863, most of which time was spent on Morris Island in charge of a naval battery co-operating in the reduction of Fort Sumter; commanded the Potomac flotilla, consisting at one time of 42 vessels, from Dec., 1863, until the close of the war, being frequently engaged with the enemy; has since commanded vessels on several stations; was promoted to captain, "for good service during the rebellion," July, 1866; was chief of staff to the North Atlantic fleet 1872; ordered to special duty at Washington Aug. 7, 1872, to draw up a code of signals for steam tactics, and appointed chief signal-officer of the navy July 1, 1873, which position he still (1876) holds. In 1863 he prepared, by order of the navy department, systems of *Fleet Tactics under Steam* and *Squadron Tactics under Steam;* in 1865, *The Naval Howitzer Afloat;* and in 1866, *The Naval Howitzer Ashore;* all of which works are textbooks at the Naval Academy; was for many years a contributor to the *Knickerbocker Magazine;* published in 1866 a volume, translated from the Spanish, *Elia, or Spain Fifty Years Ago;* and was one of the founders of the U. S. Naval Institute, organized Oct. 9, 1873, at Annapolis, "for the advancement of professional and scientific knowledge in the navy." In Dec., 1874, he was appointed chief of staff of the united fleets under command of Admiral Case which were assembled for instruction in tactics in the Florida waters. Supt. U. S. Naval Acad., Annapolis, Md., July 1, 1878.

Parker (James), b. at Bethlehem, N. J., Mar. 3, 1776; graduated at Columbia College 1793; inherited immense landed estates; was a member of the New Jersey legislature for many years; was a member of Congress 1833–37; member of the State constitutional convention 1844; president of the State Historical Society; gave to Rutgers College the land upon which its buildings were erected. D. at Perth Amboy Apr. 1, 1868.

Parker (Joel), LL.D., b. at Jaffrey, N. H., Jan. 25, 1795; graduated at Dartmouth 1811; became in 1815 a lawyer at Keene, N. H.; a judge of the New Hampshire supreme court 1833; chief-justice 1838; in 1840 chairman of a committee to revise the laws of the State; was in 1847 a law-professor in Harvard University. D. at Cambridge Aug. 17, 1875. Author of treatises and pamphlets on *The Three Powers of Government* (1867–69), *Non-extension of Slavery* (1856), *Personal Liberty Laws* (1861), *The Right of Secession* (1861), *Constitutional Law* (1862), *War-powers of Congress and the President* (1863), *Revolution and Reconstruction* (1866), *Conflict of Decisions* (1871), besides law reports, essays, addresses, lectures, etc.

Parker (Joel), D. D., b. at Bethel, Vt., Aug. 27, 1799; graduated at Hamilton College 1824; was ordained 1826; held pastorates in Rochester, N. Y., New Orleans, Philadelphia, and Newark, but principally in New York City; was president of the Union Theological Seminary and professor of sacred literature 1840–42, and for a time associate editor of the *Presbyterian Quarterly Review*. D. at New York May 2, 1873. Author of popular religious volumes.

Parker (Joel), LL.D., b. at Monmouth, N. J., Nov. 24, 1816; graduated at Princeton College in 1839; studied law, and was admitted to the bar in 1842; was elected to the State legislature in 1847; subsequently was county attorney. Upon the breaking out of the civil war he was made major-general of volunteers, and in 1862 was elected governor of New Jersey for three years, and again elected in 1871. In the national Democratic convention of 1876 he was among those prominently named as a possible nominee for the Presidency of the U. S., but on the actual ballot but few votes were cast for him.

Parker (Matthew), D. D., b. at Norwich, England, Aug. 6, 1504; educated at Corpus Christi College, Cambridge; took priests' orders 1527, and the same year M. A. and fellow of his college; chaplain to Anne Boleyn 1533; dean of Stoke Clare College, Suffolk, 1535; chaplain to Henry VIII. 1537; prebendary of Ely 1541; master of Corpus Christi College 1544; dean of Lincoln 1552; was deprived by Queen Mary 1553 for having married; appointed archbishop of Canterbury in 1559 through the influence of Nicholas Bacon and Cecil, for Queen Elizabeth was at that time violently opposed to the marriage of the clergy. The Bishops' Bible was printed at his expense. Later he became an enemy of conventicles and of the non-conforming spirit. He published Anglo-Saxon and other early English chronicles, and collected a valuable library, which he bequeathed to Corpus Christi College, Cambridge. D. May 17, 1575. The "Parker Society," named in his honor, published from 1841 to 1855 a series of 55 volumes of English ecclesiastical writings of the Elizabethan age.

Parker (Peter), M. D., b. at Framingham, Mass., June 18, 1804; graduated at Yale College 1831; studied theology and medicine at New Haven; went to Canton, China, as a missionary 1834; established a hospital, in which more than 2000 patients were treated the first year; had great success both in surgery and medicine, and trained many Chinese students; visited the Loo-Choo Islands and Japan 1837; returned to the U. S. 1840–42; became interpreter and secretary of legation to the American mission in China 1845, retaining charge of the hospital; acted as chargé d'affaires during the absence of the minister; again visited the U. S. 1855, but went to China the same year as commissioner with power to revise the treaty; finally returned to America 1857, since which time he has resided at Washington, D. C.; has been a regent of the Smithsonian Institution, and has filled other honorable scientific posts.

Parker (Richard Green), son of Bishop Samuel Parker, b. at Boston, Mass., 1798; graduated at Harvard 1817. Author of a popular series of school-books, part of which were prepared by him and J. M. Watson.

Parker (Samuel), D. D., b. at Portsmouth, N. H., Aug. 28, 1744; graduated at Harvard 1764; was an instructor for nine years; ordained to the Anglican ministry 1774 by the bishop of London; until 1779 assistant minister, and then rector, of Trinity church, Boston; in 1804 consecrated bishop of the Protestant Episcopal Church for the diocese of Massachusetts. D. Dec. 6, 1804.

Parker (Theodore), b. at Lexington, Mass., Aug. 24, 1810; was a grandson of Capt. John Parker, who commanded the company of minutemen fired on by British troops at Lexington Apr. 19, 1775; was distinguished in childhood for a precocious memory, learning by heart and retaining many pages of poetry, and knowing at ten years of age the names of all the trees and plants familiar to Massachusetts; studied Latin, Greek, and mental philosophy while working on the farm or in the tool-shop; taught school at the age of seventeen; studied at Lexington Academy; entered Harvard College 1830, but did not pursue the regular course, being obliged to carry on his studies at home and teach private classes at Boston and Watertown; became a proficient in many languages, including Syriac, Arabic, Danish, Swedish, Anglo-Saxon, and modern Greek; entered the Cambridge Divinity School 1834, graduating 1836; was settled at West Roxbury as pastor of the Second (Unitarian) church June, 1837; soon arrived at religious views widely differing from those of conservative Unitarians, and became the leader of a school of theology which rejected as unhistorical many portions of the canonical Scriptures, renounced all belief in the supernatural, and exercised great freedom in the definition of the Christianity which it continued to profess; laid down the principles of his new transcendental system in a series of five lectures delivered at Boston in the autumn of 1841, published under the title *A Discourse of Matters Pertaining to Religion* (1842); followed in the autumn of 1842 by a series of six *Sermons for the Times;* wrote articles in the *Dial;* published a volume of *Critical and Miscellaneous Writings* (1843), and a translation of De Wette's *Introduction to the Old Testament* (2 vols., 1843); spent nearly two years (1843–44) travelling in Europe, during which time his theology acquired a more exact form, chiefly the result of a careful study of German authorities in biblical criticism; returned to Boston in the autumn of 1844, when a controversy grew warm within the Unitarian denomination, arising from the act of several pastors of churches at Boston, who admitted him to their pulpits. As the result, Mr. Parker established an organization at Boston known as the "Twenty-eighth Congregational Society" (1846), which worshipped at the Melodeon, and subsequently for many years at the Music Hall, where his audiences were large and his teachings embraced a wide scope of subjects; founded and edited for three years the *Massachusetts Quarterly;* was earnestly opposed to the Mexican war, to slavery, and intemperance; was indicted in the U. S. court (June, 1854) for resistance to the Fugitive Slave Law in the case of Anthony Burns, the offence being an address at Faneuil Hall, but was never brought to trial; published several volumes of speeches, addresses, and sermons, and many single sermons, most of which enjoyed a wide circulation; suffered ill-health for several years, but continued preaching until Jan., 1859, when he was prostrated by an attack of bleeding at the lungs; visited the West Indies Feb., 1859, where he wrote a small work entitled *Theodore Parker's Experience as a Minister;* proceeded thence to Europe; resided successively in Switzerland and at Rome 1860, obtaining no relief. D. at Florence, Italy, May 10, 1860, and was buried in the Protestant cemetery outside the walls. He bequeathed a fine library of 13,000 volumes to the Boston Public Library. His complete works were edited by Frances Power Cobbe (12 vols., London, 1863–65) and by H. B. Fuller (10 vols., Boston, 1870); his *Life and Correspondence* was published by Rev. John Weiss (2 vols., New York, 1864), and his *Life* by Rev. O. B. Frothingham (New York, 1874). A French compendium, entitled *Théodore Parker, sa Vie et ses Œuvres* (1865), was prepared by Rev. Albert Réville. (See also *Sermons on Theodore Parker* (1860) and *Theodore Parker—In Memoriam*, Dec., 1860.) Several volumes of extracts from Parker's writings have been published, and a considerable quantity of miscellaneous addresses and other productions remain unpublished. Revised by O. B. Frothingham.

Parker (Thomas), b. in England June 8, 1595; studied at Oxford, in Ireland under Archbishop Usher, and at Leyden; became pastor of a church at Newbury, England; came to Massachusetts in May, 1634; preached a year at Ipswich, then began the settlement of Newbury, Mass., 1635; published several theological treatises, two of which were in Latin, and edited the *Works* of the Puritan divine Dr. Ames. A bitter controversy on church government was carried on for several years within his church, but he remained its pastor until his death, Apr. 24, 1677.

Parker (Willard), M. D., LL.D., b. at Lyndeborough, Hillsborough co., N. H., Sept. 2, 1802; graduated at Harvard 1826; studied medicine and surgery under Prof. John C. Warren; became professor of anatomy in the Vermont Medical College, and also in that of Berkshire 1830; professor of surgery in the latter institution 1833, and at Cincinnati 1836; spent some time in the hospitals of Paris and London; was for thirty years (1839–69) professor of surgery in the New York College of Physicians and Surgeons, after which he exchanged into the chair of clinical surgery, which he still (1876) retains. In 1854 he first described and reported cases of what is now known as "malignant pustule." Dr. Parker became president of the New York State Inebriate Asylum at Binghamton in 1865; was the first to call attention to the phenomena of concussion of the nerves as distinguished from that of the nerve-centres, formerly erroneously considered identical with a state of inflammation, and has made several important discoveries in practical surgery, including the operation of cystotomy for the relief of chronic cystitis, and that for the cure of abscess of the "appendix vermiformis."

Park'ers, tp. of Escambia co., Ala. Pop. 967.

Park'ersburg, p.-v. of Butler co., Ia., 18 miles W. of Cedar Falls, has 1 bank, 1 newspaper, 2 hotels. Pop. about 600. Dodge & Savage, Eds. "Eclipse."

Parkersburg, city, cap. of Wood co., West Va., on the Ohio River, at the mouth of the Little Kanawha, is the W. terminus of the Parkersburg branch of the Baltimore and Ohio R. R., has a fine railway bridge over the Ohio, possesses great facilities for manufactures and coal-refining, is the second city in the State, both in population and in

trade, is regularly laid out, has a court-house, market-house, several academies, 10 churches, 3 national banks, 3 foundries, a building for a post-office and U. S. court-house in course of erection, has several lines of steamers on the Ohio and the Little Kanawha, many mills and factories, and 2 daily and 3 weekly newspapers. Pop. 5546.

Parker's Landing, post-v. of Armstrong co., Pa., on the Allegheny River and R. R.

Parkersville, post-v. of Parker tp., Morris co., Kan.

Parkesburg, post-b. of Chester co., Pa., on the Pennsylvania R. R., 48 miles W. of Philadelphia, has a graded school, an academy, 1 bank, 3 warehouses, a steam flouring-mill, 1 newspaper, and a monthly magazine, several hotels, and stores. Pop. about 500.

A. H. Potts, Ed. "American Stock Journal."

Parkes'ine [named from Mr. Parkes, an Englishman, its inventor], a substitute for vulcanized India-rubber and for gutta percha, was originally a compound of castor oil and gun-cotton, but it is understood that by a secret process as good or better results can be obtained from much cheaper materials. It is claimed that it is cheaper and better than vulcanite or gutta-percha for all the purposes for which they are used, and is useful for many purposes where they cannot be employed.

Park Hill, post-v. of Middlesex co., Ontario, Canada, on the Grand Trunk Railway, 40 miles from Sarnia, has a great trade in grain, provisions, and lumber, and has 2 weekly newspapers. Pop. about 1000.

Park'inson (John), known by the fantastic name of **Paradisus in Sole** (Park-in-sun), b. in London in 1567; was apothecary to James I. and *botanicus regius primarius* to Charles I. Author of *Paradisus Terrestris* (1629–56) and *Theatrum Botanicum* (1640). He is one of the best of the old herbalists, and is commemorated by Plumier's genus *Parkinsonia*, order Leguminosæ. The year of his death is not known.

Park'man, p.-v. and tp., Piscataquis co., Me. P. 1105.

Parkman, post-v. and tp., Geauga co., O. Pop. 953.

Park'man (Francis), D. D., b. at Boston, Mass., June 4, 1788; graduated at Harvard 1807; studied divinity with W. E. Channing and in Edinburgh; was 1813–49 pastor of the New North church, Boston (Unitarian). D. at Boston Nov. 12, 1852. Author of *The Offering of Sympathy* (1829); founder of the Parkman professorship of pulpit eloquence in the Cambridge Divinity School, and an active laborer in public and private charities.

Parkman (Francis, Jr.), b. in Boston, Mass., Sept. 16, 1823; graduated at Harvard 1844; travelled in the far West and in Europe, and in spite of a severe chronic disease, accompanied by partial blindness, has attained a high rank as an historian and writer. His principal work is *France and England in North America*, of which the following parts have appeared: *History of the Conspiracy of Pontiac* (1851), *Pioneers of France* (1865), *The Discovery of the Great West* (1869), *The Jesuits in North America* (1867)—a work of great candor and fairness, written in graphic and unambitious style, and displaying faithful research. He has also written *The California and Oregon Trail* (1849) and *Vassal Morton*, a novel (1856).

Park's Fork, tp. of Trego co., Kan. Pop. 34.

Parksville, post-v. of Boyle co., Ky., on the Knoxville branch of the Louisville and Nashville R. R. P. 173.

Parksville, tp. of Perquimans co., N. C. Pop. 1293.

Park Valley, tp. of Box Elder co., Ut. Pop. 70.

Parkville, post-v. of Platte co., Mo., on the E. bank of Missouri River and the Kansas City St. Joseph and Council Bluffs R. R., 5 miles from Kansas City.

Park-way, a recently-formed word, corresponding to the French *boulevard*, and denoting a street of extraordinary width planted with rows or groups of trees and shrubbery, and affording at once a thoroughfare and a promenade.

Parlato're (Filippo), b. at Palermo in 1816; is director of the Museum of Physical and Natural Sciences in Florence, where he also teaches botany. Having practised extensively during the cholera at Palermo in 1837, he published a pamphlet on that disease. In 1840 he left Sicily for Paris, where he published his *Plantæ Novæ*, etc. His botanical publications are numerous; among them *Lezioni di Botanica Comparata; Ricerche sull' Anatomia delle Piante Aquatiche; Viaggio al Gran San Bernardo* (Florence, 1849); *Viaggio al Nord dell' Europa* (Florence, 1859); *Flora Palermitana; Flora Italiana*, etc.

Parl'iament, Brit'ish. The origin of parliamentary government in England, like that of many other British institutions, is involved in much obscurity. There can, however, be no doubt that alike in Saxon and Norman times the English people had always some share in making the laws whereby they were governed. The Witenagemote (or assembly of the wise) of the Saxon period, and the Parliament (or free-speaking council), which is traceable both in etymology and function to Norman influence, were at once the outgrowth and the guardians of popular rights and liberties. It is true that the earlier councils and assemblies have left no record of their proceedings, and probably they met at irregular intervals, being in some measure dependent on the caprice or necessities of the monarch. The taxes and crown levies could only be raised through the sanction of the people themselves; and it is one of the oldest as well as one of the most imperishable traditions of British government that there ought to be no taxation without representation. Successive sovereigns after the Conquest (1066) had encroached upon popular prerogative, until, in the reign of King John, the evil culminated in practical absolutism on the part of the Crown. The result was a violent recoil and a resolute demand for the restoration of baronial and popular rights, which led to the signing of Magna Charta on the field of Runnymede (1215). The Great Charter of King John is the oldest constitutional document extant in England. Among other provisions for securing general liberty, the king pledged himself to summon the superior clergy, nobles, and commons to meet at a certain place, with forty days' notice, "to assess aids and scutages when necessary." The Great Charter contained no new idea touching rights and liberties, every one of its clauses embodying an English tradition. In truth, it was only a revival of the British constitution; and the provision for calling a parliament whenever money was wanted was one of the first principles of ancient English politics. Little is known of the manner in which the pledges of the sovereign were kept for half a century after the signing of Magna Charta, but writs are still extant which were issued in the reign of Henry III. (1265), summoning the knights, citizens, and burgesses to meet in parliament. The government was even more democratic during the Middle Ages than it subsequently became, for the nobles and commons met in the same chamber, debating and voting promiscuously. Historians have failed to discover the date at which the legislature was separated into two chambers, but the present arrangement was in force during the fifteenth century. Numerous changes, sometimes violent and at other times mild and gradual, have been made in the machinery of English parliamentary government during 600 years, but certain great principles have survived all these transmutations. It will be more convenient and tend to perspicuity if we interweave historical references with our analysis of Parliament as it exists at the present time, and if we also classify under separate heads the subjects which must come under consideration. These are, (I.) its constituents, (II.) its powers, and (III.) its forms.

I. *Of what does Parliament consist?*—The imperial Parliament consists of the queen, the lords, and the commons. The three estates of the realm are the lords spiritual, the lords temporal, and the commons. The sovereign is the executive authority, and is charged with the duty of enforcing the will of Parliament; but in the matter of legislation the sovereign is no more than a constituent part of Parliament, acting in conjunction with the three estates of the realm. In ordinary times there can be no meeting of Parliament unless the monarch is present at the opening of it, either in person or by commissioners. We say "in ordinary times," for there have been exceptions to this rule. The Convention Parliament which restored Charles II. could not, in the nature of things, satisfy the above condition, but proceeded to do a supreme parliamentary act without any summons or sanction from the sovereign. Though Charles held himself to be king *de jure* before Parliament restored him, still he was sagacious enough not to insist upon his sovereign rights, which at the time a majority of the English people would have questioned. The self-constituted Parliament sat several months after the Restoration, and enacted laws which are still recognized as binding by English tribunals. Lest, however, the authority of this assembly should be questioned by the judges, an act was passed after the return of Charles, and to which the king placed his signature, confirming all that it had done. Such a precaution was generally held by lawyers to be superfluous, as the convention acted *ex necessitate rei*. Another departure from the rule laid down above occurred in 1688, when the two houses of Parliament met on the summons of the prince of Orange and proceeded to dispose of the crown itself. But the events of that period constitute, by universal consent, a revolution. At the same time, it is worthy of observation that even in disposing of the crown and kingdom by revolutionary force the English people have always kept as close to constitutional tradition

as circumstances would permit. The present sovereign has opened Parliament in person only once since the death of the prince consort in 1861.

The House of Lords is constituted as follows:

Lords Spiritual.	
Archbishops (Canterbury and York)	2
English bishops	24
Lords Temporal.	
Peers of the blood royal	5
Dukes	21
Marquises	18
Earls	111
Viscounts	24
Barons	242
Scotch representative peers	16
Irish representative peers	28
Total	491

Four Irish prelates sat in the House of Lords until 1869, when they became disqualified to sit, under the provisions of the act for disestablishing the Irish Church. The last consecrated of the 25 diocesan English prelates, provided he holds one of the inferior sees, has no seat in the House of Lords, and the same disability applies to suffragan and coadjutor bishops. A bishop is not a peer, but is only a lord of Parliament in virtue of holding an imaginary barony under the queen. In latter days there has been a steady diminution in the number of marquises, earls, and viscounts, but more than a corresponding increase in the number of barons. The creation of peerages is vested unreservedly in the Crown, and it is well known that the House of Lords consented to the passing of the Reform Bill in 1832 because the king had given his consent to the creation of as many new peers as would have served to outvote the opponents of the bill. All peerages are hereditary, the House of Lords having decided that a life-peer cannot, as one of their number, discharge any legislative functions. The question was raised in 1858, when the queen conferred on Sir James Parke a peerage "for and during the term of his natural life," under the title of Baron Wensleydale. Acting on the report of a committee, the House of Lords decided that it was not competent for him to take his seat in Parliament with such a patent of nobility. The Scotch representative peers are elected for one Parliament, the electors being those Scotch peers whose titles are older than the union with Scotland. The Irish representative peers sit for life, and are elected by the whole body of Irish peers, no matter from what period their titles date. The queen at present can only create one Irish peerage for every three which become extinct. As there is a feeling that an Irish peer who is not a lord of Parliament is a political anomaly, the House of Lords has recently requested Her Majesty to forego her right to issue patents of nobility of this class, and the queen has signified her willingness to hold in abeyance that part of her prerogative. Of the 491 peers enumerated above twelve are minors, who cannot sit till they attain their majority.

The House of Commons is constituted as follows:

England and Wales.		
53 counties return	187	members.
198 cities and boroughs	297	"
3 universities	5	"
Scotland.		
33 counties	32	"
7 cities and towns	11	"
15 districts of burghs	15	"
4 universities	2	"
Ireland.		
32 counties	64	"
31 cities and boroughs	37	"
1 university	2	"
Total	652	"

The full complement of members is 658, but two boroughs in England, returning four members, and two in Ireland, returning two members, have been recently disfranchised for bribery. The seats thus vacated wait a redistribution of political power. The constituencies of the United Kingdom have a wide range of choice in selecting their representatives, but nevertheless they are under a variety of restrictions. Certain persons are disqualified to sit in Parliament. Minors, lunatics, outlaws, and aliens are excluded; so also are the common-law judges, the clergy of the Established churches of England and Scotland, and Roman Catholic priests; likewise pensioners under the Crown during pleasure or for a term of years, contractors with government, members of the India council, and peers of Parliament. By the act of 1858 property qualification has been abolished. Prior to that date an estate of £600 a year was requisite in England and Ireland to qualify for a county, and £300 a year for a borough, except in the case of the eldest sons of peers and bishops. In Scotland and for the universities no property qualification was ever necessary. A member of the House of Commons cannot resign his seat; but if he accept any office of profit under the Crown, his seat is vacated *ipso facto*. When a member wishes to be relieved from parliamentary duties, he accepts the stewardship of the Chiltern Hundreds, an office of great antiquity, which is now a complete sinecure, and which has a merely nominal salary attached to it. Being, however, a place of *profit*, it furnishes a convenient back-door for wearied senators to make their escape into the retirement of private life. Members of the House of Commons are now elected by secret ballot in all the constituencies of the United Kingdom, with the exception of the universities. No religious test whatsoever is imposed upon members, the only oath taken by them being the oath of allegiance. Previous to 1858, Jews were incapacitated to sit on account of the oath including the words "on the true faith of a Christian." To illustrate the freedom from religious tests enjoyed by British legislators, it may be mentioned that the present House of Commons contains 475 Protestant Episcopalians, 53 Orthodox Presbyterians, 47 Roman Catholics, 16 Unitarians, 15 Congregationalists, 11 Wesleyan Methodists, 6 Jews, 4 Quakers, 4 Baptists, 1 Greek, and 20 unknown or doubtful, one or two of the last class being commonly called Secularists.

II. *The Powers of Parliament.*—The House of Lords has two functions, the legislative and the judicial. In legislation it acts in concert with the queen and the Commons, the assent of all three being necessary to give validity to a bill, which then becomes an act of Parliament. Practically, the law-lords alone sit in a judicial capacity, though every peer has a legal right to take part in trying appeals. The criminal cases which come before the House of Lords are those in which a person is impeached by the Commons, or those in which a true bill has been found by a grand jury against a peer of the realm. Peers can no longer vote by proxy in any case. Every peer, when dissatisfied with a decision of the house, has a right, with leave, to enter a protest on the journals. When sitting in his judicial capacity, he gives judgment on his honor, and not on his oath; but when summoned as a witness in any cause, he must be sworn. All bills affecting the rights and privileges of peers must originate with the House of Lords, and they may not be amended, but may be rejected by the Commons. The House of Commons is vested with the right of imposing taxes and voting money for the public service. Until 1867 the Commons decided for themselves all questions touching the election of members, but since that date election-petitions are tried by the common-law judges. Both branches of the legislature have certain privileges and powers for the protection of their own dignity, independence, and honor. At the commencement of every Parliament the Speaker of the House of Commons claims for the members, in presence of the queen or her commissioners, freedom of speech and that the best construction shall be placed on all their words. To publish the debates of the House is a breach of privilege, but this rule has long been disregarded, though peccant publishers may still be summoned to the bar of the house to answer for their contumacy. Strangers are admitted to the house, but are not "seen" by the Speaker. Until lately, whenever a member called the Speaker's attention to the presence of strangers he immediately ordered the sergeant-at-arms to clear the House. During the last session of Parliament strangers were thus "espied" in the gallery, the prince of Wales being one of the number. The Speaker's attention being called to the fact, he had no alternative but to eject all, including the heir to the throne. The incident led to a modification in the rules of procedure, and the law now is, when strangers are "seen," a vote is taken at once, without debate, whether they shall be ordered to withdraw or not. Ladies are not admitted within the house, but a clumsy evasion of this rule is effected by permitting them to sit in a gallery behind a grating, whence they can see and hear without being seen themselves. These regulations, however, are of small account when compared with the vast prerogatives which Parliament claims as a legislature and as the grand inquest of the nation. It makes and unmakes laws, and is, in fact, superior to all human law; for in the constitution of the United Kingdom despotic power lies in Parliament, there being no remedy for that which Parliament does wrong except in the same or another Parliament, summoned by the Crown and elected by the people. Any grievance which defies the ordinary remedies of law can be redressed by Parliament. It can determine the succession to the throne, and has done it. It can alter the established religion of the country, and can abolish an established Church altogether, as it has done recently in the case of Ireland. It can amend its own constitution, and can say how long a Parliament shall last. At present members are elected for seven years, but there was a time when each Parliament lasted only three years. It was a saying of Cecil

that "England could only be ruined by a Parliament." That ruin could be brought about if it violated the fundamental maxims of its own constitution. One of these is that the people, whom it professes to represent, can only be taxed with their own consent. By attempting to defy this maxim in the case of the American colonies in the reign of George III. a rupture of the empire was brought about, and a colony of England became an independent commonwealth.

III. *The Forms of Parliament.*—Parliament assembles on the summons of the sovereign; and although the law provides that not more than an interval of three years shall elapse from the dissolution of one Parliament to the assembling of the next, the practice of voting money for the public service annually has rendered this statute superfluous, as the government could not be carried on without an annual meeting of the House of Commons. Should the sovereign die between the dissolution of a Parliament and the issuing of writs for a new election, the old Parliament revives, and may continue to sit for a period not exceeding six months. At the beginning of each session the queen states her reasons for convening the Lords and Commons, and gives an outline of the legislation contemplated by her ministers. This statement is known as "the speech from the throne," and is either delivered personally or by commissioners. Adjournment is decided by each house for itself, but prorogation and dissolution are the sole acts of the sovereign. Prior to the reign of William and Mary the sovereign determined the duration of a Parliament. By the triennial act (William and Mary) the duration was limited to three years, and by the septennial act (George I.), still in force, a Parliament expires at the end of seven years. The sovereign, however, usually puts an end to it by dissolution, and does not allow it to expire by efflux of time. When the estimates are laid before the House of Commons, a member may move and carry the reduction of a vote, but no additional grant of public money can be made without a recommendation from the queen. A member of either house cannot be questioned outside of Parliament for anything he has said in his place; but if he afterwards publish his speech, he is liable to an action for libellous imputations, and is not protected by the privilege of his position as a member of Parliament. The persons of members are free from arrest in civil causes, but they may be adjudged bankrupts, and their goods are liable to distress on legal process, like those of private citizens. Every bill, before it becomes an act, must be read three times in each house, and also be reviewed clause by clause in a committee of the whole house or by a select committee. When a bill has passed both houses, the sovereign's assent is given, usually by commission, the Commons being summoned to the bar of the House of Lords, with the Speaker at their head, to hear the announcement of the queen's will. In the case of a public bill, the clerk of the Parliament reads its title and pronounces these words: "*La reigne le vaut.*" When it is a private bill, the words are, "*Soit fait comme il est desiré.*" There are numerous forms and details touching the election of Speaker, mode of addressing the house, putting the question in the two houses respectively, divisions, presenting of petitions, right of putting questions to cabinet ministers, conferences of the two houses, powers of committees, and various other matters of procedure, of which the reader will find ample information in the works enumerated below. The power of the House of Commons has steadily increased during the present century, and in any serious conflict between the two houses of Parliament the Lords invariably deem it prudent to give way. The House of Lords frequently rejects bills which have passed the Commons, such as the burials bill and the marriage with a deceased wife's sister bill, but in no case does the upper chamber reject a measure which has obtained the approval of the nation at a general election. The will of the people is paramount, in the long run, in all the departments of British legislation, and the friends of freedom desire that it should remain so for the future.

Literature.—The following works are recommended to the reader as books of reference: *Rules, Orders, and Forms of Proceeding of the House of Commons relating to Public Business* (1874); *History of the House of Commons*, by W. C. Townsend, Esq., M. A. (2 vols., 8vo); *How We are Governed*, by A. Fonblanque; *Constitutional History of England*, by Henry Hallam; *A Treatise upon the Law, Privileges, Proceedings, and Usage of Parliament*, by Sir Thomas Erskine May; *Burke's Peerage* (1875); *Essay on the Practice of the British Government*, by G. F. Leckie; *Essay on British Government*, by Francis Jeffrey; *History of the Anglo-Saxons*, by Sharon Turner; *The English Constitution*, by H. Hallam and J. L. de Lolme. RICHARD SMYTH.

Parlin Pond Plantation, tp. of Somerset co., Me. Pop. 11.

Par′ma, DUCHY OF, one of the political divisions of Italy previous to the formation of the Italian kingdom in 1860, embracing the actual provinces of Parma and Piacenza. Pope Paul III. first erected this territory, together with some of the adjacent districts, into a duchy for his son Pier-Luigi Farnese (1545). The government of the Farnese dukes was generally popular with the middle and lower classes, but was not acceptable to the nobility, who conspired frequently, and sometimes fatally, against them. In 1701, the direct Farnese line being extinct, the duchy passed to the royal family of Spain. In 1802 the French took possession of it, and in 1814 it was conferred (Spain protesting) as a sovereign duchy on the ex-empress Maria Louisa. In 1817 this arrangement was confirmed, with the stipulation, however, that the succession should fall on the duke of Lucca, the rightful heir in the Spanish line. The duke, tyrannical in his general government, made some most unpopular exchanges of territory, and in 1848 he was compelled to fly from his dominions. In 1849 he was succeeded by his more brutal son Charles III., who was assassinated in 1854; and his widow, after an ineffectual attempt to bring about some satisfactory reforms, left the country in 1859, together with her son, and the territory was soon after annexed to the new kingdom of Italy.

Parma, city of Northern Italy, situated in the great plain of Lombardy, about 12 miles S. of the Po and 75 miles S. E. of Milan, in lat. 42° 52′ N.; lon. 10° 20′ E. It is in direct railway communication with all the large towns of Piedmont, Lombardy, and Venetia. The town is circular in form, is surrounded by bastions, and is divided into two unequal parts by the river Parma, which runs through it from S. to N. The Via Emilia crosses it from E. to W. The streets are broad and in good condition, the squares large, and the public promenade, near the castle, on the S. side of the town, is pleasantly shaded with the horse-chestnut and other trees. Among the public buildings should be noticed the cathedral (Roman Byzantine, begun in 1060 and consecrated by Paschal II. 1106), which contains, among other superior works of art, many frescoes by Correggio of marvellous beauty, though now unhappily in a damaged condition; the baptistery (begun in 1196), a peculiar but fine specimen of Lombard architecture; the church of S. Giovanni Evangelista, very rich in statues and pictures, though the exquisite frescoes of Correggio, once its boast, are in even a more ruinous condition than those in the cathedral; the Madonna della Steccata, a church of the Renaissance, containing sepulchral monuments of the Farnese and Bourbon rulers of Parma and a celebrated picture by Parmigianino. The municipal museum, the academy of fine arts, the school of design, and the Farnese theatre are all in the great building known as the Pilotta, which was intended to form a part of a colossal ducal palace never completed. The national theatre is the work of Maria Louisa; the communal palace is a fine but unfinished structure. There is also a university here, and a very valuable library of about 150,000 volumes. Parma, however, owes its chief attraction to the masterpieces of Correggio in the academy of fine arts, and to his well-preserved frescoes in the little building now called the Camera di San Paolo. These latter consist of a *Diana* and a number of sportive boys, all of exceeding grace and beauty. Of the former the most celebrated is the large oil painting known as the *San Girolamo*, or *The Day*, a picture whose gorgeous and at the same time tender and harmonious coloring is probably unrivalled in the world. Parma, though lying in the old Etruscan territory, does not appear in history until the time of the Roman republic, when it was a town of much importance. Being nearly destroyed by Mark Antony, it was partially rebuilt by the first Cæsars, who gave it successively the names of *Julia* and *Augusta*. After suffering cruelly from the barbarians, it was again restored and rewalled by Theodoric. Narses took it and gave it the name of *Chrysopolis*, or the Golden City. Under the Lombards it fell into great misery. Charlemagne made a bishop (it has been an episcopal see from very early Christian times) its temporal lord, with the title of count. In the eleventh and twelfth centuries Parma was continually involved in wars arising out of papal and imperial quarrels. After the death of Frederick Barbarossa (1190), Parma declared itself a republic. In 1247, Frederick II. besieged it vigorously, but was forced to abandon the siege. In 1303, Parma ceased to exist as a republic and became the prey of feudal lords, sometimes foreign, sometimes domestic. At last it fell into the hands of the popes, who retained possession of it (except during a short occupation of the French) until 1545, when Paul III. included it in the duchy which he conferred on his son Pier-Luigi Farnese. (See PARMA, DUCHY OF.) There is now little business activity in this town beyond trade in the produce of the province, which consists chiefly of silk, grain, cheese, and cattle. Pop. in 1874, 45,500.

Parma, post-v. and tp., Jackson co., Mich., on the Kalamazoo River and the Michigan Central R. R. Pop. 1514.

Parma, post-v. and tp., Monroe co., N. Y. Pop. 2864.

Parma, post-v. and tp., Cuyahoga co., O. Pop. 1432.

Parma, Duke of. See FARNESE (ALEXANDER).

Parmelee (THEODORE N.), b. in Connecticut in 1804; was editor of the Middlesex (Conn.) *Gazette;* Washington correspondent of the New York *Herald* during the Van Buren and Tyler administrations; was intimately acquainted with the leading politicians of the time, including Pres. Tyler; was afterwards confidential secretary of Dean Richmond; editor for several years of the Buffalo *Commercial;* author of some of the biographies in the illustrated volume entitled *Men of Progress;* of the interesting series of political reminiscences published in *Harper's Magazine,* "Recollections of an Old Stager;" and of numerous fugitive literary productions. D. at Branford, Conn., July 3, 1874.

Parmen'ides [Παρμενίδης], son of Pyrrhes, and the most notable of the philosophers of the Eleatic School, was b. at Elea, a Phocæan colony situated in Lucania, about the year 519 B. C. (cf. Grote, *Hist. of Greece,* chap. lxvii.). He is said to have been the pupil of Xenophanes, founder of the Eleatic School (Aristotle, *Metaph.* i. 5), and to have to a considerable extent adopted the mode of living of the Pythagoreans, with two of whom, Ameinias and Diochætes, he was very intimate. He took an active part in the government of his native city and drew up a code of laws, to which the Eleans annually swore to conform. He disseminated his philosophy both by teaching and writing. He appears to have attained a ripe old age, and, if we may believe Plato (*Parmenides,* 127 B.), to have become personally acquainted with Socrates.

Writings.—The only work of Parmenides known to the ancients was that bearing the general and oft-imitated title *On Nature* (Περὶ Φύσεως), written, according to the custom of the time, in dactylic hexameters. It was divided into three parts: 1, An introduction, describing in highly figurative language the manner in which the philosopher reached the citadel of truth; 2, a treatise *On Truth* (τὰ πρὸς Ἀληθείην); and 3, a treatise *On Opinion* (τὰ πρὸς Δόξαν). The doctrines put in the mouth of Parmenides in the Platonic dialogue bearing his name are mostly the property of Plato, or of whoever was its author. The known extant fragments of Parmenides are comprised in something less than 160 hexameters. They are collected mainly from the writings of Plato, Aristotle, Clemens Alexandrinus, Sextus Empiricus, Plotinus, and Simplicius. There are editions of them by Brandis (1813), Karsten (1835), Mullach (1845; reprinted in the Didot *Fragmenta Philosophorum Græcorum,* Paris, 1860), and by Stein in *Symbola Philologorum Bonnensium* (1864–67), pp. 763–806. The best are those of Karsten and Stein. There is a translation into English hexameters of all the extant fragments, in the *Journal of Speculative Philosophy,* vol. iv. (For bibliography, see Ueberweg, *History of Philosophy* (Eng. trans.) vol. i., p. 50.)

Philosophy.—Parmenides, the Spinoza of ancient philosophy, was, with the exception perhaps of Herakleitos, the greatest of the pre-Socratic thinkers. The kernel of his thought is the notion of pure Being, which he identifies with pure Thinking, and labors to define by every means afforded by the undeveloped philosophic diction of his day. Pure Being, the common basis of finite existence and finite thought, alone *is.* Non-Being and all the array of finite thoughts and things which its assumption entails are delusions, unavoidable, perhaps, for the uncultured mind, but transparent enough to the true thinker. Being is

> ". . . Birthless and deathless,
> Whole and only-begotten, and moveless and ever-enduring:
> Never it was or shall be: but the *all* simultaneously now is,
> One continuous one."

The pure Being (ὂν εἶναι) of Parmenides, being an abstraction from sensuous objects, bears strong traces of its origin, being by no means our pure Being, but material existing in space in the form of a perfect bounded sphere. Such is the pith of the treatise on Truth. In opposition to pure Being stands not only non-Being, but the whole sensuous world, with its innumerable finite objects. Though the latter is mere delusion, Parmenides has nevertheless given us a theory of it in the third part of his work, which is a sort of cosmogony, as, indeed, Plutarch styles it. This part is exceedingly fragmentary, but we may still gather an outline of its contents. The ground of all delusion and finitude is the assumption of the reality of the negative or of non-Being, which gives the antitheses we find in nature—light, dark, or, in Parmenides' language, more concretely, fire, earth. Out of these are woven the sensuous world, which consists of a number of concentric spheres, the inmost (the earth) and the outmost (the firmament) being solid, while the intermediate ones are commingled light and darkness:

> "For out of formless fire are woven the narrower circlets,
> Those over these out of night; but a portion of flame shooteth through them;
> And in the centre of all is the goddess that governeth all things;
> She unto all is the author of loathsome birth and coition,
> Causing the female to mix with the male, and by mutual impulse
> Likewise the male with the female."

The predominance of the one element or the other determines the nature of each particular object. Parmenides appears to have been aware of the identity of the morning and evening star, and of the fact that the moon borrows her light. The philosophy of Parmenides largely affected all subsequent thought, and even as powerful a thinker as Aristotle could not shake off his cosmological ideas. Nowhere else have the rational and the sensuous been more clearly opposed. This is so true that some writers, notably Gladisch (*Die Eleaten und die Inder*), have endeavored to connect it with the Hindoo philosophy. (Cf. Aristotle, *Metaph.* A. 5; Plotinus, *Enneads,* v. 1, 8; Hegel, *Gesch. der Philos.,* vol. i.; Zeller, *Philos. der Griechen,* vol. i.; and the *Handbooks* of Ueberweg and Schwegler.)

THOMAS DAVIDSON.

Parmigia'no, or **Parmigianino,** whose true name was **Francesco Mazzuola,** or **Mazzola,** b. at Parma in 1503; studied the art of painting in his native city and at Rome; lived for some time at Bologna, but returned in 1531 to Parma, and d. at Casal Maggiore Aug. 24, 1540. His most celebrated pictures are *Santa Margherita* in Bologna, and *Moses breaking the Tables of the Law,* at Parma.

Parnahi'ba, a river of Brazil, rises in lat. 11° S., in the province of Goyaz, flows northward, forming the boundary between the province of Piauhi and Maranhão, and enters the Atlantic after a course of about 750 miles. Its course is free from obstructions, but its depth varies very much according to the season, many of its feeders being perfectly dry during the hot season.

Parnas'sus, a mountain of Greece in the district of Phocis, rises 8068 feet above the level of the sea. Its three peaks are covered with snow for the greatest part of the year; its sides are covered with beautiful forests and abound in crags and caverns. In ancient times it was consecrated to Apollo and the Muses. Delphi, with its famous oracle, was situated on its southern slope. The fountain of Castalia sprang between two of its peaks. The Corycian cavern, the abode of Pan and the Muses, was on its western slope, and on its highest top were celebrated the wild orgies of Dionysus.

Parnell. See CONGLETON, LORD.

Par'nell (THOMAS), b. at Dublin, Ireland, in 1679; educated at Trinity College, Dublin; took orders in the Church of England 1700; became archdeacon of Clogher 1705, prebendary in the cathedral of Dublin 1713, and vicar of Finglass 1716; resided chiefly in England; was intimate with Swift, Gay, and Pope; assisted the latter in his translation of Homer, and wrote the *Life* of Homer prefixed to the *Iliad.* D. at Chester July, 1717. Pope published in 1722 a volume of posthumous poems attributed to Parnell, the best of which was the *Hermit,* and another volume appeared many years later (1758), but its authenticity was considered doubtful. Goldsmith wrote a *Life* of Parnell (1770).

Parny', de (ÉVARISTE DÉSIRÉ DESFORGES), VICOMTE, b. at St. Paul, in the island of Bourbon, Feb. 6, 1753; was educated first at the theological seminary of Rennes, then at the military school of Paris; returned home in 1773, but having failed in marrying the lady with whom he fell in love, repaired to Paris in 1776 and became a poet. In 1785 he went to Pondicherry as aide-de-camp to the governor; during the revolution he held some subordinate positions in the department of public instruction and at the Théâtre des Arts; Napoleon gave him in 1813 a small pension. He d. in the vicinity of Paris Dec. 5, 1814. His *Poésies érotiques* (1780–81, afterwards often reprinted) are distinguished by freshness and vigor, but his *La Guerre des Dieux* (1799) is licentious and frivolous, and some of his other works, such as *Le Paradis perdu* and *Les Galantéries de la Bible,* are silly. There are complete editions of his works by Tissot (1827) and Béranger (1831), and selections by Boissonade (1827) and Sainte Beuve (1862).

Par'ody [Gr. παρά, "beside," and ᾠδή, a "song"], a burlesque upon some poem, or more rarely upon prose-writing. When the burlesque is of a loose and low kind, it becomes a travesty. Parodies always flourish best in a decadent stage of literature: but nevertheless they have been sometimes made the vehicle of much witty and useful, though often too pungent, criticism.

Parol′ (law), a technical term of legal nomenclature, borrowed from the French *parole*, a "word," and when used as an adjective in its literal sense signifying what is oral or verbal, and thus applied in several different connections to qualify the meaning of general names and phrases. Since the early English law, however, regarded contracts in writing not under seal as having no higher character than those which were simply verbal, the word when employed to designate a class of contracts acquired a special and technical signification, denoting what is unsealed. A parol contract, therefore, is one not sealed, whether oral simply or in writing. In other connections, and especially in more modern phrases, the term is strictly confined to its original and literal sense. For example, parol evidence is that delivered by the witnesses orally, as contradistinguished from writings and other similar proofs. A parol demise or lease is a mere verbal agreement to let land, which by an English statute is valid as a lease according to its provisions if the term of the letting does not exceed three years. Similar statutes have been generally enacted in the several States, although in many of them the period is reduced to one year. A parol promise is one that is purely verbal. In the very ancient common-law procedure the term was also used to describe the pleadings in an action, since these allegations of the parties were originally oral, made in open court, and reduced to writing by the clerk. Thus, a "parol demurrer" was a proceeding by which, under certain circumstances, the entire pleadings were stayed for a specified time. This sense of the word is wholly obsolete. The term is also used—generally with the French spelling—in the international law. When prisoners of war, as a condition of being released, undertake not to engage in active hostilities against their captors during a stipulated period of time, such agreement is denominated a *parole;* and an individual prisoner of war, instead of being confined, is sometimes permitted to go at large upon his *parole* or parole of honor—that is, his promise not to escape from the custody of his captors.

John Norton Pomeroy.

Parole′ [Fr., a "word"]. In military affairs, a word which differs from the countersign as follows: the countersign is communicated to all men on guard, while only the officers, and often only the higher officers of the guard, receive the parole. The countersign is usually the name of a place, as a battlefield.

Paropam′isus, or the **Paropamisan Mountains,** in ancient geography, a name of somewhat uncertain signification, sometimes limited to the range which forms the northern boundary of Cabool, sometimes extended to the whole group connecting the Caucasus with the Himalaya, but generally corresponding to the modern Hindoo-Koosh.

Paroquet, or **Parrakeet.** See Psittacidæ.

Pa′ros, an island in the Ægean Sea, one of the Cyclades, belongs to Greece, and comprises an area of 77 square miles, with 7200 inhabitants. It is hilly and fertile, but its productiveness is lessened by scarcity of water. Cotton, honey, and wax are exported; but the most famous of its products is the excellent marble quarried at the mountain Capresso, the ancient Marpessa, nearly in the centre of the island. Principal towns, Parikia on the W. coast, and Naussa on the northern coast.

Parot′id Gland [Gr. παρά, "near," and οὖς, ὠτός, the "ear"], the largest of the salivary glands, in man as well as in many other animals. In the human subject the parotid glands lie on the sides of the face, below and forward of the ear. Each gland weighs about one ounce, and discharges its secretion by a duct 2½ inches long, called the duct of Steno, which opens on the inside of the cheek, opposite the second molar tooth of the upper jaw. The parotid secretion in man is less viscid than the saliva of the other glands, and differs somewhat in its composition, but its functional uses are essentially similar.

Par′owan, post-v., cap. of Iron co., Ut., in Parowan Valley, at western base of the Wahsatch Mountains.

Parr, the young of the salmon, after it has passed from the fry stage and before it has reached that of smelt. All these stages appear to be of indefinite duration, varying according to the food-supply and other conditions. It was once thought that the parr (called also samlet, pisit, or brandling) was of a distinct species, but no expert is now of that opinion.

The Parr.

Parr (Catharine). See Catharine Parr.

Parr (Samuel), D. D., b. at Harrow-on-the-Hill, England, Jan. 15, 1747; studied two years at the University of Cambridge 1765–67; was assistant master of Harrow School 1767–72; taught a private school at Stanmore 1772–76; became master of Colchester School 1776, of Norwich School 1778; took orders in the Church of England; became curate of Hythe 1778, rector of Asterby 1780, and perpetual curate of Hatton, Warwickshire, 1786, rector of Wadenhoe 1790, and of Graffnam 1802, and head chaplain to Queen Caroline 1820. He resided from 1786 through life at Hatton, engaged in literary pursuits and the classical training of pupils; was a brilliant but overbearing and quarrelsome talker, an ardent Whig partisan, possessed an extensive knowledge of Latin literature, was regarded by many of his contemporaries as an intellectual prodigy, and came near receiving the bishopric of Gloucester from the Whig ministry of 1807. D. at Hatton Mar. 6, 1825. The *Works* of Dr. Parr, with *Memoir* of his life and a selection from his correspondence, by John Johnstone, M. D., were published in 8 vols. (London, 1828).

Parr (Thomas), commonly known as **Old Parr,** b. at Winnington, Shropshire, late in the fifteenth century; was taken to London by the earl of Arundel Sept., 1635, and introduced at court as being 152 years old. A metrical narrative of his career was published at the same time by John Taylor, "the water poet," under the title *The Olde, Olde, Very Olde Man*, in which Parr was represented as having been born during the reign of Edward IV. and as having lived through the reigns of ten sovereigns. D. at London Nov. 15, 1635. An autopsy was made by Dr. Harvey, and he was buried in Westminster Abbey, where a monument commemorates his supposed longevity. (See Thoms' *Human Longevity*, 1873.)

Parr′idæ [from *Parra*, a Linnæan genus], a family of birds distinguished by long legs and enormous toes. In form the species greatly resemble rails and coots; the bill is elongated, rather slender, straight at the basal half, but thence with the culmen vaulted to the tip, which is entire; the nostrils longitudinally oval, near the middle of the bill, and in long grooves; the wings large and pointed; the tail diversiform; the legs long and provided with transverse scales, which extend on the tibiæ as well as tarsi; toes, three anterior and one posterior, all elongated and provided (but especially the hinder ones) with long, slender claws, nearly straight or even somewhat curved upward. The family is represented by a small number of tropical birds of doubtful affinities, some authors classifying them with the Palamedeidæ, and others with the Rallidæ. By G. R. Gray they are distributed among two genera—(1) *Parra* and (2) *Hydrophasianus*—the former containing ten species, and the latter one. The species of *Parra* are found in South America, Africa, Asia, and Australia; the single representative of *Hydrophasianus* in India. The species frequent marshes as well as rivers and ponds, generally in pairs or small flocks; they make a rude nest among the reeds, in which the female usually deposits four eggs. Their elongated toes seem to be a provision for ready progression on the plants which float on the surface of the water.

Theodore Gill.

Par′ris (Albion Keith), b. at Hebron, Me., Jan. 19, 1788; was a son of Judge Samuel Parris of Maine (1755–1847); graduated at Dartmouth 1806; came to the bar 1809; became a lawyer of Paris, Me. (then Massachusetts); entered early into public life; was in Congress from Massachusetts 1815–19; was appointed in 1818 U. S. district judge; removed to Portland; was one of the leading members of the Maine constitutional convention 1819; became judge of probate 1820; was governor of Maine 1822–27; U. S. Senator 1826–28; judge of the State supreme court 1828–36; second comptroller of the U. S. treasury 1836–50; mayor of Portland, Me., 1852; D. at Portland Feb. 11, 1857.

Parris (Samuel), b. in London, England, 1653; came to Massachusetts in youth; studied at Harvard, but did not graduate; was for a time a merchant at Boston; became first minister of Danvers 1689; obtained an unhappy notoriety through the great delusion called "Salem witchcraft," which originated in his family, where his daughter and niece accused an Indian slave from the West Indies of bewitching them. After the delusion was over, Parris was dismissed from the pastorship of Danvers church, acknowledged his error, removed to Concord,

preached occasionally in several towns, and d. at Sudbury Feb. 27, 1720.

Par'rish (Edward), son of Dr. Joseph Parrish, b. in 1822 in Philadelphia; became principal of the Philadelphia School of Practical Pharmacy, and in 1864 professor of materia medica there; was a man of practical benevolence and one of the leading promoters of the practical training of pharmacists in schools. Appointed a commissioner to the Indians on the Plains, he d. at Fort Sill in 1872. Author of *Practical Pharmacy* (1856), *The Phantom Bouquet* (1863), *Education in the Society of Friends* (1866), and many professional papers.

Parrish (Joseph), M. D., b. at Philadelphia Sept. 2, 1779; took his degree 1816 at the University of Pennsylvania; was a member of the Society of Friends; became resident physician to the yellow fever hospital, Philadelphia; physician to the Philadelphia Dispensary 1806–12; surgeon to the Pennsylvania Hospital 1816–20; consulting physician to the Philadelphia Dispensary 1835–40; author of professional *Memoirs*, etc. D. Mar. 18, 1840.

Par'rot [from Fr. *perroquet*], a name in its widest sense applied to all the Psittacidæ, and in a more restricted sense employed for the moderate-sized species, like the green and gray parrots, as contradistinguished from the paroquets, macaws, lories, cockatoos, etc. (See Psittacidæ.)

Parrot (Johann Jakob Friedrich Wilhelm), b. at Carlsruhe, Germany, Oct. 14, 1792; studied medicine, and was appointed professor in physiology and pathology at the University of Dorpat, Russia, where he d. Jan. 15, 1841. In 1811 he made a journey of exploration to Caucasus, in 1829 to Ararat, which he described in *Reise in die Krim und den Kaukasus* (2 vols., Berlin, 1815–18) and *Reise zum Ararat* (2 vols., Berlin, 1834).

Parrot-Fish, a name applied to many fishes of the family Scaridæ (which see).

Par'rott, post-v., cap. of La Plata co., Col.

Parrott (Enoch G.), U. S. N., b. Nov. 27, 1815, in New Hampshire; entered the navy as a midshipman 1831; became a lieutenant 1841; a commander in 1861; a captain 1866; a commodore 1870; a rear-admiral 1873; retired in 1874; commanded the Augusta at the battle of Port Royal and the iron-clad Monadock in both the Fort Fisher fights; highly commended by Flag-officer Dupont and Rear-admiral Porter. Foxhall A. Parker.

Parrott (Robert Parker), b. at Lee, N. H., Oct. 5, 1804; graduated at the U. S. Military Academy 1824; entered the army as second lieutenant of artillery, remaining, however, at the academy as assistant professor until 1829; was transferred to the ordnance corps in 1836, in which year he resigned and accepted the superintendency of the West Point iron and cannon foundry, Cold Spring, N. Y.; was judge of court of common pleas, Putnam co., 1844–47; and was the inventor of the system of rifled guns bearing his name, and of their projectiles. (See Artillery and Ordnance.) D. at Cold Spring, N. Y., Dec. 24, 1877.

Parrs'borough, port of entry of Cumberland co., N. S., on the N. side of the Minas Channel. It exports large quantities of lumber. Pop. about 800.

Par'ry (Sir William Edward), b. at Bath, England, Dec. 19, 1790; entered the navy 1803; was engaged in the naval service on the American coast during the war of 1812; was a member of Sir John Ross's Arctic expedition 1818; commanded another expedition 1819–20, with which he penetrated farther W. within the Arctic circle than any previous explorer, thereby gaining a reward of £5000 offered by Parliament; made other expeditions 1821–23 and 1826, in the last of which he penetrated farther N. than any earlier navigator; was knighted 1829; became rear-admiral 1852, lieutenant-governor of Greenwich Hospital 1853, and d. at Ems, Germany, July 8, 1855. He published narratives of all his voyages.

Parry Sound, a provisional district of Ontario, Canada. It takes its name from Parry Sound, a port on the E. side of Georgian Bay, Lake Huron. The district lies N. of Muskoka, which it much resembles. It is settling upon the free-grant system. Pop. 1519.

Par'ryville, post-v. of Franklin tp., Carbon co., Pa., on Lehigh and Susquehanna and Lehigh Valley R. Rs.

Par'sees [Per. *pârsi*] is the name generally given to the modern followers of Zoroaster. When, in 651 A. D., the last of the Sassanides, Yezdezird, was defeated by the caliph Omar in the battle of Nahavand, and Persia was conquered and subjugated by the Arabs, the whole population was converted to Islam. Only a small number of the Persians continued to cling to the national faith, and these were subjected to severe persecutions. The Mohammedans called them *Guebres*, "infidels," and allowed them to settle only in the poorest districts of the country, around Yezd and Kirmân. Most of them, however, emigrated to the western coast of India and settled at Bombay, Surat, Nawsari, Ahmedabad, etc. Those remaining in Persia were hard pressed; they decreased in numbers and sank into poverty. At present they number only about 7000, but they are much respected by the Europeans on account of their honesty and reliability. Those, on the contrary, who went to India, prospered much, though at one time they too were exposed to persecutions by the Mohammedans. They are said to number at present from 150,000 to 200,000, and many of the wealthiest merchants of Bombay belong to their denomination. In India, however, their religion became mixed up with Hindoo ideas and practices, which at present has occasioned a schism and the establishment of a reform association. Their morals underwent less change; they are still highly respected and feel well disposed towards European civilization. (For their doctrines and tenets see the articles Zend-Avesta and Zoroaster.)

Parseeism. See Parsees.

Pars'ley [Fr. *persil*; Ger. *Petersilie*; Gr. πετροσέλινον], the *Petroselinum sativum*, a biennial umbelliferous herb cultivated in gardens. There are many varieties. The leaves of most are used in garnishing meats. Others are sometimes cultivated for the rich white root, which resembles the parsnip. The root of common parsley has valuable medicinal qualities.

Pars'nip, formerly often written **Pastnip** (*Pastinaca sativa*), an umbelliferous plant, usually biennial, is found wild in Southern and Central Europe, in England, and in the southern parts of Russian Asia. There is a considerable difference between the wild and the cultivated parsnip, the root of the latter being larger, without branches, softer, and more fleshy. It succeeds best in light rich soil. The Guernsey parsnip has a root four feet long; the Dutch, only from twenty to thirty inches. To many this root is a great relish; the Romans cultivated it carefully and appreciated it much. To others, however, it is distasteful on account of its great sweetness. For fodder it has hitherto not been much used, though cows like it, and it produces excellent flesh and butter. The wild parsnip has an acrid taste, and sometimes malignant consequences when eaten; the cultivated assumes the same acrid taste as soon as it begins to grow in spring.

Par'son (law). So far as this term describes a peculiar legal status or condition, its use is confined to the English law, and its technical meaning results entirely from the union of Church and State. A parson is a parish priest of the Established Church in England, who, in addition to his spiritual functions, has the full legal ownership and possession of all the temporal rights belonging to the parochial church. According to Lord Coke, the name is derived from *persona*, because by his person the Church is represented, and he is in himself a corporation sole in order to protect the rights of the Church, which he personates by a perpetual succession. Another more ancient writer declares that he is so called since he is bound to perform divine service in his own person—*in propria personâ servire Deum.* The special feature which distinguishes the legal condition of the parson from that of other parish priests is the fact that the freehold ownership of the church, the parsonage, the glebe, the tithes, and all other parochial dues is vested in him alone. It sometimes happens that these temporalities are perpetually annexed to and held by some spiritual corporation, in which case they are said to be "appropriated;" and the tithes may even be thus held by a lay appropriator. Under these circumstances the incumbent is termed the vicar, since he is in some respects an agent or deputy (*vicarius*) of the one who holds the benefice and actually receives the revenues, and who pays therefrom the stipend of the officiating priest. In order that a person may become a parson, or even a vicar, four requisites are necessary: He must be in holy orders—that is, a consecrated priest according to the rites of the Established Church; he must be presented to the living by the patron thereof; he must be instituted into the spiritual cure by the bishop; and finally, he must be publicly inducted into the possession of the church and other temporalities of the parish. The spiritual functions of the parson include the performance of divine service, the administration of the sacraments, preaching, solemnization of marriage, and burial of the dead. He is for the time being the owner and holder of the parochial temporalities, subject, however, to the obligation of using them for their appropriate ecclesiastical purposes. This legal condition, with all its rights, may be terminated in several different modes—namely, by death, by "cession" in taking another benefice, by being consecrated a bishop, by resignation, and by deprivation or judicial removal from the

office and its emoluments as the penalty for various offences, civil or ecclesiastical. JOHN NORTON POMEROY.

Par'sons, city of Labette co., Kan., at the junction of three branches of the Missouri Kansas and Texas R. R., contains extensive car-works and machine-shops, 2 school-houses, 4 churches, 3 newspapers, 1 furniture manufactory, 2 banks, a public library, several good hotels, and stores. Pop. about 3000. G. C. WEST, ED. "SUN."

Parsons, tp. of Wicomico co., Md. Pop. 1106.

Parsons (ANSON V.), b. at Granville, Mass., in 1799; was admitted to the bar at Litchfield, Conn., 1826; was judge of the court of common pleas at Harrisburg, Pa., 1840–42, and again 1843–51, having in the interval been secretary of the Commonwealth; and published in 1851 a volume of *Reports of Select Cases in Equity*, containing decisions by himself and by President Judge King. A second volume was printed the same year, but the edition was destroyed by fire before distribution.

Parsons (JONATHAN), b. at West Springfield, Mass., Nov. 30, 1705; graduated at Yale College 1729; was pastor of the church at Lyme, Conn., 1731–45, and at Newburyport from 1746 until his death, July 19, 1776; and was distinguished as an orator, for his scholastic attainments, and skill as a polemic theologian. Author of *Sixty Sermons on Various Subjects* (2 vols., 1780) and other religious publications.

Parsons (LEWIS E.), a native of the State of New York; became in 1841 a Whig politician and successful lawyer of Talladega co., Ala.; became a Douglas Democrat in 1860, and was a Union man throughout the civil war; was in 1865 provisional governor of Alabama under President Johnson, and was unanimously sent to the U. S. Senate by the legislature, but was not allowed to take his seat.

Parsons (Gen. MONROE M.), b. in Virginia in 1819; removed in youth to Missouri; studied and practised law; engaged in the Mexican war; was attorney-general of the State 1853–57, subsequently a member of the State senate; acted in concert with Gov. C. F. Jackson at the outbreak of the rebellion in endeavoring to throw Missouri into the ranks of the Confederacy; was active in organizing the State militia; raised a mounted brigade, which he commanded at Carthage, Springfield, and Pea Ridge; served under Gen. Price in command of a division throughout most of the war, after which he, with some followers, took service under Juarez, and was killed in an engagement with the forces of Maximilian near Camargo Aug. 17, 1865.

Parsons (MOSES), b. at Gloucester, Mass., in 1716; graduated at Harvard 1736; taught schools for several years, and was pastor of the church at Byfield, Mass., from 1744 until his death in 1783. Author of a number of published sermons; and father of Chief-Justice Theophilus Parsons.

Parsons (RICHARD C.), b. at New London, Conn., Oct. 10, 1826; received a liberal education; went to Ohio 1847; studied law at Cleveland, where he was admitted to the bar 1851; became an active Republican politician; was a member of the State legislature 1857–61, and its Speaker 1859–61; was offered by Pres. Lincoln the mission to Chili, but declined; served a year (1861–62) as consul at Rio Janeiro, Brazil; was collector of internal revenue at Cleveland 1862–66; marshal of the Supreme Court of the U. S. 1866–72, and member of Congress 1873–75.

Parsons (Gen. SAMUEL HOLDEN), b. at Lyme, Conn., May 14, 1737; graduated at Harvard 1756; studied law at Lyme in the office of his uncle, Gov. Matthew Griswold; was admitted to the bar 1759; was representative in the legislature many years in succession from 1762; became king's attorney 1774, when he removed to New London; was a member of the Connecticut committee of correspondence 1775, in which year he took command of the 6th Connecticut regiment at the siege of Boston; took part in the battle of Long Island; was chosen by Congress brigadier-general Aug. 9, 1776; succeeded Putnam in command of the Connecticut line 1779; became major-general Oct. 23, 1780; practised law at Middletown after the peace; was commissioner to treat with the Miami Indians 1785; member of the Connecticut convention for the ratification of the Constitution of the U. S. Jan., 1788; was appointed by Washington first judge of the N. W. Territory; was commissioner of Connecticut to purchase from the Wyandot Indians the tract in N. E. Ohio known as the Connecticut or Western Reserve 1789; settled near the Ohio River; published a paper on the antiquities of the Western States in the *Transactions* of the American Academy (vol. ii.), and was drowned in the rapids of the Big Beaver River, O., Nov. 17, 1789.

Parsons (THEOPHILUS), LL.D., son of Rev. Moses, b. at Byfield, Mass., Feb. 24, 1750; graduated at Harvard 1769; taught school at Falmouth (now Portland); was admitted to the bar there 1774; returned to Byfield in consequence of the destruction of Falmouth by a British squadron in Oct., 1775; began legal practice at Newburyport 1777; was a member of the patriotic association called the "Essex Junto," and author of the famous pamphlet known as the *Essex Result* (1778), which contributed largely to the defeat of the State constitution then proposed by the legislature, and the establishment of the prevailing New England school of constitutional doctrine; was a member of the convention held at Ipswich in 1779 which framed a new constitution, and of the convention of 1788 for the ratification of the Federal Constitution; was several times elected to the State legislature; removed to Boston 1800, attained the highest position at the Massachusetts bar, and became in 1806 chief-justice of the supreme judicial court, which post he held until his death, at Boston Oct. 30, 1813. His *Decisions*, which fill vols. ii. to x. of the Massachusetts *Reports*, have given him a vast legal reputation. (See his *Life*, by his son, Theophilus Parsons, Jr. (Boston, 1859).)

Parsons (THEOPHILUS), LL.D., son of the eminent jurist of the same name; b. at Newburyport, Mass., May 17, 1797; graduated at Harvard 1815; studied law in the office of Judge William Prescott; visited Europe; practised some years at the bar at Taunton, and afterwards at Boston; was a frequent contributor to the *North American Review* and other magazines and periodicals; founded the *U. S. Literary Gazette;* published three volumes of *Essays* in support of the doctrines of the Swedenborgian or "New Jerusalem" Church; became in 1847 Dane professor of law at Harvard Law School; was author of some fifteen volumes of legal treatises on the laws of contracts, mercantile business, shipping and admiralty, notes and bills of exchange, marine insurance, etc., of a *Memoir of Chief-Justice Theophilus Parsons* (1859), of theological works, *Deus Homo* (1867), *The Infinite and the Finite* (1872), and several minor religious treatises, and of a valuable manual, *The Political, Personal, and Property Rights of a Citizen of the U. S.* (1875).

Parsons (THOMAS WILLIAM), M. D., b. at Boston, Mass., Aug. 18, 1819; studied at the Boston Latin School and in Europe. Author of one of the best of the many translations of Dante's *Inferno* and *Purgatorio* (1843–67), *Poems* (1854), *The Magnolia* (1865), *Old House at Sudbury* (1870), *Shadow of the Obelisk* (1872), *Willey House and Sonnets* (1875). GEORGE LUNT.

Parsons (USHER), M. D., b. at Alfred, Me., Aug. 18, 1788; studied medicine under Dr. John Warren; entered the navy as surgeon's mate 1812; was surgeon of Com. Perry's flagship at the battle of Lake Erie Sept. 10, 1813; practised medicine at Providence, R. I.; was professor in the medical school of Brown University, president of the Rhode Island Medical Association, author of several medical and miscellaneous works, and of a *Life of Sir William Pepperell* (1856). D. at Providence Dec. 19, 1868.

Parson's Creek, tp. of Dorchester co., Md., on Chesapeake Bay. Pop. 1748.

Parson's Creek, tp. of Linn co., Mo., on the Hannibal and St. Joseph R. R. Pop. 1118.

Par'sonsfield, post-v. and tp., York co., Me., on the Great Ossipee River. Pop. 1894.

Part [Lat. *vox;* Ger. *Stimme*], in music, the melody or series of notes appointed for any voice or instrument. A *solo* (unaccompanied) is a single part or mere melody, and is complete in itself. The *duet* consists of two parts simultaneously performed, the *trio* of three, the *quartet* of four, etc. These parts may be considered as so many parallel melodies, yet written under such rules and with such mutual relations as to form by their union an agreeable and connected chain of harmonious combinations. The several parts or voices, therefore, though seemingly independent, are really the development of the fundamental harmonies indicated by the bass and its figuring, each part in every step of its progress being formed of one or the other of the intervals of a succession of chords. In music for voices accompanied by the organ or pianoforte the accompaniment is called the organ or pianoforte *part*, though it really comprises all the parts sung by a choir, and frequently ornamental harmonies in addition. WILLIAM STAUNTON.

Partan'na, town of Sicily, province of Trapani, situated on a mountain-slope 1250 feet above sea-level, and commanding a fine view of the Mediterranean and of the beautiful plain between Cape Lilibeo and the promontory of Sciacca. This town was originally a Greek colony, and terra-cotta vases of Greek workmanship and of great beauty are frequently disinterred in the vicinity. The Saracens erected three castles here, the ruins of which still

exist. In the glorious revolution of 1860, Partanna furnished most prompt and important assistance to Garibaldi. There are few objects of interest in the town itself except the Chiesa Madre, a fine church containing some noticeable works of art. Pop. in 1874, 12,467.

Parthenay′, town of France, department of Deux Sèvres, has manufactures of cloth, serges, and leather, and a large trade in corn and cattle. Pop. 5057.

Parthenogen′esis [Gr. παρθένος, "virgin," and γένεσις, "production"], in animal biology, the production of young by a female without fecundation by a male. This definition excludes all cases of ALTERNATE GENERATION (which see) and all instances of fœtation by inclusion, rare instances of which are recorded, in which cases a small fœtus is included within some part of a larger, the larger being, in fact, a twin of the smaller, while the containing organism is as likely to be a male as a female. But true parthenogenesis is the development of the embryo from the ovum, by the normal course of gestation, without sexual congress. For example, it is certain that the eggs from which male or drone bees are hatched are laid by unimpregnated bees (queens, or even workers). The *Aphides*, or plant-lice, copulate in the autumn and deposit eggs which are hatched in spring. For an indefinite number of generations afterwards the females bring forth young, but not eggs. No males are produced, and no eggs are laid until cold weather comes on or till food fails. But in this instance the parthenogenesis resembles alternate generation in the fact that the young originate, not from an ovum, but from its analogue, a substitute called pseudovum, differing considerably in its history from the ovum. Various Acarina and some Hemiptera, and even the larvæ of some flies, are capable of this form of parthenogenesis. True parthenogenesis has been observed in several hymenopterous and lepidopterous insects. In some of these cases, if an ovum be impregnated, a female is produced; if not, a male is finally hatched from the egg. But in the lower form of parthenogenesis (common among radiates, crustaceans, and some annelids) the development has been called an internal gemmation, from its likeness to the budding process (gemmiparous reproduction) of the lowest forms of animals and of many plants. Parthenogenesis, alternate generation, gemmation, etc. have been grouped together as agamic or individual reproduction. Not one instance of either in any of the vertebrate animals has been observed by any scientist. Among plants, according to Fresenius, the *Datisca cannabina* produces seed when the pistillate plant is entirely unfertilized (and there are a few other less equivocal cases). This is a true parthenogenesis, while the production of reproductive bulbs in the place of seed by the onion illustrates spurious parthenogenesis, or internal gemmation, the phenomenon seen in the case of the *Aphis*. CHARLES W. GREENE.

Par′thenon [Παρθενών, from παρθένος, the "virgin," a title of Athena], a noble temple of Athena Parthenos at Athens. It was built by Pericles about 438 B. C. The architects were Ictinus and Callicrates, and a part of the sculptured decorations were from the hand of Phidias. It stands upon the Acropolis. It is of the Doric order, built of the best Pentelic marble, is 228 feet long and 101 feet wide. It is generally believed that it was painted within and without. There were 46 columns in its peristyle. Its end porticoes have 8 columns each, and the sides 17 each, reckoning the corner columns twice. Its walls are 66 feet high. It stood almost entire until 1687, when, during a siege by the Venetians, a large part of the central portion was destroyed by the explosion of some gunpowder, which had been stored in it by the Turks. It is regarded as the finest production of Greek architecture. The metopes were carried off by Lord Elgin (by permission of the Turkish government), and are among the chief treasures of the British Museum.

Par′thia, an ancient territory of Western Asia, was situated S. E. of the Caspian Sea, and corresponded nearly to the modern Persian province of Khorassan. It was wholly mountainous, and inhabited by a rough, wild, and warlike people of Scythian descent, famous for their horsemanship and skill with the bow. Agriculture and trade they despised; war was their only occupation. They belonged successively to the Assyrian, Persian, Macedonian, and Syrian empires, but in 250 B. C. they established an independent kingdom under Arsaces, whose dynasty, the Arsacidæ, ruled till 226 A. D. and formed a vast empire, extending from the Euphrates to the Indus. The Romans attacked them several times, but without success. But Artabanus IV. was killed in 226 A. D. in a rebellion, and the dynasty of the Arsacidæ was followed by that of the Sassanidæ, a Persian family. The Persian influence now became the ruling one in Asia till the Mohammedan conquest, 651 A. D.

Par′ticiple [Lat. *participium*, a "partaking"], a verbal form which partakes of the nature of an adjective. Participles are of two kinds, termed the perfect or past, and the active or present, although they have no definite relation to time. The form in *-en* or *-n* in *driv-en, bor-n, bor-ne*, belongs to Grimm's strong conjugation, and is the Anglo-Saxon and German *-en, -n*. The form *-ed* is akin to Latin *-ât-us*, as in *plic-at-us*, "*plie-d*," whence also *plea-t*. (See Haldeman's *English Affixes*, pp. 122, 132, 138, 167.) Participial forms due to Latin, such as *reluct-ant, luc-ent*, have become adjectives in English. The present participle in *-ing* arose from a blunder in confusing the proper form in *-end* or *-and* with the noun suffix present in *cloth-ing, bless-ings, wild-ing;* Icelandic, *reikn-ing;* Ger. *rechn-ung;* Eng. a *reckon-ing;* Anglo-Sax. *feorm-ung* and *feorm-ing*, a *form-ing*—the true participial form being present in Gothic *hab-ands;* Angl. *hæbb-ende;* Icel. *haf-andi;* Ger. *hab-end;* Lat. *hab-ens* ("having"), ablative case *hab-ent-e* (in "having"), the suffix of which was corrupted into *-ing* in the English *hav-ing*. The uncorrupted form is preserved in Scotch and in vulgar speech, but with the *d* absorbed by the *n*, giving forms like *hav-en, giv-en*, etc., commonly printed *hav-in'*, as if *-ing* had been the suffix mutilated, but *-ing* is not *-in* with a *gay*-sound added.

In the *Grammar* of Joseph R. Chandler (Philadelphia, 1847) there is a vindication of expressions like "the boy was being whipped," in contradistinction to the obscure form, "the boy was whipping." Mr. Grant White (*Words and their Uses*, 1871) prefers the less definite form, and is controverted by Dr. Fitzedward Hall (*Modern English*, 1873), who quotes Skillern (*Grammar*, 1802) for "I am being conquered," and Southey (1795) for "is being torn out," and two years later, "is now being educated." Sentences like "the witch was drowning," and "the witch was being drowned," are not equivalents, and in grammar and rhetoric ambiguous forms are to be avoided.
S. S. HALDEMAN.

Par′ticle [Lat. *particula*, "a small part"], a name of rather indefinite application, given primarily to the uninflected words in Greek and Latin, such as conjunctions, adverbs, and prepositions. The word is now used for the less important words in a sentence, which may be often omitted without injury to the sense. We have examples in "*Now*, it happened thus," "And now *also*" (Matt. iii. 10), "*But* when this occurred," "*Why*, yes," "*Well*, no." Some particles do not admit of translation, as the Latin interrogative *nunquid* in "Nunquid potest cæcus cæcum ducere?" ("Can the-blind the-blind lead?") In some Latin and English grammars the term is not used.
S. S. HALDEMAN.

Parti′nico, or **Partenico,** town of Sicily, province of Palermo, about 17 miles W. of the city of Palermo. It is situated in a wide pleasant valley, and is surrounded by calcareous mountains rising in the form of isolated pyramids. The vine and the olive thrive luxuriantly in this region, and the inhabitants are chiefly occupied with the manufacture and sale of wine and oil. Pop. in 1874, 20,154.

Parti′tion [Lat. *partitio*], in the technical legal phraseology the division of land held in a united ownership and in undivided shares by joint tenants, tenants in common or coparceners, so that each individual proprietor becomes severally owner and possessed of his particular allotment distinct from the portions assigned to the others. By far the most frequent instance which occurs in this country is that of a division among tenants in common, to whom as heirs the lands of a deceased ancestor have descended. There are two kinds of partition—voluntary and compulsory. In the former the whole proceeding is the result of agreement, and is consummated by the mutual execution and interchange of the proper deeds of conveyance, by which the designated allotment is released to each. The latter form is effected by means of a judicial proceeding instituted by one or more of the common owners against the others, in which the court determines the amount of the respective shares, and through its ministerial officers makes the actual division. The ancient common law provided a particular form of action for this purpose, but it has long been disused. Courts of equity possess a general jurisdiction over the subject-matter, and may decree a partition as the result of a regular suit in chancery. In the several States of this country the whole matter has very generally been regulated by statute, simple and expeditious special proceedings have been established, and a power to entertain them has frequently been conferred upon inferior courts, as, for example, upon the courts of probate. Whatever be the form of judicial proceeding adopted, all the co-owners are parties plaintiff or defendant, the extent of their interests is ascertained by a preliminary adjudication, commissioners are then appointed, who admeasure the shares and effect the allotment, and their acts are re-

viewed, and if found to be proper are confirmed by the court. If the land is incapable of an equitable division it may, by virtue of a statutory authority, be sold at public sale under the direction and control of the court, and the proceeds arising therefrom distributed among the owners. In such a case the rights of lien-holders, either on the whole tract or on the undivided shares, such as mortgagees and judgment creditors, are of course affected, and must therefore be ascertained and protected by the decree, the liens being transferred from the land to the fund resulting from its sale. In addition to the technical and strictly appropriate sense above described, the term "partition" is sometimes used to denote a similar process of dividing personal property, goods, and chattels among joint owners or owners in common. JOHN NORTON POMEROY.

Part'nership, in law. This consists in the association of two or more persons, who combine their labor or capital with a view to a common benefit or profit. It will be considered under the following principal divisions: I. The contract itself—its nature, its formation, and its relation to real estate; II. Its effect as to third persons; III. Its effect as between the partners themselves; IV. Dissolution and its consequences.

I. Partnership in goods is not to be confounded with joint tenancy or tenancy in common. In the former (see JOINT TENANCY) the survivor takes the whole interest, while in partnership the share of a deceased member passes to his personal representatives. One partner is for certain purposes the agent of the other, so that he can sell the entire stock in trade to a third person, while in the case of joint tenancy or ownership in common each owner has no implied authority to sell more than his own share. The ordinary rules of the law of agency become applicable to a partner, so that as to third persons his power to bind his associates will be derived from that department of law. As between himself and his associates, he is in a fiduciary position. The law of agency as to third persons, and that of trust as between themselves, are component parts of the legal rules affecting partners. The general principles of law governing contracts are to be extended to this relation. Thus, the incapacity to enter into this contract, depending upon infancy, mental weakness, duress, etc., is not different from that which is recognized in other cases of contract. A partnership may be constituted either by the respective partners contributing capital or skill, or one or more furnishing capital and others skill. Thus, lawyers in partnership may furnish no capital; members of a mercantile firm may all contribute capital, while some may supply capital and others skill. The general presumption is, that they will share profits equally, though there may be a special arrangement to the contrary. The capital of a mercantile partnership usually consists in the main of personal property, though there may be real estate when land is used for partnership purposes. An important inquiry arises as to the point whether it is to be governed by the technical rules applying to land or by those which prevail in the law of personal property. The courts do not wholly agree upon this point. Some maintain that the land required for or devoted to partnership purposes must be deemed, with a view to effectuate the intention of the parties, as stock in trade or personal property. Others insist that the characteristics of land shall not be taken away except to a modified extent, or so far as is necessary to work out the ends of the partnership. Thus, they would hold that the land is held in trust, and that the widow of a deceased partner could have no dower nor his heirs inherit until the partnership debts are paid and the joint affairs were fully settled. After this they would assert that any real estate remaining would be governed by the laws controlling land—that the trust imposed for the purposes of the partnership would cease, and, accordingly, that the widow would have her dower and the heirs would inherit. The latter view finds the greater support in the courts of this country. A word should be added as to the "good-will" of a partnership. By this expression is meant "the hope or expectation that customers will continue to resort to the place where the business is transacted." This expectation is treated by courts of equity as property of a peculiar kind. It cannot be sold by a sheriff on an execution, as it is in its nature intangible. It can only be made valuable through the peculiar remedies of courts of equity, such as an injunction. When one of several partners dies, the executor of the deceased can only realize anything from this source by means of a sale of the stock and premises, in which case the "good-will" accompanies the sale. In other cases the surviving partners are entitled to the good-will for their own benefit. This subject does not apply to professional partnerships, since the disposition of those who employ professional men to resort to them for advice is personal rather than dependent upon locality. This topic is frequently connected with the subject of the right to use firm-names and trade-marks. (See TRADE-MARKS.)

Partners at common law have been classified into secret, dormant, nominal, and ostensible. A dormant partner is one who simply supplies capital and takes no active part in management. A secret partner is one who is not known, though he may be active. A "nominal" partner is one who has no real connection with the firm, but holds himself out as a partner. Persons who give credit to the firm on the faith of his name may hold him liable on the ground of estoppel. (See ESTOPPEL.) There is by statute in some of the States a partnership known as limited. The theory of this is that there shall be one or more partners liable in the usual manner for the entire debts of the firm or *in solido*, and others who are only responsible for the amount of capital contributed. This result can only be accomplished by statute, and certain preliminary steps are required to be taken, such as publication in newspapers and filing notices in public offices. This will be more fully noticed at the close of this article. (For details the statutes must be consulted.) In France this system is known by the term "*en commandité*." Partnerships as to their subject-matter at common law may be either general or special; that is, they may be extended to nearly all kinds of trade or business in which persons engage, or they may be confined to a single item of property, such as the use of a race-horse for profit. They cannot be resorted to in the case of a mere position of trust, such as that of an executor or trustee, the duty to perform the trust being personal.

II. The great point of interest in partnership law is the capacity of one member of a firm to bind his associates in respect to third persons. There has been much diversity of opinion among jurists as to the true ground of partnership liability. Some have maintained that it rested upon participation in profits. The argument is that whenever a person takes by agreement a share of the profits as such, he withdraws a portion of the fund to which the creditors had a right to look for reimbursement, and accordingly should be held liable. This is the doctrine of a celebrated early English case (*Waugh* v. *Carver*, 2 Henry Blackstone's Reports, 235) which has been quite generally followed in the courts of this country. Much difficulty has arisen in the practical application of this rule in determining when a person takes the profits, *as such*, so as to make him a partner. Would a salesman, for instance, who received a percentage of the profits for his services, be a partner? The answer is that he would not, as the percentage is a mere mode of paying a subordinate for his services. He does not receive the profits in the character of a partner. It has accordingly been laid down that under this rule the test of partnership is the community of profit—a specific interest in the profits as profits, in contradistinction to a stipulated portion of the profits as compensation for services. Perplexing questions growing out of this view have led the English courts recently to a reconsideration of the correctness of the rule laid down in *Waugh* v. *Carver*, and it has been distinctly repudiated in the leading case of *Cox* v. *Hickman* (8 House of Lords' Cases, 268) by the highest appellate court. It is, however, quite probable that the American courts will adhere to the old doctrine with all its perplexities. The New York court of appeals has very recently reaffirmed (in *Leggett* v. *Hyde*, 58 New York Reports, 272) the correctness of the early English theory, and makes the participation in profits the basis of partnership. The other theory is, that agency is the test of partnership. The ground from which liability springs is, that one of the partners is the agent of the other, and thus has the capacity to bind him. The reception of profits may be evidence to show that the agency exists, but the final inquiry in all cases will be whether there has been such an agency created as to constitute a partnership. Were the question entirely new and the courts unfettered by precedents, this doctrine would seem to be the most philosophical and attended by the fewest difficulties. It is well settled, as already suggested, that a person may be a partner as to third persons who is not such in fact as between himself and his supposed associates. This proposition rests on the familiar doctrines of estoppel. It is on this ground that one who merely lends his name to a firm (nominal partner) is liable to those who have acted upon the supposition that he was in fact a partner. A similar principle is applied to one who lends money at usurious rates of interest to a firm on an agreement that he shall be paid legal interest and a share in the profits. The lender cannot allege the invalidity of the usurious contract, even though the borrowers can, and will be held liable, on the principle of *Waugh* v. *Carver*, already referred to, as a participant in the profits. One cannot be charged as a partner by a dealer with a firm unless he held that relation when the contract upon

which he is sought to be charged was made. Thus, if A purchases a quantity of paper of B, and afterward enters into a partnership with C in reference to publishing a newspaper, and they make use in the firm of the paper purchased of A, B has a claim only against A. He is not a creditor of the firm. The general principle may be laid down that if one partner borrows money or buys goods as an individual, and subsequently lends or sells to his firm, the lender or seller has no action against the firm, but only against the individual partners. On the other hand, if the loan or sale was in reality made to the firm, even though that fact was not disclosed, the partnership would be liable, on principles recognized in the law of agency as applicable to undisclosed principals. The difficulties attending this class of questions can be solved by inquiring whether there are two transactions or only one. If the borrowing or purchasing partner makes the contract for himself, and then by a new and independent act or contract deals with the partnership, it is only liable to him. But if he were at the time of the original transaction with the lender or seller not, in fact, dealing for himself, but for the partnership, it is liable on that contract. The kind of contracts which one partner under the general laws of agency can make so as to bind his associates depends upon the nature of the business. There is necessarily a much wider range in mercantile than in professional partnerships. Usually, a partner in a mercantile firm can buy and sell goods on credit, borrow such money as is required in the firm business, and give the firm note, draw checks, pay debts with the firm's property, and do like acts usual and necessary in the business in which they are engaged. It is enough to bind the firm that the member acting in the contract had the appearance of authority, even though in fact it had been withdrawn from him or was wholly unauthorized. An illustration may be found in the following case: A partner without the consent of his associates has no right to give a promissory note signed with the firm-name without consideration and as an act of accommodation to a friend to enable him to borrow money. Still, if he does issue such a note, and it is taken before maturity in the regular course of business by a purchaser in good faith, he can collect it from the firm, notwithstanding the partner's violation of duty. The ground of this rule is, that the partner has the apparent authority to issue the note. It cannot be distinguished in its appearance from one given in the regular business of the firm; and if one of two innocent persons must suffer, that one must sustain the loss who reposed the confidence. Still, if the person dealing with the firm knew, or had reason to know, that the partner was violating his duty, the firm would not be liable. Accordingly, a creditor of an individual partner could not enforce a firm-note given without the consent of the partnership, as he could not reasonably expect that his private debt would be paid by the firm. Owing to the intimate relation between the partners, the act of one is for many purposes the act of all. Thus, notice to one of any fact affecting their business is notice to all. An admission made by one is supposed to be made by all. An admission by one cannot be used to prove the existence of the partnership when that is in dispute, but after the partnership has been shown to exist the admission affecting their interest is receivable in evidence. It has been much questioned whether after the dissolution of a partnership an admission of a debt by one of the former partners will take it out of the statute of limitations as against the others. The better opinion would seem to be that it will not, as a mere admission, but a new promise is necessary in that case. On similar grounds, a partnership is liable for the torts or wrongful acts of one of its members connected with their business. Thus, if one of them is guilty of a fraud in making a contract the whole number is answerable. This rule cannot be applied when the wrongful act is wholly unconnected with his employment. The extraordinary powers given to a partner are conferred upon him for mercantile convenience, and this is the measure of them. He will not be allowed, without the consent of his associates, to submit the decision of a question to arbitrators which might form the subject of litigation, as each of the partners has a right to the judgment of the courts in respect to his legal interests.

III. The relation of partners, though growing out of a contract, is one of trust and confidence, and courts will hesitate to compel a person to go into partnership with another, though he may have agreed to do so. The injured party will commonly be left to an action for damages for breach of the agreement.

It is quite usual when a partnership is formed to enter into a formal agreement prescribing the duties of the respective partners, restricting their powers, defining their rights to participate in the profits, and sometimes providing for a continuance of the firm in case of the death or withdrawal of a member. Such an agreement is principally useful in defining the rights of the partners as between themselves. It will not bind third persons dealing with the firm unless its terms are communicated to them. They have a right to suppose, until they learn to the contrary, that the usual condition of things exists, and may accordingly deal with any member of the firm in the ordinary manner. The rule of *delectus personarum* should be adverted to in this connection. The meaning of this is, that partnership is so much a matter of trust and confidence that no new member can be introduced without the consent of all, or that the withdrawal of one destroys the partnership. It thus happens that on the withdrawal or death of one of the members the owners of the respective interests become mere tenants in common, unless they agree to the contrary. The agency to make new contracts is withdrawn, and the only power that remains to a member is to settle and adjust transactions already entered into. This rule has no application to joint-stock companies. (See JOINT-STOCK COMPANIES.) A member of such a company may sell his stock, and the company will continue in existence. The accounts between partners can only be adjusted in a court of equity. Still, if they make a settlement and find an amount due from one to the other, there will spring up an implied contract on the part of the person found to be indebted to pay the amount due; and this contract is enforceable in a court of law. The view that their relation is one of trust and confidence prevents one of the firm from doing any act without his partners' consent in reference to the firm business which shall enure to his own individual advantage. Thus, if he buys up a claim against the firm for less than its face, he can only charge what he paid. So, if during the existence of the partnership he take, without the consent of his associates, from a landlord, in his own name, a renewal of a valuable lease belonging to the firm, he will be obliged to account as a trustee for the profits which may accrue. A cognate question concerns the right of a partner to carry on an independent business. It would be contrary to equity that he should engage in other business which would deprive his associates of any benefit which they had a right to expect from him; and, on the other hand, no good reason can be given why he should abstain from an entirely distinct occupation which in no possible way can be injurious to the partnership. A partner has no right to any additional compensation above his stipulated portion of the profits for extraordinary services unless such pay has been agreed upon. "The law," it has been said, "never undertakes to settle between them their various and unequal services in the transaction of their private affairs." However, any agreement fairly entered into for extra compensation will be binding. The remedies of the partners as between themselves are in the main to be sought in a court of equity. That tribunal has adequate means by its officers to take and state an account between them, and to enjoin one of the partners from doing an act injurious to the firm, and, if necessary, to appoint a receiver of its effects. This branch of the subject will be more appropriately considered under the topic of dissolution. (See the next subdivision.)

IV. A partnership may be dissolved in a number of modes. Whatever breaks up the relation of trust and confidence between the parties destroys the partnership. The leading modes are—(*a*) the express consent of the parties; (*b*) the sale by one of his interest; (*c*) death of one or more members; (*d*) bankruptcy; (*e*) marriage of a female partner; (*f*) insanity legally established; (*g*) the fact that one becomes by the law of nations an enemy to his associates; (*h*) the action of a court of equity decreeing a dissolution on such grounds as that the ends sought to be accomplished are impracticable, or that one of the firm is so conducting himself as to bring disaster upon the common interests, or is in such a state of mind that he cannot contribute to the common advantage; on the other hand, there are cases in which the court may interfere and prevent a dissolution by one of the partners when the interests of the firm require that no dissolution take place; (*i*) the voluntary withdrawal of a member. Such a person as is last named is commonly called a "retiring" partner. Notwithstanding his withdrawal, if the other members continue to prosecute the business, he will be liable for new engagements of the firm to those who had no notice of his withdrawal. For the purpose of giving such notice it is common to send circulars to customers announcing the change in membership. To persons who have not had dealings with the firm a publication in newspapers properly made will suffice. The effect of a dissolution is to prevent any new contracts from being made. The agency of each partner for that purpose is terminated. It only remains to pay debts and to close existing transactions. One of the most important cases of dissolution is that caused by the death of a member. The

survivors have no right, as far as the estate of the deceased partner is concerned, to carry on the business. Their duty is to wind it up. The title to the effects, in the view of a court of law, vests in them, so that they should bring suits and do other acts without making the representatives of the deceased parties to the proceeding. Still, in equity the survivors act as trustees, and may be compelled by the representatives of the deceased to account for any proceeds realized from the estate. So if any claims are due from the firm, they should, according to the prevalent American view, be collected from the survivors, unless it can be shown that they are insolvent, in which case the creditor may resort directly to the representatives. The theory in England (which is adopted in some of our States) is different. The partners are deemed in equity to be jointly and severally liable. (See JOINT AND SEVERAL.) The consequence is, that the creditor may proceed directly against the representatives of the deceased partner. Should the survivors, in violation of these rules, carry on the business and sustain a loss, they would be answerable personally; on the other hand, should they make gains, they might be held accountable for them on the general principles of law applicable to trustees. (See TRUSTS.) The contingency of dissolution by death is sometimes provided for in the partnership articles, and the partnership is to continue notwithstanding it may occur. In this case the estate of the deceased will be liable. So if the executors interfere in the management, they may become personally liable for debts. It should be added that the court has a superintending power over the acts of survivors, and may in appropriate cases grant injunctions to prevent any waste of assets, and if necessary appoint a receiver in the interest of creditors and others concerned, who may close up the business. The same general practice is resorted to when a dissolution of the relation is ordered by the court for any reason. The receiver is an officer of the court, and must follow its directions. (See RECEIVER.)

A question frequently arises on a dissolution as to the correct principle to be adopted in appropriating the funds of the partnership to the payment of individual and firm debts when the assets are insufficient to discharge both. It is plain that each partner may have debts of his own growing out of the transaction of his private business. Creditors of this class have a right to be paid from his share of the firm property so long as there are no conflicting claims of partners or partnership creditors. Where there is a contest for priority between the two sets of creditors, justice requires that the partnership creditors should first be paid out of the partnership estate. Were it not so, and could any individual creditor exhaust the share of his debtor, it might happen that after the firm assets had been used the residue of the partnership indebtedness would have to be satisfied from the private estate of the other members of the firm. An inequality of burdens would thus be caused. This would be contrary to the spirit of the administration of equity jurisprudence and to a favorite maxim, that "Equity delighteth in equality." The operation of this rule cannot be prevented by diligent action on the part of the private creditor in the way of collecting his claim. Thus, if he should proceed to judgment, and should sell on an execution the partner's share, the purchaser, while he would acquire the legal title to the portion sold, would in a court of equity be liable as a trustee to the creditors of the firm and the other partners until the partnership accounts were adjusted. If upon this adjustment the entire property was used to pay debts, the creditor of the individual partner must yield his claims. The general rule that in case of insolvency the partnership creditors must be first paid out of the partnership assets has been recognized in the legislation of Congress upon bankruptcy. (See *Revised Statutes of the U. S.*) It has been contended by many jurists that the rule is not complete and just in its action unless a similar preference is given to the individual creditor over the private estate of his debtor. If this proposition be sound, the result is that in case of bankruptcy the partnership creditors should be first paid out of the partnership property, and the private creditors out of the individual estate, and that after the preferential claims had been paid each set of creditors has a secondary claim upon any surplus remaining. This whole rule prevails in the legislation of Congress. However, when there are no partnership assets it is said that the rule will not be applied, and the individual creditors, as well as those of the partnership, will be placed upon an equality as to their claims against the estate of the debtor partner. This last proposition is strongly objected to by some writers as inequitable and unfair. No such rule prevails in favor of private creditors where there are no private assets, and it is urged that justice dictates that the partnership creditors should regularly give way to private creditors in respect to individual assets.

Some reference should be made in this connection to part-owners of ships. These in general are not partners. They are rather to be regarded as tenants in common. On general principles of law one cannot even make repairs against the assent of his associates and charge them for their share of the expenses, though by an early rule this may be done in the case of houses and mills owned by such tenants. Nor can a part-owner sell any more than his own interest. Nor can he insure other part-owners' interest without special authority. The prevailing opinion, notwithstanding some dissent, is that one part-owner has no lien on the share of his associates for any general balance due him for expenditures upon the ship, nor for the carrying on of a specific adventure, unless there has been a consent of the others to the expenditure, so as to form a species of partnership. Ships may, however, like other chattels, be owned and managed by partners, and the general principles of the law of partnership be applicable to them. So part-owners may enter into a partnership for a particular adventure, when they will, for the time being, subject themselves to the rules appertaining to partners.

It is proper to add some further considerations in respect to limited partnerships, briefly alluded to in subdivision I. It was found at an early day in this country that the general rules of partnership law were in many instances harsh and severe. Though one may contribute but to a small amount to the most extensive business, in case of its failure he may have his entire estate taken to pay debts. In legal phrase he is liable *in solido*. To avoid this result corporations are frequently resorted to in order that only the amount contributed to the capital stock may be at risk. On the same general principle the practice was introduced by statute of forming limited or special partnerships on a plan in vogue in France. The statutes on this subject, as adopted in a number of the States, vary in their details. A leading feature of them is that there is a combination of two kinds of partnership—general and limited. In other words, there is at least one active partner, liable on the principle of the common law *in solido*; there are other partners, who take no active part in the business, but contribute to the capital stock, who are liable only for the amount contributed. Publicity is another important element in the case. In an ordinary partnership there is in general no ready means of knowing who the partners may be, nor how much capital they may have contributed. On the other hand, in a special or limited partnership much care is taken to secure full disclosure upon these points. A certificate is to be signed by the partners and properly published in some newspaper, and recorded in some specified public office in the vicinity of the parties' residence or place of business. The office of the certificate is to set forth the nature of the business to be transacted, the names of the partners, distinguishing between those who are general and those who are special, the amount of capital contributed in cash by the special partners, the name of the partnership, and the date of its commencement and of its termination. Much care must be taken to comply with these regulations. As the exemption from liability is provided by statute, if its terms are not substantially complied with the supposed special partners will really be general partners, and be liable *in solido*. Thus, it has been decided in one of the State courts that if the certificate, as published, by an error of a compositor state a different amount from that published in the newspapers as required by law (the amount contributed as stated in the filed certificate being $3000, and that as mistakenly published $5000), there is no special partnership formed, and the contributor is liable as a general partner. Still, merely formal variations from the statute will not be fatal to the existence of the special partnership. For instance, a statement that the special partner has "actually paid in" his share of the capital is sufficient, although the statute requires the payment to be "in cash," the two expressions being substantially equivalent. After the partnership has been formed, special rules continue to govern it. The special partner must not withdraw his capital; his name must not be used in a contract with his consent, nor must he be an active manager of the affairs of the firm. Should these rules be violated he becomes a general partner. This partnership may expire by the lapse of a prescribed time, or it may be dissolved by the action of a court of equity. So it may be renewed by the observance of prescribed statutory forms analogous to those whereby it was created.

(For further information on the general topic of partnership, which is of much commercial importance, consult the treatises of Collyer, Lindley, Bissett, Story, and Parsons, and those of the writers on the more general subject of contracts. See also JOINT-STOCK COMPANIES, CONTRACT, and TENANCY IN COMMON.) T. W. DWIGHT.

Par'ton (James), b. at Canterbury, England, Feb. 9, 1822; was brought to New York in early childhood; educated in an academy at White Plains, where he became a teacher at the age of nineteen; subsequently taught school in Philadelphia and New York; was for some years assistant editor of the *Home Journal;* has been a prolific and successful author, chiefly in the field of biography, and a popular lecturer upon literary, social, and political topics; in 1856 married the well-known authoress "Fanny Fern;" resided in New York until Mar., 1875, when he became a resident of Newburyport, Mass. Among his works are *Biographies* of Horace Greeley (1855; new ed. 1868), Aaron Burr (1857; new ed., 2 vols., 1864), Andrew Jackson (3 vols., 1860), Benjamin Franklin (2 vols., 1864), and Thomas Jefferson (1874), *Humorous Poetry of the English Language* (1857), *People's Book of Biography* (1868), *Smoking and Drinking* (1868), *Famous Americans of Recent Times* (1870), *Topics of the Time* (1871), *Triumphs of Enterprise* (1871), *Words of Washington* (1872), and *Caricatures in all Times and Lands,* in *Harper's Monthly* for 1875. He has for many years been engaged upon a memoir of Voltaire.

Parton (Sarah Payson **Willis**), wife of James Parton and sister of Nathaniel P. Willis, b. at Portland, Me., July 7, 1811; married Mr. Charles H. Eldredge of Boston, a bank-cashier, on whose death she resorted to literature as a means of subsistence; obtained great success by her short humorous essays entitled *Fern Leaves from Fanny's Portfolio* (2 vols., 1853–54), *Little Ferns for Fanny's Little Friends* (1853); wrote regularly for many years for the *New York Ledger;* issued several volumes of collected articles, and was author of two novels, *Ruth Hall* and *Rose Clark.* D. in New York Oct. 10, 1872. (See *Fanny Fern: a Memorial Volume, containing her Select Writings and a Memoir,* by James Parton, 1873.)

Part-Owners (law), in the most general sense, the owners of personal property—goods and chattels—in undivided shares, not being at the same time partners. They cannot transfer nor encumber the entire article, but only their own shares therein. They are not, by virtue of their being part-owners, agents for each other; such agency, if it exist at all, must arise from some other fact than the mere part-ownership. In these respects the interests, rights, and powers of part-owners differ materially from those of partners. The term, although thus defined in a general manner, is almost exclusively confined to the ownership of shipping. A ship or other vessel navigating the ocean is often regarded as divided into a number of equal shares, which are held by different persons, not partners, who together constitute the part-owners. In such a case the majority have the right to employ her in a particular voyage or adventure against the will of the minority, but may be compelled by a court of admiralty to secure such minority, in the amount of their respective shares, against her loss or failure to return. If, on the other hand, the majority are unwilling to use the vessel for any purpose, the minority possess a like authority to control her movements upon giving similar security to their fellow-owners. In the ordinary management of the ship the part-owners are usually represented by certain agents, of whom the most important are the master and the ship's husband, who are clothed with large powers to bind the owners by various species of maritime contracts and liabilities. When such agents have acted within the scope of their authority, and have bound the part-owners by their engagements, the latter are liable therefor *in solido;* that is, all are liable jointly, and each is liable individually, for the whole demand. John Norton Pomeroy.

Par'tridge, tp. of Woodford co., Ill., on Lake Peoria. Pop. 395.

Partridge [Fr. *perdrix;* Gr. πέρδιξ], the English name for *Perdix cinerea,* a representative of the family Tetraonidæ, and typical of a peculiar family; it is applied in some sections to the *Ortyx Virginiana,* or bob-white, etc. (Ortyginæ), and in others to the *Bonasa umbellus,* or ruffled grouse (Tetraoninæ). See Perdicinæ.

Partridge (Alden), b. in Norwich, Vt., about 1785; graduated at the U. S. Military Academy 1806, when he was appointed first lieutenant of engineers; captain 1810; was retained at the academy as assistant professor of mathematics until Apr., 1813, when he was appointed professor, and in Sept., 1813, professor of engineering; commanded at West Point Jan., 1815, Nov., 1816, and Jan. to July, 1817; resigned Apr., 1818, and in 1819 was appointed principal of the surveying party to determine the N. W. boundary of the U. S. In 1820 he founded a military school at Norwich, Conn., which was subsequently incorporated in the Norwich University, of which he was appointed president. He also established military schools in New Hampshire, Delaware, Pennsylvania, and Virginia, and delivered lectures on military matters throughout the U. S. Was appointed surveyor-general of Vermont 1822, and was a member of the Vermont legislature 1833–34 and 1839. D. at Norwich, Vt., Jan. 17, 1854.

Partridge (George), b. at Duxbury, Mass., Feb. 8, 1740; graduated at Harvard 1762; taught school at Kingston for some years; was an active member of the provincial congress 1774–75; delegate to the Continental Congress 1779–85; member of Congress 1789–91, and sheriff of Plymouth co. several years. D. at Duxbury July, 1828, bequeathing much of his property to religious and educational uses.

Par'tridgeber'ry, or **Checkerberry,** the common name of the *Mitchella repens,* a genus of edible berries found in the U. S., Canada, Mexico, and some parts of South America, belonging to the madder family. (See Rubiaceæ.) It is a trailing evergreen, bearing a fruit about the size of whortleberries, which remains on the stem through the winter. The wintergreen (*Gaultheria procumbens*) is sometimes incorrectly referred to this family.

Partridge-wood, a name applied in commerce and the arts to several handsome tropical woods used for veneering and for making small ornamental wares. It is more generally given to the wood of *Andira inermis,* a leguminous tree of the West Indies and South America. This wood is hard, and in Brazil is used in shipbuilding.

Party Wall (law), a wall which stands at or on the line between two adjoining lots belonging to different owners, and in which both proprietors have common rights and a common use. The special circumstance which ordinarily gives it a distinctive legal character is the existence in each proprietor of a double right—an ownership in fee of the portion resting upon his own soil, and an easement in the portion resting upon the soil of his neighbor. If, as is generally the case, the wall is erected upon the line which separates the estates, each owner has an easement extending over the half belonging to the other, and is in turn subjected to the corresponding right held by the other. This easement consists in the right that the wall itself shall remain unimpaired, and shall be used for the support of the two buildings which it separates. From these principles are derived a number of special rules in respect to its use and maintenance, its repair, additions to its height and to its foundations, and its rebuilding when necessary. In several of the States the rights and duties of the proprietors are carefully defined and regulated by statute. John Norton Pomeroy.

Párvatí' [Sansk., "mountain-born"], a female divinity of the ancient Hindoo pantheon, the consort of Siva, and usually identified with Devi, Durga, Kali, and Bhaváni. Her worship, which is widely diffused at the present time, is attended by the most repugnant and terrible ceremonies. (See Hindu Religion, by Prof. John Dowson.)

Pasakenta, post-v. and tp., Tehama co., Cal. P. 356.

Pascagou'la, city and tp., cap. of Jackson co., Miss., situated on an inlet of the Gulf of Mexico, and upon the New Orleans and Mobile R. R., 40 miles from the former place, is a port of entry, and contains 2 academies, several churches, 1 newspaper, 1 foundry, several shipyards, a Masonic lodge, 15 lumber, 3 planing, and a number of shingle and lath mills, and stores. There is a lighthouse at the entrance of the inlet, and good anchorage. Pop. 480. M. Smith, Ed. "Star of Pascagoula."

Pascagoula River, formed in Greene co., Miss., by the union of Chickasawha and Leaf rivers. It flows S. into Pascagoula Bay, a beautiful arm of the Mississippi Sound. The river sometimes floods its valley at high water. It is navigated by small steamboats. Much timber is cut in its pine forests for the New Orleans market.

Pascal (Blaise), b. at Clermont-Ferrand, Auvergne, June 19, 1623, an only son; very early showed himself possessed of the most extraordinary mental gifts. His father resigned his office in the provinces and repaired to Paris in order to give him the best education possible. His mother died when he was only three years old, but with his two sisters he always lived in the greatest intimacy and love. The father was a good mathematician himself, but as he wished that the son should acquire the languages and belles-lettres first, he kept all mathematical books away from him. Some slight circumstance, however, started his genius, and one day the father found the boy pondering over geometrical problems which had risen spontaneously in his mind. The study of Euclid began; and such was the progress of young Pascal that in his sixteenth year he wrote a treatise on *Conic Sections,* which attracted the attention of Descartes, and in his nineteenth year, his father having accepted an office in Rouen as intendant of finance for the province of Normandy, he

invented a calculating-machine to aid him in figuring out his accounts. Meanwhile, Torricelli's theory of fluids drew him from the study of geometry to that of physics, and the results were two admirable dissertations, on the *Equilibrium of Fluids* and on the *Weight of the Atmosphere*, which were not published until after his death, but which mark the beginning of modern physical science. He also undertook the first barometrical measurements, and the report of his experiences involved him in polemics with Father Noël, a scientist of the Aristotelian school, in which controversy the dialectics and definitions of the old school made their last efforts against the experiments and analyses of the new school. After his death a third treatise was found among his papers, in which he demonstrates the principles of the calculus of probabilities; and in 1659 he published under a *nom de plume* his celebrated essay on the cycloid, *Traité générale de la Roulette*, the idea of which came to him under his severe sufferings like a sudden inspiration, and made him forget both sickness and weakness for the eight days during which he put the demonstration down on paper.

While in Rouen, Pascal became acquainted with the Jansenists. Jansen's ideas were gaining ground at this time, especially in France, where they were represented at the Sorbonne by several great scholars and at the Port-Royal by a number of zealous disciples. Jansen's *Oratio de Interioris Hominis Reformatione* impressed Pascal very deeply, and, so to speak, wrought his conversion. Jansen said that science is simply the result of a curiosity which belongs to our lower nature, and contains nothing which is of any essential use for us to know, and this struck Pascal as truth; he confesses that from the moment he began to meditate on human nature and moral questions the abstract sciences, such as mathematics and physics, seemed to him sterile and valueless. He consequently abandoned science and determined to devote himself wholly to the study of religion and morals. Once more, however, he relapsed. His father died in 1651, and the fortune which he inherited, as well as other circumstances, carried him back into the world. He formed plans for different kinds of employment, and thought of marrying, when he again was led to abandon all such ideas, partly by the influence of his sister, partly by an incident which made an overwhelming impression on his mind. He was riding one day across the bridge at Neuilly. The horses became frightened; the leaders plunged into the Seine; and if the harness had not broken, the other pair and the carriage would have followed. From that day Pascal always felt as if there were an abyss beside him, and during the last years of his life he was frequently subject to hallucinations. Delicate and nervous by nature, overwork had early broken his health and strained his whole nervous system. To these circumstances he added in his later years a most rigorous asceticism. He denied himself the help of a servant; he abstained from any but the simplest and coarsest food; he wore an iron girdle around his loins, and whenever an unholy thought entered his mind he would drive the pointed edges into his flesh. He wished to live in prayer, charity, and sufferings, which he considered as the three forms of a true Christian life; and his wish was fulfilled. The last two years of his life were one long agony, broken only by prayers and charitable deeds. D. in Paris in the house of his eldest sister, Aug. 19, 1662. But the more strongly the life of Pascal impresses us on account of its asceticism and extreme enthusiasm, the more admirable seem his two great religious works, the *Provincial Letters* and the *Pensées*. Here are no exaggerations, no extremes; they are the beautiful expressions of a beautiful soul, and they have been read through all following ages and by all Christian denominations with the greatest enjoyment. The *Pensées* is not a finished book, but aphorisms or preparations for a work on religion. They were collected and published after Pascal's death in 1670, but in a mutilated form, everything being omitted that the editor did not understand; and in that condition they remained until 1842, when Victor Cousin drew attention to the fact. The *Provincial Letters* were published in 1656–57. The first three letters are simply a vindication of Antoine Arnauld, the celebrated Jansenist professor at the Sorbonne, whom the Jesuits had succeeded in driving from the school. But the following fourteen letters form a direct attack on the Jesuits themselves. They criticise the morals and policy of the order with a calm, almost humorous, irony, but beneath this calm, almost pleasant, surface lies a deep, implacable hatred. They roused even the most indifferent to attention; and the universal indignation which a century after Pascal caused the expulsion of the order from France is generally ascribed to the *Provincial Letters*. No less striking are the positive moral views which this book contains. It is Pascal who has done away with the moral philosophy of the Middle Ages, which was not much more than a system of definitions of names. In every case he established a connection between the rules of the moral system and the passions of human nature, and by this method established the principle of modern philosophy. It must also be noticed that, according to all French critics, the prose of the French language became finally formed and refined by the writings of Pascal. CLEMENS PETERSEN.

Pascalis (FELIX A. OUVRIÈRE), M. D., b. in France about 1750; became a physician in San Domingo; settled in Philadelphia after the negro insurrection of 1793, and subsequently resided nearly thirty years in New York, where he d. July 27, 1833. Author of several treatises upon medical subjects, and noted for his maintenance of the non-contagious character of yellow fever.

Pas'chal I., ANTIPOPE, a Roman archdeacon, appointed pope by the exarch of Ravenna in 687 A. D. Theodorus II., antipope, was chosen by a faction, but Sergius I. was declared the true successor of Conon, the deceased pope. Paschal was imprisoned as a simonial and pronounced a magician. D. in 694.—PASCHAL III., ANTIPOPE (*Guido di Crema*), b. in Lombardy, became in 1155 a cardinal-deacon, and in 1164 was declared pope by Frederick Barbarossa, whose partisan he was. D. at Rome Sept. 20, 1168.

Paschal I., POPE, b. at Rome, became abbot of St. Stephanus; succeeded Stephen IV. in 817; crowned Lothaire as emperor 823. D. Feb. 10, 824.—PASCHAL II. (*Raniero*). b. at Bleda, Italy, about 1050; was a Cluniac monk; became a cardinal-priest, and in 1099 succeeded Urban II.; was involved in life-long contests with the Henrys (IV. and V.) of Germany concerning investitures. Henry V. kept the pope in prison for some time. Similar troubles with Henry I. of England were settled by a compromise, by which Henry kept the substance of his former rights, but made unimportant concessions to the pope, and similar concessions were made by the king of France. D. Feb. 21, 1118.

Pas'chal Chron'icle [Lat. *Chronicon Paschale;* Gr. Πασχάλιον], an epitome of events, by an unknown author, arranged chronologically from Adam to the twentieth year of Heraclius (A. D. 629), so called from its being compiled in part from the paschal canons (relating to the festival of Easter) of various towns and provinces; it was also called *Alexandrinum*, from having been at one time supposed to be the production of Peter of Alexandria, or otherwise of George of Alexandria. It sometimes, also, is known by the name of *Fasti Siculi*, from having been found in an old library in Sicily, whence it was brought to Rome. Though full of faults in style and matter, it yet affords much valuable chronological material. The Chronicle ended originally, according to Holstein, in the reign of Constantius, with the death of his rival Magnentius (A. D. 354), and was continued thence, with interpolations in the former part, to 629 by a different compiler. Clinton, however, gives reasons for believing both parts to be by one and the same compiler. (*Fast. Rom.*, vol. ii., p. 209.) A list of emperors from Augustus to Constantine Monomachus (1042) is appended, having been removed from the text, as evidently the work of a later hand. The most recent and convenient edition is that of L. Dindorf (Bonn, 1832, 2 vols. 8vo). (See *Vossius de Hist. Græc.*, p. 332; Harles, *Hist. Ling. Græc.*, vol. ii., pt. i., p. 481.) HENRY DRISLER.

Pascua'ro, or **Patzquaro,** town of the Mexican confederation, state of Michoacan, is picturesquely situated on the south-eastern shore of Lake Pascuaro, 7000 feet above the level of the sea; is well built, and has some sugar-refineries and copper-works. Pop. about 6000.

Pas-de-Calais', department of France, borders N. and W. on the Strait of Dover and the English Channel, and comprises an area of 2550 square miles, with 761,158 inhabitants. A range of low hills, rich in coal, iron ore, marble, and slate, traverses the department, ending in Cape Gris-nez, and forming for a distance of several miles along the coast a row of cliffs similar to those on the opposite English coast. On both sides of this range of hills the ground is low, with a very fertile soil, except along the coast, which generally is marshy or sandy. Both agriculture and manufactures are in a very advanced state in this department. Wheat, hemp, and fruits are extensively cultivated; iron-foundries, glassworks, tanneries, mills, and factories are in operation, and important fisheries along the coast are carried on. Of 81,619 children of school age, 13,388 were without school education in 1857.

Pa'sewalk, town of Prussia, province of Pomerania, on the Ucker, manufactures spirits, tobacco, leather, and cloth. Pop. 7414.

Pasha', or **Bashaw'** [from the Pers. *padishah*, "powerful ruler"], in Turkish countries, a high civil, military, or naval functionary. Pashas are of three classes, distinguished as pashas of one, two, or three tails; for the badge of a pasha's rank is the tail of a horse or yak borne as a

standard, those of highest rank having three and those of lowest but one tail.

Pas'kevitch (Ivan Fedorovitch), Russian field-marshal, count of Erivan, prince of Warsaw, b. at Poltava May 19, 1782; was educated as a page at the court of Paul I. at St. Petersburg; entered the army in 1800; distinguished himself in the campaigns against Napoleon, and was made a general in 1814; conducted in 1826 the expedition against Persia and took Erivan; commanded in 1829 a Russian army in Asia against the Turks and captured Erzroom; suppressed in 1831 the revolution in Poland, compelled Warsaw to capitulate, and was appointed viceroy. As such he governed with severity, but with justice; the principles he held were detested by the Poles, but not the man. In 1849 he led the Russian armies into Hungary and quelled the revolution, and in 1854 he commanded the Russian army on the Danube against the Turks. This time, however, he met with nothing but defeat and repulses. He resigned the command and retired to Warsaw. D. Feb. 1, 1856.

Pas'koag, post-v., Burrillville tp., Providence co., R. I.

Pasque Flower [so called, probably, because its petals were used to stain Easter or *pasque* eggs], a name given to *Anemone pulsatilla*, a ranunculaceous herb of Europe and Asia, and also to some other species of Pulsatilla section of the genus. They are spring-blooming plants, with poisonous and medicinal qualities. (See Anemone and Pulsatilla.)

Pasquier' (Etienne), b. at Paris Apr. 7, 1529; studied jurisprudence, and pleaded his first case in 1549; started on a literary career with some poetry in French and Latin, and became celebrated as an author by his *Recherches de la France* (1560), and as an advocate by his defence of the University of Paris in its lawsuit with the Jesuits in 1564. D. at Paris Aug. 31, 1615. There is a collected edition of his works (2 vols., fol., Amsterdam, 1723) and an edition of his *Œuvres Choisies* (2 vols., Paris, 1849).

Pasquinade' [Fr.], an anonymous attack, often in verse, and of bitter, caustic, and witty character. The name is derived from Antonio Pasquino, a cobbler, who lived at Rome towards the close of the fifteenth century, and who was famous for his sharp personal sarcasms. After his death it became customary to post up pasquinades upon a broken statue dug up near where he had lived. The torso was, and is to this day, called by his name. A most popular topic for pasquinades has been the Roman clergy and the public officers.

Pas'quotank, county of N. E. North Carolina. Area, 240 square miles. It is bounded E. by the navigable Pasquotank River, S. by Albemarle Sound, W. by Little River, and extends N. into the Great Dismal Swamp. It is highly fertile, and produces fine crops of corn, wheat, and cotton. Cap. Elizabeth City. Pop. 8131.

Pasquotank River, a navigable stream, rises in the Dismal Swamp, Va., and flows S. and S. E. into North Carolina, entering Albemarle Sound by a broad estuary. Steamboats pass from Norfolk, Va., by way of the Dismal Swamp Canal and the Pasquotank River.

Passadum'keag, post-v. and tp., Penobscot co., Me., on the European and North American R. R. Pop. 243.

Passa'ic, county of N. New Jersey, bounded N by New York. Area, 193 square miles. It is uneven and partly mountainous, with fertile valleys. Manufacturing is the chief employment of the people. Silk goods, thread, cottons, linens, iron castings, iron, machinery, locomotive engines, and a great variety of other goods are manufactured. Grain, garden, and dairy products are the agricultural staples. Iron ore is mined to some extent. The county is traversed by various railroads, chiefly operated as branches of the Erie R. R. Cap. Paterson. Pop. 46,416.

Passaic, tp. of Morris co., N. J., on the Passaic River. Pop. 1624.

Passaic River rises in Morris co., N. J., and after a tortuous course of 100 miles flows into Newark Bay, 3 miles from Newark. It is navigable some 13 miles. At Paterson it has a remarkable fall of some 72 feet, affording a very valuable water-power.

Passamaquod'dy Bay lies E. of Washington co., Me., and S. W. of Charlotte co., New Brunswick. It abounds in good and deep harbors and in fine views. Picturesque islands are numerous and the fisheries are important. Its tides average 25 feet in rise. It receives the noble estuary of the St. Croix.

Passa'rowitz, town of European Turkey, province of Servia, has about 7000 inhabitants, and is historically noteworthy on account of the treaty of peace signed here in 1718 by Austria and Turkey.

Pas'sau, town of Bavaria, at the confluence of the Ilz, Inn, and Danube, consists of three different parts, built on the wooded hills between the rivers and defended by two fortresses and eight detached forts. It has several fine buildings, breweries, distilleries, and manufactures of tobacco. By the treaty signed here in 1552 by Charles V. and the allied Protestant princes religious liberty was conferred on the Protestants of Germany. The cathedral and a great part of the town were destroyed by fire in 1662. Pop. 13,883.

Passavant' (Johann David), b. at Frankfort in 1787; studied the art of painting in Paris and Rome, but devoted himself subsequently to the theoretical and critical treatment of the art, and became inspector of the Städel Museum in his native city, where he d. Aug. 12, 1861. He wrote *Rafael von Urbino und sein Vater Giovanni Santo* (3 vols., 1839–58), *Die christliche Kunst in Spanien* (1853), *Le Peintre-Graveur* (6 vols., 1860–64).

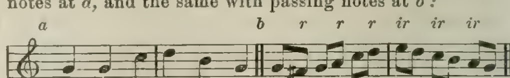
Pass Christian', post-v. of Harrison co., Miss., on the Mississippi Sound and New Orleans Mobile and Chattanooga R. R. Pop. 1951.

Pas'senger Pig'eon, the most common wild pigeon of the Eastern and Central U. S., *Ectopistes migratorius.* It is a fine, graceful bird, 16 inches long, one-half the length being composed by the tail-feathers. It is gregarious, and performs its very rapid migrations solely for the sake of finding good feeding-grounds. It is hunted so much that the enormous flocks so often seen in former years are now rare. The young birds are highly prized as food. Beech-nuts, rice, acorns, and buckwheat are eagerly sought by the wild pigeon, and, in fact, all kinds of grain and seeds. They are often caught in nets. Each bird has been estimated to consume half a pint of grain in season daily.

Pas'seres [*Passer*, "swallow"], a group of birds variously ranked as an order, sub-order, or minor combination of families, and accepted by different authors with different limits. As now generally adopted, it is applied to those families represented by the common song-birds, and distinguished by the structure of the skull and especially maxillo-palatine bones, as Ægithognathinæ, and contrasted by Huxley as Coracomorphæ with the Cypselomorphæ—*i. e.* the swallows, goatsuckers, and humming-birds. It is probably of the rank of a "super-family," and is generally differentiated into a large number of groups called families, but which are probably mostly of less value. No less than 22 of these so-called families are recognized for North American birds—viz. Hirundinidæ, Motacillidæ, Sylvicolidæ, Cærebidæ, Tanagridæ, Fringillidæ, Icteridæ, Sturnidæ, Corvidæ, Paridæ, Certhiidæ, Chamæadæ, Troglodytidæ, Laniidæ, Vireonidæ, Ampelidæ, Sylviidæ, Cinclidæ, Saxicolidæ, Turdidæ, Alandidæ, and Tyrannidæ.

Theodore Gill.

Pass'ing Notes, in music, certain notes in a melody, or in any of the parts in a harmonized piece, which are not radical and essential, but introduced to promote fluency, elegance, smoothness, expression, and ease of execution. By some writers these notes are called *transitions*, or *transient notes.* In the following example, see a series of plain notes at *a*, and the same with passing notes at *b :*



Transitions are of two kinds, *regular* and *irregular:* the former are those which occur on the unaccented and the latter those on the accented parts of the measure. In the example they are marked *r* and *ir*. Wm. Staunton.

Pas'sion-flower, a name in its widest sense applicable to nearly all the species of Passiflora, the principal genus and type of the order Passifloraceæ, mostly climbing plants of tropical America, but especially to *P. cærulea*, and a few other ornamental species in common cultivation. The name is derived from the fancied resemblance of the various parts of the flower to the means of our Lord's passion and death; the nails, the crown of thorns, the five wounds, and even the hammer and the cross itself, having been identified in the blossom. There are nearly 150 species of true passion-flower. Some of these bear edible fruits (called *granadilla*); many have active medicinal powers, and many others are cultivated in greenhouses for their beautiful flowers. Of these the best known is the *Passiflora cærulea*, a native of Brazil. The U. S. have six or seven native species, of which only *P. incarnata* is handsome. Its fruit, called May-pip, is eaten in the Southern States.

Pas'sionists, Congregation of the, an order of the Roman Catholic Church, founded at Ovado, Piedmont, in 1720 by Paul of the Cross (1694–1775). It was con-

firmed by Benedict XIV. in 1741 and 1746, and by Pius VI. in 1775. A house of women was admitted to the order before the founder's death. The Passionists are numerous in the U. S. and Europe. They practise many austerities, and devote themselves to local missions and the work of preaching. The mother-house is on the Celian Hill in Rome.

Passion Plays. See Miracles and Oberammergau.

Passion-Tide, the last two weeks of Lent, the first week of which is Passion Week and the last Holy Week (which see). But popularly, Holy Week is called Passion Week also.

Passive State (or **Passivity**) **of Metals.** These terms are applied by chemists to certain phenomena having a very wide range, and as yet very inadequately investigated, which do not all seem likely to be referred ultimately to the same cause. It is found that a number of the metals which are acted on and dissolved with energy by certain acids and other chemical solvents may under special circumstances become what is called "passive," the action of the acid or other agent being totally suspended, and the metal remaining immersed therein often with a clean, brilliant metallic surface, and having lost entirely the power to decompose the liquid. Strong nitric acid is the solvent that has been best investigated in this relation, though many other agents behave similarly. Keir first observed the phenomenon in the case of iron immersed in strong nitric acid and solution of nitrate of silver, and Schönbein, Faraday, and Herschel have been among its most distinguished investigators. Iron is made passive towards nitric acid of density = 1.2 to 1.35 by a number of different methods. A wire heated at one end till enfilmed with black ferroso-ferric oxide becomes passive, not only where heated, but for a certain distance beyond, showing that it is not the film which merely protects mechanically. If first dipped in fuming nitric acid or in a mixture of weaker acid with oil of vitriol, it becomes passive towards the weaker acid itself. Contact of an iron wire which is being powerfully acted on with another wire in the passive state, or with a platinum or gold wire, will often instantly transform the first wire to the passive condition. An iron wire which is made the positive pole of a voltaic circuit, the negative pole being platinum, becomes passive, and remains so when the current ceases. Phenomena of a similar kind are observed with other metals in too great number and variety to be here detailed, the reader being referred for complete information to Gmelin's *Handbook of Chemistry,* or to Watts's *Dictionary of Chemistry* (under the head of "Electricity" in each work). All the phenomena of passivity are usually referred to *voltaic* action, but it is as yet doubtful whether they are all of this nature; and it must be stated that little or no progress has yet been made towards a clear understanding of their causes. H. Wurtz.

Passom'eter [Lat. *passus,* "step;" Gr. *μέτρον,* "measure"], a little instrument in the form of a watch which, carried about the person of a pedestrian, registers the number of his steps in walking. It has a dial and two index-hands, which latter are driven by a ratchet movement actuated by the inertia of a small pendulous weight made to vibrate by the motion of the walker. F. A. P. Barnard.

Pass'over [Heb. *pesach;* Gr. *πάσχα*], the first and the greatest of the three annual festivals of the Jews, was instituted by Moses in commemoration of the deliverance of the Israelites from Egyptian bondage, and celebrated from the 15th to the 21st day of Nisan, both inclusive, thus falling between our March and April, at the time of the first full moon in the spring. The first and the last day of the festival were kept holy and observed by abstaining from all work, by prayers, hymns, thanksgivings, and other ceremonies, and during the whole period the bread was eaten without leaven, whence the name of the Feast of Unleavened Bread. On the evening of the 14th the Passover lamb was killed by the head of the family. The animal should be one year old, male, without blemish, and it should be roasted entire, with unbroken bones, and consumed entirely in one meal. The blood was sprinkled on the doorsill in commemoration of the night preceding the exodus from Egypt, when the angel went through the country and slew all the first-born, but passed by the houses of the Israelites. The fat pieces were burnt on the altar as a sacrifice, and the family gathered to partake of the roasted lamb, with prayers and hymns and clad in travelling garb. On account of some uncertainty with respect to the fixing of the new moon by the Sanhedrim at Jerusalem, the Jews who lived in foreign countries in "exile" were ordered to celebrate all their festivals on two successive days—a law which is still in force among the orthodox. At present, however, the Passover feast has generally simply the character of a hallowed family feast among the Jews. But as the death and resurrection of Christ coincided with the celebration of the Passover, many of the symbols, commemorations, and ceremonies of this Jewish festival passed into the Christian Easter feast, receiving a broader and more ideal signification. (For an interesting account of the Samaritan Passover, still observed in Mount Gerizim, see John Mills' *Three Months' Residence at Nablus* (1864).)

Pas'sow (Franz Ludwig Karl Friedrich), b. at Ludwigslust, Germany, Sept. 20, 1786; was educated at Gotha and Leipsic; became in 1807 Greek professor at Weimar; was 1810–14 director of the Conradinum at Jenkau: became in 1815 professor of ancient literature in the University of Breslau. D. there Mar. 11, 1833. Published texts and translations of *Persius* (1809), *Musæus* (1810), *Longus* (1811); author of *Turnziel* (1818), an admirable Greek-German lexicon (1819–24; 4th ed. 1831), *Grundzüge der griechischen und römischen Literatur und Kunstgeschichte* (1829), and *Opuscula Academica* (edited by Bach, 1835).

Passpatangy, tp. of King George co., Va., on the Potomac. Pop. 1131.

Pass'port [Fr. *passeport*], a permission to pass through a port (as the Italian *passaporto,* not *passaporta,* shows) into a territory, and hence, generally, to enter into a foreign country whether by sea or land. It is a measure of self-defence to demand from a foreigner a certificate issued by his own government and certifying to his nationality or standing. In war a passport or safe-conduct issued to aliens allows them to enter its borders from a hostile country, and being, as its very nature implies, given for special purposes and to particular persons, must be strictly interpreted. A passport issued in peace, and often given in conformity to a treaty, is simply a statement of what the officer issuing it believes a person to be, but the comity between governments does not always require that the person thus provided shall be allowed admission into the foreign state; for the passport may have been obtained by fraud or the person be peculiarly objectionable. Even a passport honestly obtained is only a *primâ facie* evidence of character and of nationality. Hence, if he should be, as sometimes happens, a citizen of the country where he produces his passport, and should be arrested there on accusation of crime before committed, or for falsely assuming a foreign nationality, his passport could be no protection. T. D. Woolsey.

Passump'sic, post-v., Caledonia co., Vt., on the Passumpsic and Connecticut rivers and Passumpsic R. R.

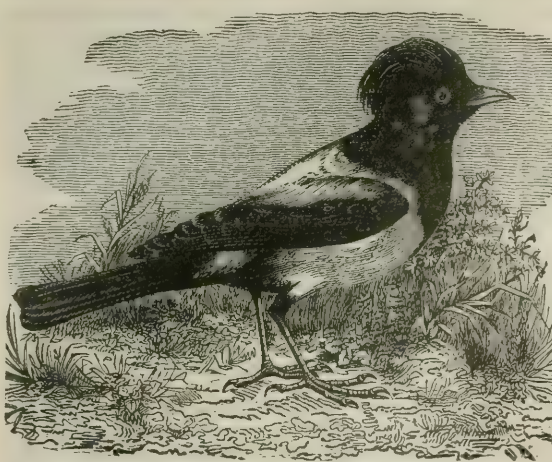
Pas'ta (Giuditta), b. at Saronno, near Milan, in 1798, of Jewish parentage; received her musical education in the Conservatory of Milan; made her début as a singer in 1815 on the minor stages of Leghorn and Parma; sung in 1816 in Paris and London without producing any great impression; returned to Italy and appeared with better success in Venice and Milan in 1819. Her great career began at Verona during the congress of 1822. In the following years she sung with great success in Paris and London, and subsequently in Naples, where Pacini wrote his *Niobe* for her, and in Milan, where Bellini composed his *Norma* and *La Sonnambula* for her. In 1833 she sang for the last time at Paris, but her voice had lost somewhat in strength and passion, its most characteristic qualities. Her last engagement was at St. Petersburg in 1840. She then retired to her villa at Lake Como. D. Apr. 1, 1865.

Pas'tel [Fr.], a colored crayon made of pipeclay or other opaque material mixed with gum-water and some pigment. Pastel pictures are executed on roughened paper and parchment, and the color is generally worked on with the finger. This kind of picture is not generally durable, and has to be protected by glass.

Pasteur' (Louis), b. at Dôle, department of Jura, France, Dec. 27, 1822; studied physical sciences, especially chemistry, and was appointed professor in 1848 at Dijon, in 1849 at Strasbourg, in 1854 at Lille, in 1857 at Paris, where he first was director of the normal school, afterwards professor of chemistry at the Sorbonne. Besides a number of essays in *Annales de Chimie,* he wrote *Nouvel Exemple de Fermentation* ([illegible]), *Études sur le Vin* (1866), *Études sur le Vinaigre* (1868), *Études sur la Maladie des Vers de Soie* (1870). Several of his chemical works have received prizes, and in 1874 the French government gave him a pension.

Pas'to, town of the United States of Colombia, stands in lat. 1° 13′ N., on a fertile plain among the Andes, at an elevation of 8500 feet, and has 8000 inhabitants, mostly Indians and mestizoes, engaged in agriculture and cattle-rearing and carrying on a transit-trade with Quito.

Pas'tor, an interesting genus of starlings, having representatives in Europe and the Old-World tropical regions. They are extremely useful as destroyers of insects, but sometimes are destructive to small fruits. *P. roseus,* the



The Rose-colored Pastor.

rose-colored pastor of Europe, is a handsome bird, a good singer, and a favorite cage-bird.

Pas′toral [Lat. *pastoralis*] **Po′etry** received its name from the circumstance that it chose its subjects from pastoral life. The form is indifferent. Dramas, epics, novels, ballads may all be pastoral. It is the fundamental sentiment of the composition which in this case constitutes the class. But it is a peculiar fact that this feeling of innocence and naïveté, which is so different from the pathos of the tragedy and the humor of the comedy, and which finds its fit materials only in the quiet, secluded life of the shepherd, acquired an artistic expression for the first time in one of the most corrupt and lascivious ages; and the class of poetry which it constituted has ever since flourished most rankly at times and in places where actual life had degenerated into frivolity, licentiousness, and affectation. It was at the court of King Hiero II. of Syracuse (270–216 B. C.), and under the influence of the revival of Greek civilization which took place in Alexandria, that pastoral poetry first appeared as an independent branch of literary or poetical composition. Theocritus was its father. It reached its highest development at the imperial court of Rome, in Virgil's *Bucolica* or *Eclogæ*. By Longus we have a pastoral in prose of the fourth or fifth century, *Poimenica.* In the fifteenth and sixteenth centuries pastoral poetry was revived at the small Italian courts, whence it was introduced to Spain, France, and England. Tasso's *Aminta* (1572) and Guarini's *Pastor Fido* (1590), both in dramatic form, made it the literary fashion, and of what consequence it was in England at that time may be seen from Spenser's *Shepherd's Calendar*, Sidney's *Arcadia*, Fletcher's *Faithful Shepherdess*, Shakspeare's *As You Like It*, etc. Again, in the eighteenth century, it attracted some attention: *The Gentle Shepherd* (1725), by Allan Ramsay, in England, and Gesner's *Idyllen* (1756), in Germany. In France, at the same time, pastoral subjects were employed more frequently by the artists, especially the painters, than the poets; and the manner of the treatment is exceedingly instructive with respect to the true significance and intrinsic worth of this kind of poetry. CLEMENS PETERSEN.

Pastoral Staff, a shepherd's crook of wood or metal, borne by bishops and abbots of the Roman Catholic Church. The archbishop's staff is cruciform and called a CROSIER (which see). The Greek bishops have a staff with the head shaped like a T or a Y. The staff is sometimes very richly ornamented.

Pas′tures, tp. of Augusta co., Va., on the Chesapeake and Ohio R. R. Pop. 3292.

Patæc′idæ [from *Patæcus*], a family of fishes of the order Teleocephali, related to the Blennidæ, and distinguished by the prominent profile. The body is oblong, elevated forward, and much compressed; the skin naked; the lateral line running near the back; the head deflected backward, and with the forehead very prominent and projecting forward; the eyes well advanced; opercula complete and striated; mouth with a small lateral cleft; teeth on the jaws; branchial apertures wide; branchiostegal rays six; dorsal fin very long, commencing above the forehead, and with most of its rays spinous; anal fin moderately elongated; caudal narrow; pectorals inserted very low down; ventrals wanting. This strange form is represented by two species, both of which are found in the Australian seas. THEODORE GILL.

Patago′nia, the southern portion of South America, extending from lat. 39° to 53° S., and bounded N. by the Rio Negro, which separates it from the Argentine Republic, E. by the Atlantic, S. by the Strait of Magellan, which separates it from Terra del Fuego, and W. by the Pacific. The western part of Patagonia is covered by the Andes, which, entering it from Chili, continue their course, parallel with the shore of the Pacific, down to the Strait of Magellan, but decreasing in height from 8500 to 3000 feet. The western slope of these mountains is steep, rugged, and abrupt, and leaves only a small strip of coast-land between its basis and the ocean. A string of innumerable islands, high, rocky, barren towards the ocean, wooded towards the mainland, garnish the whole range of the coast. The principal of these islands are — Wellington, 165 miles long, about 40 miles broad, between lat. 47° 30′ and 50° 5′ S., and separated from the mainland by Mersier Channel; Queen Adelaide, Hanover, the Chonos Archipelago, etc. The climate of this whole region may be described as one continuous rainstorm. The ever-blowing western gales, saturated with the vapors of the Pacific Ocean, are cooled on the tops of the Andes, and discharge their moisture in storms of pouring rain, sleet, and snow, which occur daily and make the country uninhabitable, though in many places they cover the ground with luxuriant vegetation. The trees and plants are generally the same as those of Chili. Ferns, mosses, and lichens predominate, and huge sea-weeds cover the surface of the waters between the main coast and the island. The quinoa, both the sweet and the bitter, which grows in Chili at an elevation of 13,000 feet above the level of the sea, in places where neither rye nor barley would ripen, is also found here, and its seed, which in its chemical composition resembles oats very much, forms in the northern part of the country the chief nourishment of the inhabitants. The eastern part of Patagonia consists of broad terraces, through which the Andes gradually slope down into the low plain which extends along the Atlantic. Numerous rivers descend from the Andes, cross the plains in an eastern direction, and enter the Atlantic, such as the Rio Negro, 500 miles long and navigable throughout; the Chupat; the St. George, also navigable, and forming the outlet of the large lake of Viedma, in lat. 49° 30′ S., and about 100 miles in circumference. The climate here is dry. Rain is rare. The winter is long and cold, and ushered in by hurricanes, which suddenly supplant the scorching heat of the summer. The soil is unproductive, in many places sandy, everywhere strewn with pebbles and boulders, and saturated with salt and saltpetre. Trees are few, but the pastures are in many places good. This country, comprising about 350,000 square miles, is probably not inhabited by more than 120,000 persons, all aboriginal Indians. The Patagonians are tall, bulky, and muscular, with black eyes and black, coarse hair, thick lips, and a skin of a reddish-brown color, hideously painted and greased over, and clad only in a mantle or cloak of skin. They live as nomads, and in some places cattle are reared; their chief occupation, however, is hunting, and they are unsurpassed in horsemanship and the handling of the arrow, ball, and bow. They worship a god of the good and a god of the evil, and all that happens, the hurricane and good-fortune in hunting, is considered as directly sent by one of these two gods, and directly referring to their own past actions, either as rewards or as punishments. They are utterly averse to Christianity, uncontrollable in a state of passion, and passionately fond of strong drink. Travellers describe nine tribes of Patagonians living S. of the Rio Negro—the Poyuches, Puelches, Cuilliheches, Chenches, Cañecaneches, Chaoches, Huilliches, Dilmaches, and Yakanaches—all speaking the same language, but with slight modifications. Their favorite food is horseflesh and the blood of animals; they have cooking utensils, but they generally prefer to eat their meat raw. The country was discovered by Magalhaens in 1520; he called it *Patagonia* ("large-footed") from some huge footprints observed on the coast and ascribed to the natives. It was visited by Drake in 1578, by Byron in 1764, by Cook in 1774, and recently explored by Darwin in 1834 and Musters in 1869. CLEMENS PETERSEN.

Pa′tanjala. See HINDU PHILOSOPHY.

Pataps′co River rises in Carroll co., Md., flows 80 miles S. and S. E., and enters Chesapeake Bay by a fine estuary, on which stands Baltimore. In its upper course it is very rapid, affording much water-power. Its estuary admits first-class ships.

Pataska′la, post-v. of Lima tp., Licking co., O., on the Pittsburg Cincinnati and St. Louis R. R., and Central Ohio division of Baltimore and Ohio R. R. Pop. 462.

Patch Grove, post-v. and tp., Grant co., Wis. Pop. of v. 177; of tp. 829.

Patchogue′, post-v. of Suffolk co., N. Y., 54 miles E. of Brooklyn (L. I.), has 3 churches, 1 paper and 2 cotton twine mills, stores, and a fish and oyster trade, there being a natural bed of "Bluepoints" here. Pop. about 3100.

Patchou′li, the *Pogostemon patchouli*, a labiate plant of Southern Asia. It is extensively used in perfumery and against the ravages of clothes-moths. The Orientals use it for stuffing mattresses and to ward off contagion and vermin. They also mix it with tobacco for smoking.

Patel′la [Lat.], or **Knee-Pan,** a probably sesamoid bone found in the tendon of the quadriceps extensor muscle of the thigh, just anterior to the knee-joint. It is considered by some anatomists to be the homotype of the olecranon process of the elbow; if so, it is not truly a sesamoid bone, but a part of the true neuro-skeleton. It develops from one or two centres. It does not begin to form until the child is from three to six years of age.

Patent Laws, History of. The practice of inciting inventors to improvements in arts and industries by giving them exclusive control for a limited time is of remote origin, but of this origin the data is so scant that neither time nor country can be given. So far as concerns modern jurisprudence, however, it was first adopted by the English, and the common law gave to the king the power of granting such privileges. But this power was abused, and patents were granted not only to projectors who deserved them, but to favorites and venal speculators, who thus obtained monopolies of the traffic in many of the necessaries of life and not a few of its conveniences, the right to which had existed in the public from time immemorial. The term *patent* was thus early applied indiscriminately to the rightful privileges by which inventors were rewarded for creating new and valuable improvements which had never belonged to the people, because they had never before existed, and to the wrongful monopolies, like those for the sale of salt, currants, vinegar, potash, pilchards, and many other articles, the right to traffic in which had always and undeniably belonged to the public. Confusion was thus created in the popular mind between a patent for an invention, which is right and proper in itself, and a monopoly in previously-known articles of trade, which is manifestly a violation of the common law and of natural justice. It was the latter class of patents, the wrongful monopolies, that constituted the inciting cause of the Great Revolution. And the same enactment, the famous Statute of Monopolies, that swept away the arbitrary and unconstitutional power of the British kings excepted from its operation the patents granted to inventors. It is upon this recognition of the rights of inventors that the patent laws of all lands ruled by the Anglo-Saxon race are based to-day. And as this statute did not establish, but confirmed, the practice of thus encouraging improvements in the useful arts, such practice may be traced unbroken from the complex systems of statute jurisprudence and equity practice of fifty-eight nationalities, states, and colonies to-day back to the time when Edward III. issued the first recorded patent to "two friars and two aldermen" for an alleged discovery of the philosopher's stone. But the separation of patents for new inventions, rightfully granted to those who added to the wealth of their country by increasing its industrial resources, from the wrongful monopolies that crushed the people, was a matter of slow growth. It may be said to have first taken positive and decided form in a hot debate in Parliament on Nov. 20, 1601, in the reign of Elizabeth, and it ended only with the dethronement of the Stuarts. But the Statute of Monopolies in 1623 (21 James I.), although it did not end the struggle, defined and made clear the principles of the common law. For by this last "the Crown, as the patron of science and art, and guardian of the common weal, had power to grant many privileges," even "although, *primâ facie*, as it was said, they appear to be against the common right; the *consideration* was the invention of a new manufacture or the introduction of a new trade; the grant could only be by charter or letters patent, and the term of privilege was to be reasonable." (See *Coryton on Patents*, p. 27.) The earliest form of these privileges was that of "conducting exclusively *new* trades, or dealing in objects of commerce *hitherto unknown*, as a *reward* and *encouragement* to parties introducing them." The common-law granting of patents has, it may be remarked, an apt illustration in the Scottish practice, for in Scotland, up to 1852, patents were issued to inventors in the total absence of a statute on the subject.

The common-law origin of patents for inventions is, moreover, a matter of much interest in its connection with the like origin of copyrights (which are simply patents under another name and applied to another class of objects) for literary productions, etc. Some of the earliest recorded of English patents were in reality nothing more nor less than copyrights protecting literary property, and some of these were far less defensible on grounds of public policy or of abstract justice than any patent ever granted for a *bonâ fide* new and useful invention. In 1539 a patent to Lord Cromwell gave him for five years an exclusive right to print the English Bible. In 1551, Laurentius Torrenti was given a seven years' patent for printing the *Pandects* and *Digests* of Justinian, and two years later Richard Tuthille secured a like grant of printing "all manner of books of the temporal law called the common law." Other patents of a similar kind were granted about the same time, and in 1556 the Stationers' Company of London received a charter far more in the nature of an unjust monopoly, using this term in its most odious sense, than was ever claimed for a new and useful improvement in the arts. This company found some difficulty in enforcing its claim against certain reserved rights of the Crown, but nearly half a century later obtained "the exclusive right of printing primers, psalters, psalms, almanacs, and prognostications." On Mar. 3, 1615, the nominees of Edward, Lord Morley, received the privilege of "the sole printing of a small book entitled *God and the Kinge*," and in 1617, seventeen years before the first patent granted in England for a mechanical improvement in the art of printing (that of Arnold Rotsipen for a printing engine), the attorney-general issued an injunction to restrain infringements upon a patent granted to the same Edward, Lord Morley, for the sole printing of a book *On the Oath of Allegiance.* Other like patents bear date Apr. 26, 1630, Aug. 18, 1635, May 12, 1641 (this last to confirm to the heirs of Sir Edward Coke the sole privilege of printing his works on jurisprudence), June 4, 1642, etc. etc. In Nov., 1644, both houses of Parliament "made an ordinance which prohibited printing unless the book was first licensed and entered on the register of the Stationers' Company," *or printing any book without consent of the owner, or importing if published abroad* —a provision that was substantially confirmed by the Long Parliament in 1649, and which made copyrights as much a creation of statute as the act of 21 James I. had made patents for inventions a creation of the statute—no more, no less, both having a common-law origin, both subsequently recognized, defined, and controlled by legislation. I have spoken of the patent of Arnold Rotsipen, the first granted in England, and I presume in the world, on improvements in printing machinery. This was dated June 24, 1634, and on Nov. 1 of the same year protection was afforded to "John Day Grant, citizen, fishmonger, and broom-broker of the city of London;" and as this last-named patent illustrates the identity which at that time existed between patents for inventions and copyrights for literary productions, I quote *verbatim* the language of the official abridgment of his patent, which was, "for the sole printing of the weekly bills of the prices of all foreign commodities for the term of fourteen years." We may pass from this to the even clearer case of copyright embraced in the patent granted Aug. 18, 1635, for a term of twenty-one years to "William Braithwaite, reader and schoolmaster, for the sole printing and sale of his books containing an easy method" of teaching devised by him. In 1709 an act (8 Anne, c. 19) of Parliament provided that after Apr. 10, 1710, "the authors of books already printed who have not transferred their rights, and the booksellers, etc. who have purchased copies, to have the sole right of printing them for twenty-one years. The authors of books not printed to have the sole right for fourteen years. . . . Copies of books to be entered before publication in the register-book of the Company of Stationers. . . . After the fourteen years the right of printing, etc. to return to the author, if living, for other fourteen years." This was virtually the then existing patent act applied to books, except that the places of registry were different, and the term of a patent for an invention and for a copyright on a book were, by virtue of reversion, twice as long in the latter case as in the former. Indeed, the only material difference in the previous status of patents for inventions and for copyrights had been in the fact that in the one there was no specified limit, in the other the term had been set by the act of 21 James I. at fourteen years. And at the present time the substantial identity in principle and practice between a patent commonly so termed and a "copyright" is illustrated by this, that an industrial design that in England and Canada is secured by copyright, in the U. S. is protected by a "patent." That patents and copyrights were, in this country, from the outset considered as identical in character is shown by that paragraph of the Constitution upon which all Federal legislation concerning either is necessarily based, and which reads as follows: "Congress shall have power . . . to promote the progress of science and the useful arts by securing for limited times to *authors and inventors* the exclusive right to their respective *writings and discoveries.*"

I have considered this subject of the common origin of patents and copyrights not without reason. At the present time international copyright is attracting wide attention and the approval of all judicious thinkers; at this time also the patent laws, both in this country and abroad, are subject to the onslaughts of a class that, however sincere, are misled and mistaken as to the nature, tendencies, and results of the grand system of jurisprudence that they assail. It would seem that authors, themselves protected by the legal application of the great ethical principles that underlie the granting of patents for inventions, should be the foremost to defend the latter against attack. But by every one who has discussed the subject, from Thomas Noon Talfourd to Charles Reade, a fictitious antagonism has been created between the two systems. Patents for inventions and copyrights for books had a common origin, they rest upon the same basis, they must stand or fall together, and together they should receive the mutual support of the men whose genius for industrial improvement has made the material progress of the age, and of the writers whose genius has added to that progress the wealth of artistic, scientific, and literary advancement.

With patents for inventions, as with patents (copyrights) for books, the early procedure was crude and imperfect, but developed and expanded to meet the requirements of successive periods. The earlier patents were based upon the condition that the invention be *worked* within the realm, this *working* being the consideration paid by the patentee for the protection afforded. In some cases a tax or a portion of the profits were paid to the Crown—the former still a feature of the British patent laws, from which it has passed to those of France and Belgium. But the secret of the invention was not required to be revealed until after the expiration of the patent. From this it resulted that the inventor frequently succeeded in keeping his invention from the public even after the expiration of the term, and hence the *making known* of the invention became, subsequently, an essential part of the consideration for which the patent was issued. To this end it was at a very early date required as a preliminary to the issue of a patent that the inventor should place on record a description of his invention so "full, clear, and exact" that any one skilled in the art could proceed to put it in practice, and so definite in its statements as to clearly distinguish between what is new and what is old. For this purpose drawings are commonly essential, and the necessity of accuracy in the preparation of the descriptions, termed "specifications," has established a special class of practitioners termed patent agents or solicitors, who devote themselves to this special pursuit. The development of the patent law has been coincident with that development of the industries which has been due for the most part to the law itself. The earliest triumphs of modern invention, Watt's steam-engine, Arkwright's spinning-machinery, Cort's puddling process, Dudley iron manufacture, furnished in the litigation of the patents thereon the established precedents upon which the decisions of courts in patent cases all over the world are based. Previous to 1852 the British patent law related only to England. Scotland, as previously remarked, granted patents under the common law; Ireland had a separate patent law so costly and imperfect that many British inventors lost their inventions in the latter island before they could patent them there. In 1852 this was remedied by the law still in force, which embraces in one patent "England, Scotland, Ireland, the principality of Wales, the Isle of Man, and Berwick-upon-Tweed." The British patent law has from the beginning placed the introducer of a new improvement on the same footing as an original inventor. It requires no preliminary examination to determine the question of novelty, and declares a patent invalid if the invention has been previously publicly known in the realm. The cost of obtaining a British patent, including charges of competent and responsible agents, is about £60 sterling, or $300, gold. A tax of £50 is exacted at the end of three years, and another of £100 at the end of seven years. The full term is fourteen years. The cost is high, but, on the other hand, no models are required, and very frequently a single British patent may be made to embrace inventions that would require half a dozen U. S. patents to protect them. This last remark applies, moreover, to European patents generally.

The patent system of Great Britain was the parent stem from which all others have sprung, our own the earliest. In 1641 the general court of Massachusetts granted a ten years' patent to Samuel Winslow for a process of making salt. In 1652 the superior court decreed to John Clark a royalty of ten shillings from every family who should use his method of "saving wood and warming houses at little cost" during a period of three years—a privilege afterward confirmed to him during life. A twenty years' patent in the same colony was granted to John Winthrop, son of Governor Winthrop, in 1656, for a process of making salt. In 1672 the printed statutes of Connecticut provided that "there shall be no monopolies granted amongst us but of such new inventions as shall be judged profitable and for the benefit of the country, and for such time as the general court shall judge meet." In 1728, Connecticut granted a ten years' patent to Samuel Higley and Joseph Dewey "for the sole practice of the art of steel-making." A patent had previously been granted for a mill for slitting iron on "Stony Brook." In 1774 a *forty years'* patent was granted to John Shipman for a grist-mill within the town of Saybrook and 10 miles westward of Connecticut River. Most of these contained clauses that excluded rival establishments within their territories. As early as 1753 a Connecticut patent was granted to Jabez Hamlin and Elihu Chauncy for the *introduction* of a "new water-machine for dressing flax," brought from abroad; the term was fifteen years. Massachusetts and Connecticut were therefore the pioneers in the transplanting to this country the British system, although similar examples are found in the other colonies (or States) up to the time when the first U. S. patent law, the act of 1790, came into force.

The statute of 1790 provided for the granting of letters patent on "any useful art, manufacture, engine, machine, or device, or any improvement therein, not before known or used." The petition for the grant was to the secretary of state, the secretary of war, and the attorney-general. The patent was issued on the approval of these officials or any two of them. The description of the invention was certified by the attorney-general, and the President caused the great seal of the U. S. to be affixed on the issue of the patent. The term of the patent was for "any term not exceeding fourteen years" in the discretion of the aforenamed members of the cabinet. Although discretionary power was vested in these last, no preliminary examination to determine actual patentability was, in practice, instituted by the act. Provision was duly made for punishing infringers, the English idea of patentable novelty substantially adopted, and a schedule of government fees, that, exclusive of 10 cents per 100 words for copying specification on filing same, amounted to $3.70. A patent could be issued "to any person," no distinction between citizens and foreigners being made. In 1793 a new statute was passed, repealing that of 1790, although retaining much of its substance. This act of 1793 restricted the grant of patents to citizens of the U. S.; provided that the petition should be to the secretary of state; that owners of patents from any State should be incapable of holding a patent from the U. S. except on condition of relinquishing the State patent; that interfering applications should be decided by arbitrators; that patents obtained "surreptitiously or upon false suggestion" could be declared void on motion made and proof produced before the U. S. district court of the district wherein the patentee resided, if made within three years from the date of the patent, but not afterward; and provided further that the government fee paid by applicant for a patent be thirty dollars. This act of 1793 also provided that infringers should pay at least triple damages to the patentee. In 1794 a supplement permitted parties to suits set aside, suspended, or abated by the act of 1793 to revive them. Another statute, adopted in 1800, provided that the applicant should make oath that to the best of his knowledge or belief the invention had not been previously known or used "either in this or any foreign country;" and such knowledge or use either at home or abroad was made to render a patent utterly void. This act extended the privilege of obtaining patents to aliens who had resided within the U. S. for a period of two years previous to the date of their petition. In 1819 another amendment to the law provided "that the circuit courts of the U. S. shall have original cognizance, as well in equity as at law, of all actions, suits, controversies, and cases arising under any law of the U. S. granting or confirming to *authors* or *inventors* the exclusive right to their respective *writings, inventions,* or *discoveries.*" In 1832 another act provided for the publication of lists of expired patents annually in two newspapers in the city of Washington. The same statute made certain regulations concerning applications for extension of patents by Congress, and also established the practice of reissuing defective patents in order to better protect actual inventors against the results of accident, inadvertence, or mistake in the original application. Another act of the same year permitted all aliens who at the time of petitioning for a patent were residents of the U. S., and had declared their intention of becoming citizens, to secure patents, but rendered their patents void if the invention was not worked within one year of the date of the patent, or if the working thereafter ceased during a period of six months, or if the alien failed to become a citizen in due course. These several acts were repealed by the act of 1836, which, while

retaining many features of the old law, introduced many changes. It attached to the department of state "an office to be denominated the patent office, the chief officer of which shall be called the commissioner of patents." There was also provided a chief clerk of the patent office, who acted for the commissioner in his absence. This law was the first to institute the system of preliminary examinations to determine the patentability of inventions before issue of patents thereon, and from the single examiner appointed under it has come the immense staff of examiners and the complicated system of examinations, appeals, etc. that now obtains, and which, while undoubtedly productive of much good, has just as undoubtedly been the means of robbing many a poor inventor of the rights that belonged to him in justice, equity, and law. This statute provided a board of appeal, to which appeal could be had from adverse decisions of the examiner and commissioner. Aliens resident in the U. S. for one year, and who had made declaration of intention to become citizens, were allowed to take out patents for the same fees as citizens; but if a subject of the king of Great Britain, the fee was $500, and to all other foreigners $300. This law provided also for the filing of caveats on partially-perfected inventions, confirmed the right of reissue, fixed the standard of damages in infringement cases at the actual damages, except where exemplary damages were held by the court to be warranted, and in such cases limited the award to three times the actual damage; and placed the power of extending patents for an additional term of seven years after the expiration of the original fourteen in the hands of a board composed of the commissioner of patents, the secretary of state, and solicitor of the treasury. In 1836 the patent office was burned and many of the records lost. The act of 1837 provided for the restoration of the records by refusing recognition in any judicial proceeding to a previously-existing patent unless a true copy of the same was filed in the patent office. This act also provided for the filing of disclaimers where patent claims were found to be too broad. It also permitted a foreigner to withdraw two-thirds of the fee paid in case his application for a patent was rejected. The act of 1839 was chiefly notable for its proviso that "no patent shall be held to be invalid by reason of purchase, use, or sale prior to the application for a patent, except on proof of abandonment of such invention to the public, or that such purchase, use, sale, or prior use has been for more than two years prior to such application for a patent." This act also provided for appeals from the commissioner to the chief-justice of the U. S. court for the District of Columbia. The act of 1842 provided for the issue of patents for terms of seven years on designs, and on "busts, statues, or bas-reliefs or compositions in alto or basso relievo," and "any new or useful pattern, print, or picture." Recent legislation, it may be remarked, has placed industrial designs within the protection of the patent office—other items than those above indicated under protection of copyright. But the language of this act shows what has been the case from the first—that in all essentials patents and copyrights are the same in principle, rest on the same basis, and no distinguishing line can be drawn between them. The act of 1848 placed the power of extending patents wholly in the hands of the commissioner of patents. In 1849 the patent office was transferred from the department of state to that of the interior. An act passed in 1852 permitted appeals to be made from the commissioner to the assistant judges of the U. S. district court of the District of Columbia in the same manner as previously to the chief-justice. The act of 1861 (12 *Statutes at Large*, 130) provided that writs of error lie to the Supreme Court of the U. S. in all cases arising "under any law of the U. S. granting or confirming to authors the exclusive right to their restrictive writings, or to inventors the exclusive right to their inventions or discoveries," without regard to the sum or value in controversy. Another act of the same year (12 *Stat. at Large*, 246) repealed previous laws, while retaining in itself much of their substance. The important changes made by this statute were the extension of the term of patents from fourteen to seventeen years; the abrogation of extensions by the commissioner; the compulsory attendance of witnesses in patent cases; the establishment of a board of examiners-in-chief, intermediate between the examiners and the commissioner, to hear appeals from the decisions of the former; the repeal of the provision permitting withdrawal of two-thirds of the fee in case of rejection, and the sweeping away of all distinctions between citizens and foreigners in the granting of patents. This last-named change was subject to the proviso that it should not apply to citizens of countries discriminating against American citizens in the grant of patents; Canadians therefore were compelled to pay a fee of $500 until the passage of the Canadian patent law of 1872 removed the objection. The act of 1861 made an important change in the payment of fees, fifteen dollars being payable on the application, and twenty dollars on the issue of the patent. In 1870 a new statute replaced the old. It made but few changes, and these mostly for the worse. In one respect, however, it caused a decided advance in the utility of the patent office by providing for the printing of all patents as fast as issued. Brief abstracts, together with decisions of the courts in patent cases, decisions of the commissioner, etc., are published weekly in the official gazette. The reports of the commissioner of patents, formerly published annually, contained, from 1842 to 1849, inclusive, but the most imperfect notices of a few of the patents granted; from 1850 to 1852, inclusive, the claims only; in 1853 rude wood-cuts, white lines on black ground; from 1854 to 1869, inclusive, good line engravings with the claims, except that no engravings appear for the latter half of the last-named year; in 1870 and 1871, the claims, with short descriptive "briefs."

I had intended to include in this a sketch of the gradual adoption of patent laws in the various countries of Europe from the year 1791, when France, the earliest among continental nations to adopt the system, enacted her first statute on the subject. But the length this article has already reached prevents. Wherever patent laws have been fairly tried they have produced but one result—the quickening of industries, the creation of wealth, the cheapening of all the necessaries of life, the bringing of luxuries within the reach of the poor, the diffusion of knowledge, the rapid but normal growth of every element of national prosperity or individual good. It would be difficult to find an important invention made during the past two centuries and a half that has not owed its existence to the patent laws, for there is scarcely an inventor in all the records of the industries who has not looked upon the rewards offered by the grant of letters patent as the inciting cause of his efforts, the tangible form in which the fruits of his labor should come. These laws, based upon the first principles of justice, and proved expedient by the experience of 250 years, have turned the energies of the masses to the search for improvements in every handicraft under the sun; they have trained multitudes of men to the special work of invention, as the copyright laws have trained other multitudes to research and original thought in other departments of intellectual work. In unnumbered instances they have lured the sons of genius through the darkness of adversity, the bitterness of hunger and cold, with the fair promise of success, and have offered to wealth the most brilliant inducements in the fostering of industries and arts. But grand as is the system, and colossal as its results undeniably are, the laws of almost every country need more or less of reform to better adapt them to the complex conditions of the greater advancement which those laws have produced. There are fifty-eight nationalities and self-governing colonies that have adopted patent laws, and with all its defects that of our own country is beyond question the best. But the practice that seemed good a quarter of a century since is now proved by experience to be in some respects fallacious, and there is no more worthy field for the effort of the jurist than exists in the remedy of defects without injury to the organic structure of the present law. Few who are familiar with the working of the existing system can doubt that its utility, both as concerns the inventor and the public, would be vastly increased if the onerous tax of a model in each application were done away with; the absurd definitions of "patentable novelty" that encrust the practice of the patent office should be superseded by the correct idea that every invention, really new and really useful, is the proper subject of letters patent; the right of direct appeal in interference cases from the commissioner to the district court of the District of Columbia be restored: the rejected applications closed against access of the public; the reissue of patents permitted upon the specification as well as upon the drawing, and the full publication (after the manner of the British patent office) of all patents that have been granted from the organization of the system, carried into effect. The necessity for these changes is growing more imperative every year, and their adoption would leave but little to be desired in a beneficent system that, founded on the principles of ideal justice, has done more than any one other branch of jurisprudence to promote and enrich the practical arts of life.

JAMES A. WHITNEY.

Patents [Lat. *patens*], **Laws relating to.** A patent for an invention is a declaration by the government defining what an inventor may be protected in the use of, and for what length of time. It consists of appropriate language of the grant and a description of the invention patented. Patent laws are laws which prescribe under what formalities and conditions patents may be granted, and provide for enforcing the protection which the patent grants.

A patent to a first inventor is not, as is often erroneously supposed, a grant of right to the *invention*. It is merely a grant of right to *protection* in the exclusive use of the invention. An inventor has a right to use his invention without a patent. He needs a patent and the aid of patent laws only to vest him with power to exclude others from the use of the invention. The grant of protection to an inventor in the exclusive use of his invention for a limited time is so well founded in justice and public policy that, although not of remote origin, it has been adopted by all civilized nations. There are now at least nineteen governments where there is a regular system of patent laws to secure such protection, and in nearly all of them the protection is granted to the first inventor. In England it is granted to the first introducer of the invention, whether he be the inventor or an importer of the invention. In most countries this protection is granted on condition of a forfeiture of the right unless the invention be put into use by the patentee within a specified time. The length of time for which the protection is granted in different countries varies from three to twenty-one years, but is generally limited to the shortest term during which protection, if any, has been previously granted for the same invention in any other country. The effect of patent laws being to reward the inventor according to his merits by securing to him, for a limited time, the benefit of his own productions, they are well calculated to stimulate inventive genius and render it a source of national wealth and power, and especially so when, as in this country, they have the aid of general education among the masses of the people. This is well illustrated by the work of American inventors. Previously to Oct. 1, 1874, 168,947 original patents were granted in the U. S., of which about 6500 were for improvements in machinery for weaving and in textile fabrics, 6000 for improvements in carriages and wagons, 4000 for improvements in firearms and blasting, 3500 for improvements concerning railways, 2500 for improvements in the art of printing, and 2000 for inventions in sewing-machines. On an average over 215 original patents now issue weekly from the U. S. Patent Office. The authority for the patent laws in this country is the clause in the Constitution of the U. S. which declares that Congress shall have power "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." In consequence of this delegation of power by the several States, all legislation on the subject of patents for new inventions belongs to Congress, and by such legislation the exclusive jurisdiction for the administration of the patent laws belongs to the Federal courts. Neither State legislatures nor State courts have anything to do with either making or executing them. In the exercise of the power thus delegated, Congress passed its first general patent act in 1790, and its last one in 1870.

For what Subjects-Matter Patents may be granted.—The act now in force provides "that any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereof not known or used by others in this country, and not patented or described in any printed publication in this or any foreign country before his invention or discovery thereof, and not in public use or on sale for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the duty required by law and other due proceedings had, obtain a patent therefor." It will be noticed that, by the language of the Constitution, Congress was given power to secure to inventors the exclusive right to their "discoveries," while the statute purports to secure what has been "invented or discovered." As the statute puts "invented or discovered" in the alternative, thereby indicating that Congress understood those terms to refer to different things or to things of different origin, it appears as if Congress had exceeded its authority in providing protection for *inventions* as well as for *discoveries*. But notwithstanding this disjunctive use in the statute of the terms "invented" or "discovered," the courts have held that, with reference to patentable subjects-matter, *discovery* is synonymous with *invention*, and such, from previous adjudications which had taken place in England, was well understood to be the import of those terms at the time of the adoption of the American Constitution. The word "discovery," as used in the Constitution and patent laws, does not mean a discovery of an abstract law or fact, but such a discovery only as is inseparable from invention. There cannot be invention without discovery. The ascertainment of the relation between the thing to be done and the means of doing it must of necessity involve discovery. Some inventions are produced which are chiefly the result of accidental discovery, requiring very little study or experiment, while others are the result of long and laborious research. It will be noticed that only four classes of patentable subjects-matter are mentioned in our statute; but these are sufficient to comprehend patentable improvements of any kind. In the English law only one was mentioned, being "manufacture," but the courts of England by construction give that one term sufficient scope to embrace all kinds of patentable subjects-matter. As used in the statute, the term "machine" includes all kinds of mechanism, whether machines proper or apparatus which have a mode of operation in working out or producing a result. The term "manufacture," according to the patent laws of this country, includes all kinds of useful articles which are made, except machines and compositions of matter, such, for example, as fabrics, tools, implements, wearing apparel, household furniture, etc. The designation "composition of matter" includes all kinds of mixtures or compounds of substances, such as medicines, articles of food and drink, perfumeries, paints, dyes, etc. The term "art" comprehends all methods and processes which may consist of modes of procedure with or without new ingredients or materials. It is often difficult to determine to which of the four classes of subjects-matter mentioned in the statute an invention belongs. Some of them merge into or overlap each other so that the line of separation becomes obscure to such an extent that an invention may properly be ranged under either of two classes. It sometimes happens that a new article is such that it may be designated either as a new manufacture or a new composition of matter, and it is often such that it may be regarded either as a new apparatus or a new manufacture. But this difficulty produces no inconvenience in practice, because when it occurs the law will be satisfied by the invention being arranged under either class. As both new articles of manufacture and the means of producing them are patentable, it frequently happens that an inventor is entitled to separate patents for three kinds of subject-matter, all having reference to the same production. When the article is new, he can patent *that* as a new manufacture; when the method of producing it is new, he can also patent *that* as a new process; and when the mechanism used in the process of producing the article is new, he can also patent *that* as a new machine or apparatus, and thus have three patents, one for the article, one for the machine that produces it, and a third for the method or process of production.

To whom Patents may be granted.—In this country, with one exception, he only is entitled to a patent who is the first inventor. The statute says "original and first inventor," but obviously the word original is superfluous, because, if one is the first inventor, he must be an original inventor. The exception referred to is that an applicant for a patent need not be the first inventor as against a mere prior knowledge or use in a foreign country, provided he believe himself to be the first inventor at the time of making his application for a patent. Patents may be granted to first inventors, whether individual or joint, or to their assignees, executors, or administrators, and to foreigners and citizens on the same terms.

What constitutes Patentable Inventions.—The mere conception of an idea is not patentable. An invention, to be patentable, must be completed ready for use without the addition of further invention or the necessity of further experiment. It must be so matured that the means of producing the result can be accurately and fully set forth. Mere experiments equivocal in their results are not patentable. When the invention consists of a process or of a composition of matter, it is not necessary, in order to entitle its author to a patent, that he should understand the rationale of the chemical changes involved. He has brought such an invention to a patentable condition when he has ascertained what articles are to be used and how they are to be used to produce the desired result. Some inventions are new in kind, while others are only new as improvements on something which in kind had prior existence. The former are patentable much more broadly than the latter. When an invention consists of doing by a machine what had previously been done by hand only, or had never been done at all, it is new in kind. The first sewing-machine and the first recording telegraph are instances of inventions which were new in kind. To give an invention patentable novelty it is immaterial whether it was the result of much or little or any research or labor. The law does not rate inventions according to the quantity of attention and time bestowed upon their production, but according to their nature. The patentability or non-patentability of an invention is to be determined from its character. How it was arrived at is immaterial. An invention or discovery made by accident is none the less patentable. New combinations of either new or old elements are patentable, but a combination of old elements, to be patentable, must produce some new result due to the co-operative or reciprocal action of the combined parts.

The mere addition of one old device to another, each producing its own result in such manner that their combination produces those same two results and no other, is not patentable, and is not invention. Any part in a machine which does not participate in the mode of operation of the machine is regarded as a dead part. Nearly all patents on machinery are for combinations of parts some or all of which were old. When a single part or any combination of parts less than the combination of the whole is new, then such part or such sub-combination of parts is patentable, as well as the entire combination, and they can be patented by separate claims in one patent or by a plurality of patents. Although an invention, to be patentable, must, with the exception mentioned, be new and useful, it does not follow that all new and useful productions are patentable. There are many things which, though both new and useful, are not patentable. Any change which was so obvious as to exclude the possibility of the exercise of the inventive faculties being necessary to produce it is not the subject of a patent. Any improvement which is merely the result of mechanical skill or superior workmanship is not patentable. A new discovery of a law of nature or of an abstract principle is not patentable. A discovery consisting of the adoption of a known equivalent of what was already in use is not patentable; such, for illustration, as the removal from a machine of one of the elements which it has in combination with other elements, and the substitution in its place of another known element possessing only the same function and performing only the same office in the combination as did the part for which it was substituted. In a process or composition of matter the substitution of one known chemical agent for another having only the same function is not patentable. Combinations in mechanism consisting of a mere assemblage of old parts, each part possessing only the same function and performing only the same office in the combination as it did out of it, and none of the parts co-operating with the others to produce any new or improved result, are not patentable combinations, but in judgment of law are mere aggregations of old elements. A new use of an old thing, called a double use, is not patentable; that is to say, if a machine or an instrument be known and used for one purpose, a discovery that it can be used to advantage for another purpose, accompanied by an actual application of it unchanged to such new purpose, is not patentable, but in such cases a very slight adaptation of it for the new use will render it patentable. This exclusion of a new use of an old thing from patentability is for the reason that when an invention is made, its author, having created it, is entitled to all its attributes, whether discovered by him or by any one else subsequently to his invention; and when that right passes from him to the public, it becomes vested with the same right; that is, to all uses of the invention. Anything which is injurious to public health or morals is not patentable.

Utility.—Although the statute requires the invention to be useful, yet no particular degree of utility is necessary to render an invention patentable. It need not be more useful than what was previously known for the same purpose. The requirements of the law are answered so far as utility is concerned if the invention be not absolutely frivolous or injurious to the public. Any invention injurious to health or public morals, or designed to facilitate the commission of crime, is not patentable, and fails of being so by reason of what is denominated want of utility.

How an Inventor may lose his Right to a Patent.—An inventor who has acquired a right to a patent may lose it in two ways: 1. By neglecting to apply for a patent for more than two years after the invention has been put into public use or on sale. The "public use" mentioned in the statute is not limited to a continuous public use for more than two years, but comprehends also a single instance of such use more than two years before the application for a patent. Public use has been judicially defined to be a use in public. The loss of an inventor's right to a patent by neglecting to apply for it for more than two years after the invention has been either used in public or put on sale is in the nature of a forfeiture of his right, and does not depend upon his intention. 2. An inventor may so deal with his invention as to create an abandonment or dedication of it to the public at any time. This he may do either by express declaration or by his silence while with his knowledge its use is generally adopted by others. Such a surrender of an inventor's right is a matter of intention on his part, but intention may be inferred from existing facts. Delay alone to apply for a patent, no matter for how long, will not constitute abandonment, but unreasonable delay, associated with the fact of the same invention being originated by another and patented or put into general use by him, will constitute abandonment. Hence, if a person unreasonably neglect to apply for a patent after completing his invention, he does so at the peril of losing his right. The issue of a patent is no guaranty to its owner of the right which it purports to secure. A patent is only *primâ facie* evidence of such right. It gives to its owner a right of action against infringers of the patent, and authorizes him to contest his right to the thing patented. Proof against a patent at any time during its term, in a suit brought for an infringement, that the patentee was not the first inventor of the thing patented, or that its subject-matter was not patentable, or that the inventor lost his right by forfeiture or abandonment, or any other fact against the validity of the patent, will invalidate the patent.

How Patents are obtained.—Patents are obtained by applications in the form of petitions to the commissioner of patents, accompanied by a description, including drawings and a model when the invention is of a kind admitting of drawings and model. When the invention is of a composition of matter, specimens must be furnished if required by the commissioner. The commissioner of patents is the head of the Patent Office, and has a corps of assistants called examiners, among whom the different patentable subjects-matter are divided, and whose duty it is to examine applications to ascertain whether the papers are in proper form and whether the invention described therein is, so far as they can ascertain, new and useful. On the commissioner receiving an application for a patent, he refers it to the proper primary examiner for his examination into the state of the art to which the invention appertains, and for his report of the result of his examination to the commissioner. If no reason is found against granting the patent, it is allowed and issued. If any cause is found by the examiner against the grant, it in such case is reported to the applicant; and if he can by explanation or argument remove the objection, the patent will still be issued, otherwise it will be refused by the primary examiner. From the decision of the primary examiner an appeal lies to a board of three examiners, designated examiners-in-chief. From a decision of the board of examiners-in-chief an appeal lies to the commissioner of patents, and from his decision an appeal lies to the supreme court of the District of Columbia. When an application is made for a patent which in the opinion of the commissioner would interfere with any pending application or with any existing patent, notice is given to the parties interested, and an opportunity granted to them to show by evidence which was prior in date of invention; and the patent will be issued to the one proved to be the first. The business in the Patent Office has become so extensive that there has grown up a class of persons known as patent agents or solicitors of patents, who conduct Patent Office business in behalf of inventors, and, being located in different parts of the U. S., are always accessible to inventors. The term for which patents for inventions issue in this country is seventeen years; but when an invention is patented in this country after being patented in a foreign country, the patent here will expire at the same time with the foreign patent, or, if there be more than one foreign patent, then at the same time with the foreign patent having the shortest term; but in no case can the American patent be in force for more than seventeen years. If an inventor, after conceiving the outlines of his invention, desire further time to mature the same, and in the mean time to guard against any other patent being granted for the invention, he may do so by filing in the Patent Office a caveat, setting forth the design and distinguishing characteristics of his invention and praying protection of his right until he shall have matured his invention. Such caveat will be preserved in secrecy by the commissioner of patents, and the effect of it will be to entitle the caveator for one year to notice from the commissioner of any application which may be made for a patent which would in any way interfere with his right. After receiving such notice, if any be given, the caveator will be allowed three months in which to file a complete application.

Designs.—New designs are also patentable, such as a design for a manufacture, bust, statue, alto-relievo, or bas-relief, also designs for printed fabrics, also ornaments, patterns, prints, or pictures to be placed on or worked into any article of manufacture, also new shapes.

Amendment of Patents.—A patent may be amended by being surrendered to the commissioner and the grant of an amended one, called a reissue, in its stead, or by filing with the commissioner a disclaimer of so much of the thing patented as the patentee was not the first inventor of. To amend by a reissue, the original patent and an amended specification must be delivered to the commissioner, asking an acceptance of the surrender and a grant of a reissue in conformity with the amended specification. A patent may by a reissue be amended in either its descriptive parts or its claims so as to conform to what the patentee was the

first inventor of: but no new matter can be introduced into the reissue, nor, in case of a machine patent, can the model deposited on the original application or the drawings attached to the patent be amended except each by the other; but when there is neither model nor drawing, amendments may be made upon proof satisfactory to the commissioner that such new matter or amendment was a part of the original invention and was omitted from the original specification by inadvertence, accident, or mistake.

Repeal of Patents.—There is no statutory provision for the repeal of patents; but where patents interfere by each claiming the same invention, any one interested in either patent may institute a suit in equity against the owners of the other patent, in which case the court has power to declare either patent invalid in whole or in part. It is also understood that the attorney-general of the U. S. has a right of action to invalidate a patent where there was fraud in the issuing of it.

Sale and Transfer of Patents.—A patentee may sell his entire patent or any undivided part of it for the whole or any specified part of the U. S. The conveyance of such an interest, to be valid, must be in writing, and is called an assignment. Such an assignment will be void as against any subsequent purchaser or mortgagee for a valuable consideration without notice that such assignment had been made. unless it be recorded in the Patent Office within three months from its date. Parties having an undivided interest in a patent are not thereby constituted partners, but are tenants in common; and any of such parties may grant licenses to others to use the invention in making, using, and vending the patented article, and receive and retain the consideration for the same without liability to their co-owners. Licenses under patents need not be in writing. They may be oral or implied. A license to a party to use the invention is not divisible or assignable unless expressly made so by its terms. A license, although in writing, need not be recorded. An invention not patented is assignable, but an invention is not salable or assignable before it is made, because a thing not *in esse* is not the subject of sale. An agreement, however, to assign an invention when made will be operative upon it as soon as it shall be made.

Remedies for the Protection of Patent Rights.—The law protects patentees against false representations of others. It provides that any person who, without authority from the patentee, shall in any manner mark upon anything made, used, or sold by him, for which he has not obtained a patent, the name, or any imitation of the name, of any person who has obtained a patent therefor, or who shall in any manner work upon or affix to any such patented article the word "patent" or "patented" or the words "letters patent," or any word of like import, with the intent to imitate or counterfeit the mark or device of the patentee, or who shall in any manner mark upon or affix to any unpatented article the word "patent" or any word importing that the same is patented, for the purpose of deceiving the public, shall be liable for every such offence to a penalty of $100. In case of an infringement of a patent, the law gives its owner right to remuneration for past infringement and to have further infringement prevented. He has a right to an action at law for a trial by jury, in which his recovery will be the actual damages he has sustained from the infringement. He also has a right to sue in equity, in which he can recover not only damages, but, in addition thereto, according to the statute, the profits realized by the defendant from the infringement, and obtain an injunction restraining further infringement; and where no serious doubt is raised respecting the validity of the patent or on the question of infringement, he may, on short notice, have a preliminary injunction restraining the infringement during the pendency of the suit. In suits for infringement all of the owners of undivided interests in the patent for the territory in which the infringement has been committed must be joined as co-plaintiffs or co-complainants. Where there has been a joint infringement, the infringers are jointly and severally liable for the infringement. Ignorance on the part of an infringer of the existence of a patent at the time of infringement is immaterial, so far as his liability for the infringement is concerned. To entitle a patentee to recover for an infringement of his patent, he is not required to show that the infringer knew of the existence of the patent. Still, neither the patentee nor his assigns are allowed to recover damages for infringement, unless it appear that they marked the patented articles made or sold by them with the word "patented," together with the date of the patent, or that the defendant was personally notified of the infringement and continued to infringe after such notice.

Relation of a Patentee to the Government.—The relation between the public and the inventor is that of contracting parties. The inventor being in possession of the invention, it is his; he has created it; he is not bound to divulge it; but if, without law to protect it, he make it known, others may use it. The public is in possession of power sufficient to protect him against the use of the invention by others. The public by its law offers to give him the protection for a limited time in case he, in consideration thereof, explain his secret. Promised protection is what the public gives. A description of the invention is the consideration given in return by the inventor. When the inventor has published the required description in the Patent Office, he has paid the full consideration for his protection, and the part of the contract remaining to be performed by the public is to furnish the patentee with the use of its officers and courts during the term for which the patent was granted, to prevent the use of the invention by others. It will be noticed that in forming this relation the public neither promises nor imparts anything to the inventor except legal protection to his property, while it receives a valuable addition to its productive resources. Instead, therefore, of anything being given to the inventor by the grant of a patent in the nature of property or of a right to the invention, as is generally supposed, the inventor imparts such right to the public, and the public, not the inventor, is the recipient of the right. From this relation of the inventor to the public, it will be realized how strong is his claim to a full and efficient protection to his right, because — (1) He has purchased the protection to his property in the invention for a special and valuable consideration; (2) He receives no greater protection than is furnished to others for other property without a special purchase; and (3) The protection is only for a limited time, while for tangible property the protection is without limitation of time. But notwithstanding this manifestly superior claim of patentees to full protection for their property in patented inventions, their title to such property is treated with comparative indifference, and trespass upon it by others is not held in the same disrepute as is trespass upon other kinds of property. Patents have been, and to a considerable extent still are, regarded as monopolies, creating undue restriction upon the rights of the public and appropriating to individuals what belongs equally to all. One cause of this false impression is a mistake as to what a patent grants, and an assumption that by it the government grants to a patentee an exclusive right to something which the public was previously in possession of. Another cause is the fact that patents for new inventions had their rise, and for a considerable time their progress, in England in the society of other grants, which did confer upon individuals privileges which the public was in previous possession of, and which were therefore monopolies, and odious monopolies, and which in the course of time became so obnoxious to the people as to be entirely abolished. From the fact that patents for new inventions were introduced in the form of and contemporaneously with oppressive monopolies which took rights from the public and gave them to individuals, they caught and have retained much of the odium, and even the name, of monopolies. This state of things was introduced into England with the feudal system, and continued down to the twenty-first year of the reign of James I., when the grant of letters patent for new inventions was taken out of the association with the monopolies by the celebrated statute of monopolies, which, after declaring "that all monopolies and all commissions, grants, licenses, charters, and letters patent heretofore made or granted, or hereafter to be made or granted, to any person or persons, bodies politic or corporate whatsoever, of or for the sole buying, selling, making, working, or using of anything within this realm, . . . are altogether contrary to the laws of this realm, and so are and shall be utterly void and of none effect, and in no wise to be put in use or execution," contains the following proviso: "That any declaration before mentioned shall not extend to any letters patent and grants of privilege for the term of 14 years or under hereafter to be made of the sole working or making of any manner of *new manufactures* within this realm to the *true and first inventor and inventors* of such manufactures." From the causes above stated the courts of England, for many years after the introduction of patents, treated them with disfavor, and whenever they became the subject of litigation struggled to invalidate them. Nearly all authors who early wrote on the patent laws treated these grants as monopolies, and thus, from the origin of patents down to within a few years, the impression was general, and still prevails to a large extent, that a patent is a grant of a special favor, and that, if justifiable at all, it is so only as a necessary evil. Such an understanding is entirely destitute of any foundation in fact or justice. Patents for new inventions are not monopolies, have none of their properties, and were never recognized as such by the common law or sanctioned as such by the statute of monopolies. The common-law definition of a monopoly is given by Lord Coke in the following words:

"A monopoly is an institution or an allowance by the king, by his grant, commission, or otherwise, to any person or persons, bodies politic or corporate, of or for the sole buying, selling, making, working, or using of anything *whereby any person or persons are sought to be restrained of any freedom or liberty which they had before or hindered in their lawful trade.*" Justice and consistency require that the property of an inventor, the creation of his own mind, should be exonerated from any idea of his being the grantee of a monopoly, that it should be freed from all such slanderous imputations, from such odious cognomens, and consequently from the bad odor which their habitual use diffuses through the public mind. All books and publications on the subject of patents should be entirely purged of their use as without foundation, authority, or meaning, so that the products of genius rendered fruitful by labor when subjected to proper limitations by patents and law, may be regarded as sacred to the use and benefit of their authors as any other property can be.

GEORGE GIFFORD.

Pater'culus (CAIUS VELLEIUS), b. about 19 B. C.; entered early the Roman army, and served from 2 to 14 A. D. under Tiberius in Germania, Pannonia, and Dalmatia. The year of his death is unknown, but his *C. Velleii Paterculi Historiæ Romanæ ad M. Vinicium Cos. Libri II.* reached to 30 A. D. The first manuscript of this book, and the only one that has come down to us, was discovered by Beatus Rhenanus at Murbach in Alsace, and printed at Bâle in 1520. The best editions are that by Orelli (Leipsic, 1835), and that by Kritz (2d ed., Leipsic, 1848). The beginning of the work is wanting, and there is also a portion lost after the eighth chapter of the first book.

Paternò, town of Sicily, province of Catania, is situated at the foot of the western slope of Etna, about 8½ miles from the city of Catania, on one of the routes to the summit of the great volcano. Remains of ancient aqueducts and the ruins of an old bridge over the Simeto may be seen here, and not far from the town other noteworthy traces of the Roman period. The old Norman castle, occupying a very elevated position, is one of the most curious existing monuments of its kind. Near the thermal springs in the neighborhood there is a cave called the Grotta del Fracasso, in which is heard a loud roaring noise caused by subterranean torrents from the melting snows of Etna. At a lower point the waters rise to the surface and form a stagnant pool, which poisons the air with miasma. Paternò has been supposed to occupy the site of the ancient *Hybla Major.* The present town contains some respectable buildings, but is of little general interest. The vicinity is very fertile in grapes, olives, hemp, etc. Pop. in 1874, 15,778.

Pa'ter Nos'ter [Lat. for "Our Father," the first words of the Lord's Prayer], the name given by Roman Catholics to the Lord's Prayer. In the ancient Church it was regarded as so sacred that its formula was kept a secret from the uninitiated. (See ARCANI DISCIPLINA.) In later times this prayer was repeated by the vulgar as a charm. The closing words, "For thine is the kingdom," etc., are not present in all the versions, and some Christians do not use them.

Pat'erson, city and cap. of Passaic co., N. J., situated both sides of the Passaic River, 5 miles above tidewater navigation and 15¾ miles N. W. of New York City. The Morris Canal and the New York and Erie, Delaware Lackawanna and Western, and New Jersey Midland R. Rs. pass through the city, giving it frequent connection with the great metropolis and other important places. The city is built upon a broad plain, whose W. extremity rises to a height of over 300 feet, known as "Garrett Mountain." Good drainage and valuable water-power are afforded by the Passaic River. The Passaic Falls, 100 feet high, are located within the city limits. Paterson is supplied with water and gas, and contains an excellent system of public instruction, besides several private institutions, 35 churches, 2 orphan asylums, 4 banks, 1 loan company, 6 horse railways, an electric fire-alarm telegraph, a volunteer fire department, 2 daily and 3 weekly newspapers, a court-house and jail, and a number of fine stores. It ranks second among the cities of the State in point of manufactures, which include silk, locomotives, iron bridges, heavy castings, brass and plumbers' goods, cotton machinery, steam fire-engines, flax, hemp, jute, carpets, cotton yarns, netting, calico prints, shirts, and paper. The iron industry for 1873 amounted to $8,517,000, and gave employment to 3758 persons. There are 25 firms engaged in the manufacture of all kinds of silk goods and fabrics, with a capital of $4,000,000, and it is owing to this industry that Paterson is called the "Lyons of America." The other important industries are the Passaic rolling-mills, the Paterson iron-works, paper, cotton, and planing mills, and machine-works. Paterson is the third city in the State in point of population, having 33,579 inhabitants in 1870. JAS. D. DONNELL, ED. "PATERSON PRESS."

Pat'erson (WILLIAM), b. at Skipmyre, Dumfriesshire, Scotland, in 1665; was persecuted as a Covenanter by Charles II.; settled at London as a merchant; visited the West Indies, where he obtained much information about the localities of the "Spanish Main" from the buccaneers; issued proposals for the establishment of the Bank of England, of which, upon its establishment in 1694, he was one of the directors; made unsuccessful efforts in England in the same year to organize a scheme of colonization in Darien; obtained from the Scottish Parliament in 1695 an act of incorporation; obtained large subscriptions, and proceeded to Darien with a considerable number of emigrants; was unsuccessful on account of quarrels, fever, famine, and the opposition of the Dutch, Spanish, and English governments; returned to Scotland 1700; was an advocate of the union of Scotland with England; entered Parliament 1708; obtained some compensation for his losses about 1715; wrote several treatises on economical subjects. D. at Westminster Jan. 22, 1719. (See *Biographies* by Bannister and Pagan.)

Patholog'ical Anat'omy, the science which treats of the changes produced in the tissues and organs of the body by disease. It embraces the study of these diseased conditions during life and after death. To ascertain the character and nature of these changes, we are obliged to employ the naked eye, the simple and compound microscope, and chemical reagents. In many diseases the lesion of some one organ appears to constitute the disease; in others, general constitutional symptoms exist without the presence of any lesions which we are able to detect. There is no department of medicine in which so much progress has been made of late years; and for this progress we are principally indebted to the Germans. The greatest obstacle to a real knowledge of such diseased conditions is our inability to observe diseased organs while still alive. We see changes after they have taken place, but not the process of change itself. While, therefore, we have, to some extent, a certain basis of facts, it must be confessed that many theories are current which show the want of knowledge rather than the existence of it. F. DELAFIELD.

Pathol'ogy [Gr., from πάθος and λόγος], the doctrine of the diseases. Under this name is comprehended the science which treats of all the diseased conditions which affect the human body. It is also applied to the diseases of some of the lower animals. We use the terms general pathology, special pathology, surgical pathology, medical pathology, internal and external pathology, and comparative pathology. By general pathology we understand the knowledge of those general principles which govern all diseased conditions. The processes of growth and decay, of inflammation and degeneration, the laws which govern the development and spread of contagious and infectious diseases—all belong to the domain of general pathology. Special pathology applies these general principles in detail to the study of the laws and phenomena which belong to individual diseases. Surgical or external pathology treats of diseases affecting the exterior of the body—the skin, the bones, the joints, etc. Medical or internal pathology treats of the diseases of the viscera. English authors restrict the term "pathology" rather to the principles of medicine and surgery, while the French include under it also what with us is usually embraced in the practice of medicine and surgery. F. DELAFIELD.

Pat'kul (JOHANN REINHOLD), b. about 1660 of a wealthy and influential family of Livonian nobility; received a military education and served as a captain in the army, but became famous afterwards as a diplomatist, or rather as an intriguer. Livonia was at that time a possession of the Swedish Crown; and in the controversies between the Livonian nobility and the Swedish king, Patkul played a conspicuous part. Accused of rebellion, he was summoned to Stockholm, but on his arrival there he soon discovered that the judgment was sure to go against him. He escaped to Courland, but was sentenced to death, and his estates were confiscated. For some time he lived in Switzerland and France, occupied in scientific studies, but in 1698 he entered the service of Augustus II. of Saxony and Poland, and the formidable alliance which was formed shortly after against Charles XII. by Augustus II., Peter the Great, and Frederick IV. of Denmark was principally Patkul's work. It seems, however, as if he could serve no friend and no purpose with full faith. In 1705, Augustus II. arrested him and put him in the dungeons of Königstein; and when Charles XII. made Patkul's surrender one of the conditions of peace, Augustus II. consented. On leaving Saxony the Swedes carried him away with them, and

Oct. 10, 1707, he was broken on the wheel and beheaded in the convent of Kazimierz near Posen.

Pat'more (Coventry Kearsey Dighton), b. at Woodford, Essex, England, July 23, 1823, son of Peter George Patmore, a man of letters. The son was assistant librarian in the British Museum 1846–68: author of *Poems* (1844), *Tamerton Church Tower* (1853), *The Angel in the House* (4 parts, 1854–62), and other works.

Pat'mos [*Patino*, called also during the Middle Ages *Palmosa*, "island of palms"], one of the ancient group of the Sporades, now belonging to Turkey, about 30 miles W. of the coast of Asia Minor, and 20 miles S. of the W. extremity of Samos. It is one mass of rock, rugged and barren, about 10 miles long, 5 miles broad, and 28 miles in circumference. It may be seen in the distance in going from Beyroot to Constantinople. A narrow isthmus divides it into two unequal parts. Its chief port, on the E. side of the isthmus, is one of the best harbors in all the Greek islands. The Romans used the island as a place of banishment. The apostle John was sent there under Domitian, and recalled after the tyrant's death (Sept. 18, 96 A. D.). The grotto where he is said to have written the Apocalypse, now covered by a chapel, is about halfway up the hill overlooking the town. The town itself is half an hour from the landing. High over all stands the celebrated monastery bearing the name of "John the Divine," built by the Byzantine emperors in the twelfth century, and now occupied by some 50 monks. The library contains about 1000 printed volumes and 240 manuscripts, of little value. The inhabitants, numbering rather more than 4000, are all Greeks, and have a bad reputation. They live by fishing, boating, and doing agricultural work, in the season of it, on the continent or on the more fertile islands.
R. D. Hitchcock.

Pat'na, city of British India, in the presidency of Bengal, stands on the right bank of the Ganges, 285 miles N. W. of Calcutta, and extends with its suburbs along the river for a distance of 7½ miles. It is indifferently built, handsome brick buildings alternating with mud huts covered with tiles or thatched. But it has some manufactures of shawls, tablecloths, lacquered ware, and, being situated on the East India Railway, it has become the centre of the opium-trade. It is the chief seat of Mohammedanism in India. Pop. about 300,000.

Pato'ka, post-v. and tp., Marion co., Ill., on E. fork of Kaskaskia River and Illinois Central R. R. Pop. 1294.

Patoka, tp. of Crawford co., Ind., on Patoka Creek. Pop. 1253.

Patoka, tp. of Dubois co., Ind. Pop. 3086.

Patoka, tp. of Gibson co., Ind., on Patoka Creek and junction of Evansville and Crawfordsville with Louisville New Albany and St. Louis R. R. Includes Princeton, the county-seat. Pop. 4397.

Patoka, post-v. of White River tp., Gibson co., Ind., on the Evansville and Crawfordsville R. R. Pop. 844.

Patoka, tp. of Pike co., Ind. Pop. 1760.

Pat'on (Sir Joseph Noel), R. A., b. at Dunfermline, Scotland; studied painting at the Royal Academy, London; became favorably known to the public by his etchings in illustration of Shakspeare and Shelley; gained premiums by his fresco *The Spirit of Religion* (1845) and his colossal oil-painting *Christ Bearing the Cross* (1847); produced numerous successful pictures illustrating scenes from the poets; became a member of the Academy 1856, queen's limner for Scotland 1865, and was knighted 1867. Author of *Poems by a Painter* and *Spin-drift* (1867).

Patras', town of Greece in the Morea, on the Gulf of Patras, is fortified, and has a large though not perfectly safe harbor provided with a mole. It is a prosperous and well-built city and the seat of the foreign commerce of the country. Its chief export is currants, which are extensively cultivated in its vicinity. Pop. 19,641.

Pa'tria Potes'tas (Roman civil law), the power given by the Roman law to the *paterfamilias*, or legal head of the family, over his children and all others who were considered as standing in the position of children. The most remarkable feature of the early Roman law—the original *lex civilis* or law for the citizen—was the fact that, so far as it concerned private relations, it dealt with the heads of families (*patresfamilias*) only. Families were the social units, and their representatives were alone recognized by the law, so far as it dealt with the private rights and duties of person, of property, and of contract. Each family, in respect to its internal affairs and the relations of its members with each other, was an independent jurisdiction, presided over by the *paterfamilias*, who was its sole lawgiver, judge, and administrator. In order to maintain this character, the early Roman law clothed him with three species of authority, very similar in their nature and extent, and differing chiefly in the subjects to which they applied. They were his dominical power—that over his slaves; his marital power (*manus*)—that over his wife by a complete legal marriage; and his paternal power—that over his children. This paternal power extended (1) to the children born in lawful marriage, continuing over the daughters and the sons' daughters until their marriage, when they passed from their original family into that of their husbands, but continuing over the sons and their wives and male descendants as long as the *paterfamilias* lived, unless lost or abandoned in some special manner provided for by law; (2) to children originally illegitimate who had been made legitimate by any legal method; (3) to persons introduced into the family and made children by "adoption," which took place when a person already under the power of a *paterfamilias* was by him transferred into that of another family head, and thus became in all legal respects the child of the latter; (4) to those brought into the family and made children by "arrogation," which took place when a person not under the power of another voluntarily submitted himself to the authority of a *paterfamilias* with the same legal effects as in case of adoption. The paternal power of any *paterfamilias* ended (1) by his death, when each of the sons became head of his own family, with a like power over his own descendants, and each of his unmarried daughters became free from the paternal authority, although subjected to that of a tutor; (2) by emancipation, which was a legal mode of freeing a child and rendering him completely *sui juris;* (3) by transferring a child into another family and under the power of its head; and finally, the *paterfamilias* himself might be subjected to a loss of his legal character and position by certain acts or defaults, which produced the same effects upon his capacities and rights as would be produced by his actual death. During the earlier stages of the Roman law this power of the *paterfamilias* within the domain of private relations was absolute over all the persons to whom it extended. It included the right of putting them to death, of selling them, and of complete ownership and disposition over all their property and acquisitions. In fact, the private status of the children in these respects resembled that of slaves. The sons under power could acquire and hold no property of their own; all belonged to the *paterfamilias*, and all their contracts and acquisitions enured to his benefit alone. These incapacities, however, did not extend to public affairs, nor within the domain of the public law. The son under power could nevertheless perform all the public duties of a citizen: he could vote, be elected to any office, even the highest, or hold any command in the army, and while performing such official functions could exercise jurisdiction over his own father; but within the domain of the private law he had no personal rights. He could contract a legal marriage, but the consent of his family head was necessary. These terribly severe provisions of the law continued without substantial change throughout the republic. Their mitigation, however, commenced near its close by allowing the son to acquire property (called his *peculium*) from certain special sources, the most important of which was his service in the army. They were rapidly modified by the notions of equity which entered into and reformed the jurisprudence under the empire, and all their harshest features had disappeared long before the codification of Justinian. The paternal power was finally reduced to a conformity with the sentiments of natural right and justice, and so far as it affected the persons of children, it embraced merely the authority to administer correction, to appoint testamentary guardians, and to sanction their marriage. John Norton Pomeroy.

Pa'triarch [Gr. πατριάρχης, "father of a race" or "family"], often loosely used of any venerable person, but more especially (1) in Bible history the fathers of mankind and of the Hebrew people, from Adam to the time of Moses, are called patriarchs, and their age is called the patriarchal age. (2) The pontiff whose authority centred at Tiberias, and who ruled over all the Jews westward of the Euphrates, from the latter part of the second century till 415 A. D., was called patriarch of the Jews. (3) In church history, during the fourth century, patriarch was the title of any and every bishop, but by the Council of Chalcedon (451) was made the official title of the bishops of Rome, Alexandria, Antioch, Constantinople, and Jerusalem. This system extended only to the Roman empire. From time to time other episcopal dignitaries have been called patriarchs.
R. D. Hitchcock.

Patri'cian. The word *patricius* in Latin is derived from *pater*, and by the Roman historians the connection was supposed to be that originally the "patricii" were the sons of the senators or patres. So Livy: "Patres certe ab honore, patriciique progenies eorum appellati" (Liv. t. 8).

But doubtless the true explanation of the word is that offered by Mommsen: he says: "Whoever was begotten in an illegal marriage or out of marriage was excluded from the membership of the community. On this account the Roman burgesses assumed the names of the 'father's children' (*patricii*), inasmuch as they alone in the eye of the law had a father." (*Hist. of Rome*, ch. v., vol. i., p. 69, Eng. trans.) It is certain that the patricians were the original burgesses of Rome, the "populus Romanus;" in the earliest times there was no plebeian class inside the state. The patricians were divided into certain clans, *gentes* as they were called; the gentes were divided into families, and all these families were connected together by certain religious rites called *sacra gentilicia*. Attached to each household were the slaves and the clients, the latter including foreign refugees and emancipated slaves. Sometimes a patrician would marry a client's daughter, in which case the children resulting from the marriage would take rank neither with the patricians nor the clients; they would have no political rights, but would be independent. There were many ways in which a state of independency might be attained by the clients; as, for instance, when a patron died and left no heir. Thus there soon arose in Rome a third class, the plebeians. To the class so formed were added many citizens among the conquered tribes round about Rome; after the conquest of Alba many of their citizens were brought to Rome, only a few being received as burgesses, while the majority joined the plebeians. The civil history of Rome for more than four centuries after the foundation of the city presents a constant struggle between the two orders of patricians and plebeians. At the beginning of the struggle the whole political, judicial, and hierarchical power was in the hands of the patricians; at the end of it a perfect equalization had taken place. The first great advantage gained by the plebeians was the establishment of magistrates of their own, tribunes of the plebs (495 B. C.), for the sole object of the protection of plebeians. During the next half century from that date rapid advances were made: intermarriage between the two orders was sanctioned; the consulship was for a while discontinued and the office of military tribune established, to which plebeians were made eligible; and a way into the senate was prepared for the plebeians by throwing open the quæstorship. The patricians, however, at this date still retained some of the highest offices; they alone were eligible for the augurships and the pontificate. Further, two new offices were created—offices of the highest power—the censorship and the prætorship of the city. By the coming of the Gauls (390 B. C.) the work of equalization was thrown back somewhat, but only for a time. By the Licinian Rogations the consulship was restored, and it was definitely arranged that one of the two consuls should be a plebeian. In B. C. 356 a plebeian was raised to the dictatorship; in 351 the censorship was thrown open; the prætorship followed soon after; and at length, in 300 B. C., the plebeians were elected to the highest sacred offices, the pontificate and the augurships. From this time onward the title of patrician carried with it no advantages apart from the respect which was considered due to high birth and the memory of noble ancestry. A. H. BULLEN.

Pat′rick, county of Virginia, bounded S. by North Carolina and N. W. by the Blue Ridge. Area, 485 square miles. It is mountainous and contains much mineral wealth. The soil is productive. Corn, tobacco, and live-stock are leading products. Cap. Patrick Court-house. Pop. 10,161.

Patrick (SAINT), the apostle and patron saint of Ireland. His baptismal name was *Succath* ("brave in battle"). His birthplace is not certainly known, and his dates are all disputed. He says of himself, in his *Confession*, that he was born "in the village of Bonavem of Tabernia," which some think to have been Kirkpatrick, near Glasgow in Scotland, but others, more probably, Boulogne in Northern France. According to the chronology hitherto most generally accepted, he was b. about 387; was a captive in Ireland from 403 to 409; went thither as a missionary in 432, and d. 465. Todd thinks he was b. 410, went on his mission 440–42, and d. 493. Killen thinks he was b. about 373, went on his mission about 405, and d. 465. The sending of Palladius by Pope Celestine "to the Irish believing in Christ," in 431, was accordingly an act of usurpation which miscarried. He d. on the 17th of March, the day now sacred to his memory. Ireland was then occupied by a great number of petty tribes, most of which were evangelized by Patrick. And so well was the work accomplished that Ireland was known in subsequent centuries as the "island of the saints." The method employed was that of dealing cautiously and gently with the old paganism of the people. The chieftains were first won over, and then through them their clans. Of Patrick himself much that has been related is fabulous. But his autobiographical *Confession* and his *Epistle to Coroticus*, both of which are unquestionably genuine, reveal to us a devout, simple-minded, unlettered man, and a most discreet and energetic missionary. It is a very curious fact that in these writings of his we find no mention of the pope, and no trace of purgatory, auricular confession, transubstantiation, or worship of the Virgin; while salvation by faith and all the related doctrines are clearly taught. (See James Henthorn Todd's *St. Patrick* (1864), W. D. Killen's *Old Catholic Church* (1871), and W. D. Killen's *Ecclesiastical History of Ireland* (2 vols., 1875).) R. D. HITCHCOCK.

Patrick (MARSENA A.), b. in New York Mar. 1811; graduated from the U. S. Military Academy and became brevet second lieutenant of infantry July, 1835; served in the Florida war; in the war with Mexico as Gen. Wool's chief commissary; resigned in 1850 and devoted himself to farming, and was superintendent of the New York State Agricultural Society and president of the Agricultural College. As inspector-general of New York he rendered valuable service in organizing volunteers, and in Mar., 1862, was appointed brigadier-general U. S. volunteers, serving with McDowell in the Shenandoah Valley and in Northern Virginia, and with the army of the Potomac at South Mountain and Antietam. In Oct., 1862, he was made provost-marshal-general of that army, and subsequently of the combined armies operating against Richmond; and, after the surrender, of the department of Virginia. In June, 1865, he again resigned his commission, and in 1867 became president of the New York State Agricultural Society.

Patrick (SIMON), D. D., b. at Gainsborough, England, Sept. 8, 1626; educated at Cambridge; became bishop of Chichester 1689, and of Ely 1691. D. May 31, 1707. Author of a voluminous *Commentary and Paraphrase on the Old Testament* (10 vols., 4to, 1695–1710), and other works.

Patrick Court-house, post-v., cap. of Patrick co., Va., also called TAYLORSVILLE.

Pa′triot, post-v. of Posey tp., Switzerland co., Ind., on the Ohio River.

Patripas′sians [Lat. *pater*, "father," and *patior*, to "suffer"], or **Monarchians** [Gr. μόνος, "single," and ἀρχή, "principle"], Antitrinitarians of the ancient Christian Church, who either taught, or were charged with teaching, either expressly or by implication, that God the Father was incarnated and suffered in the person of Jesus Christ. They denied the doctrine of Three Persons in the Godhead, teaching only three manifestations of the One Person. For themselves, they claimed that they were emphasizing both the unity of God and the divinity of Christ. Of those who held to the heresy in its balder form, the most eminent were Praxeas of Asia Minor, who was in Rome between 190–200 A. D., Noëtus, who was excommunicated at Smyrna shortly after 200, and the two popes, Zephyrinus (202–218) and Callistus (218–223). A much finer type of the heresy was developed by Beryllus of Bostra, recovered to orthodoxy by Origen in 244, and by Sabellius of Ptolemais in Egypt, 250–260 A. D., whose system has frequently reappeared, especially in Occidental Christendom.
R. D. HITCHCOCK.

Pat′ronage means, in general, the right of making appointments to vacant benefices, but it is commonly limited to the right of presenting candidates to vacant ecclesiastical benefices. As long as the Christian Church was chiefly missionary there could, of course, be no question of patronage. In the district or diocese which was placed under his superintendence the bishop fixed his residence at the religious house, where he lived together with a number of priests, as many as were sufficient for the religious instruction of the population of the diocese, and the whole establishment was maintained at the expense of the episcopal treasury. In course of time the bishop at the cathedral church would establish and endow branch churches in his diocese and nominate a priest among the *episcopi clerus*, who enjoyed the revenues of the parish endowment. But soon, when Christianity became the generally accepted religion, the bishop became unable to provide his whole diocese with churches or the churches with revenues. Private persons of wealth and piety then took the duty upon themselves. The count, the baron, the lord of the castle built on his domain a church and endowed it with land or other property sufficient to maintain the building and the priest. He now became the patron of this church; and he enjoyed the right of nominating a person in holy orders to be the officiating minister. So far the development was natural and sound. The third Lateran Council of 1179, and also the fourth of 1215, decreed that presentation by the patron, or induction, as it was called, was by itself not sufficient to confer any eccle-

siastical benefice, as it referred only to the temporalities of the office; institution or investment with its spiritualities was furthermore necessary; and as this could only be given by the Church, the bishop, or the pope, the patron's right of appointment was thereby actually annulled. In the thirteenth century the pope claimed for himself the patronage of all benefices whose incumbents died at the court of Rome; and as the number of ecclesiastics of all ranks and from all countries who visited Rome was very great, this claim was of considerable importance. The pope also gave dispensations for non-residence and for holding several benefices at the same time, and even assumed the right of giving away bishoprics, abbacies, and other ecclesiastical benefices before they were vacant—a measure which roused general indignation, so much the more as it was well known that he sold them. In England, under Edward I., an act of Parliament made every one subject to heavy penalties who should venture to enforce the authority of such papal provisions in England. Also, France made vigorous and successful protest. (See GALLICANISM.) With the Reformation the patronage generally returned to the original possessor, the founder of the church. In England it is treated exactly like any other piece of property: it may be connected with the manor, and is then called *appendant advowson*, and it may have been separated from it and belong to a person, in which case it is called *advowson in gross*. In Scotland it was twice cancelled and twice re-established; it still exists there, but in a somewhat restricted form. In Denmark it was abolished by the constitution of 1848.

Patrons of Husbandry, a secret order having for its object the affiliation, and promotion of the interests, of cultivators of the soil. Its ritual and work, though modelled, to some extent, after those of the Masonic order and the order of Odd Fellows, is simpler than either, and is wholly subordinate to its main purpose, the advancement and benefit of the great agricultural class.

After the late civil war agricultural interests all over the country were greatly depressed. In the South the poverty of the farmers after the war, the difficulty of obtaining efficient labor, the imperfect and ruinous way in which the soil had been cultivated, and in some sections the lack of knowledge of the best methods of cultivation, were sufficient causes for this depression; in the Eastern and Middle States, notwithstanding the efforts to spread agricultural knowledge, the steady and alarming decrease in the yield of cereals and other crops, indicating the near approach of a sterility which would render successful farming impossible, and the serious agitation in several of these States of the question, "Does farming pay?" showed the apprehensions which were depressing agriculture there; while in the West the fierce competition for a market, the low price of grain and other agricultural products, the high and increasing cost of transportation, the enormous prices charged for agricultural machinery, the high rates of interest, and the habit of the farmers, isolated as they were from all co-operation with each other, of buying always in the dearest market and selling in the cheapest,—all these things had rendered farming an unprofitable, or at least a precarious, pursuit. In some of the North-western States four-fifths of the farms were mortgaged or incumbered, and very often the debt incurred in purchasing agricultural machinery led to the foreclosure and sale at half its value of a farm, and the farmer and his family were compelled to go still farther West and take up new lands, which in their turn would be forfeited. This state of the agricultural interest led thoughtful men, throughout the country, to consider whether there was not some way by which these depressing influences could be averted from the great farming interest. Doleful letters from all parts of the country poured into the agricultural department at Washington, and one of the officers of that department, Mr. William Saunders, then superintendent of its gardens and conservatories, a gentleman of Scottish birth, of fine education and culture, whose whole life had been devoted to agricultural and horticultural pursuits, and who had some reputation as an agricultural writer, gave his whole mind to the question, whether some measures of relief could not be adopted for these widespread troubles, which seemed likely at no distant day to sap the foundations of the nation, by causing a very general abandonment of agricultural pursuits. Though himself neither a Mason nor an Odd Fellow, he had been an attentive observer of the progress of these secret organizations, and became convinced that if the bond of union which proved so effective in ensuring the permanency of these orders could be rendered available for farmers and tillers of the soil, it would go far toward solving then existing difficulties. After mature consideration he communicated the conclusions to which he had come to his friends, Messrs. O. H. Kelley, J. R. Thompson, and William M. Ireland, all members of the Masonic order, Rev. A. B. Grosh, a high official among the Odd Fellows and author of one or more works on that subject, and Rev. John Trimble, Jr. All these gentlemen were, we believe, clerks or employés in some of the departments at Washington. None of them were rich, though some had small farms in the West. They were all interested in the ideas advanced by Mr. Saunders, and with great unanimity labored together to render them practical. After some months of labor and consultation they united on a plan for an order, as yet nameless, and by Aug. 5, 1867, had prepared their ritual and work for the first degree. On the 12th of that month, Mr. Saunders, having occasion to go to Western New York, Ohio, and the Western States, took this first degree with him, and interested some of his agricultural friends in the proposed new order. Five of these—viz. Messrs. A. S. Moss, F. M. McDowell, George D. Hinckley, Anson Bartlett, and William Muir—took a deep interest in the subject, and rendered Mr. Saunders efficient service, then and subsequently. Encouraged by their aid and that of other agriculturists, the little coterie at Washington went forward in the autumn of 1867, completed the second, third, and fourth degrees, and gave the name of "Patrons of Husbandry" to the order. On Dec. 4, 1867, nine persons, all of whom have been named above except Mr. Edward P. Faris from Illinois, met at the office of Mr. Saunders on Four-and-a-half street, near the old canal, Washington, and organized the National Grange. (See GRANGE.) The following were the officers elected: William Saunders, master; J. R. Thompson, lecturer; Anson Bartlett, overseer; William Muir, steward; A. S. Moss, assistant steward; Rev. A. B. Grosh, chaplain; William M. Ireland, treasurer; O. H. Kelley, secretary; Edward P. Faris, gatekeeper. Their constitution provided for the admission of women as members of the order, and also for the election of four ladies as officers, to be designated, respectively, Ceres, Pomona, Flora, and Lady Assistant Steward. At a subsequent meeting these were elected, and also an executive committee. Two or three weeks later a subordinate grange was organized in Washington with about 60 members, which was made the school of instruction for the order. On Jan. 1, 1868, Mr. Saunders, as master of the National Grange, sent out a circular to intelligent agriculturists all over the country, setting forth the considerations which led to the formation of the order and its purposes and aims. These, as laid down in this circular, are substantially the objects and aims of the order to-day. Availing itself of the secret formulas and ritual as a means of unity and permanence of organization, and of the membership of women and young people of both sexes to add to the interest of the meetings of the granges, and to elevate their character, its main objects were declared to be the promotion of unity and co-operation among the tillers of the soil and the diffusion of a higher measure of general intelligence and culture, as well as of special knowledge on agricultural subjects and political economy generally. The introduction of political topics and the discussion of any subject connected with partisan politics was prohibited, but all methods of intellectual culture, whether by readings, recitations, essays, orations, or music, were to be adopted, and social culture was also to be encouraged so far as was compatible with good order. In subsequent circulars Mr. Saunders urged the importance of the formation of grange libraries, composed of standard and valuable books of reference on all subjects. The full development of the plans of co-operative purchasing and selling came later, as we shall see presently.

The early progress of the order was exceedingly slow. Mr. Saunders's excellent circular (which with other expenses had involved the National Grange in an indebtedness of $150) seemed destined to produce no effect. They had the one subordinate grange in Washington, but January, February, and March passed and there was no answer announcing the formation of another grange. On Apr. 1, 1868, Mr. Kelley, having resigned his clerkship in the post-office department, set out on a mission to establish subordinate granges. He was to have $2000 salary, provided he could organize a sufficient number of granges to receive that sum in the way of fees. He organized four granges during that month, and after arriving in Minnesota, where he had a small farm, six more. He remained in Minnesota till Jan., 1871, diffusing intelligence concerning the order, and succeeded in inducing a number of prominent agriculturists to unite with it. Mr. Saunders and his associates in Washington meantime were not idle. Eminent citizens of several of the Southern States became members and powerful advocates of the order, and a number of agricultural periodicals undertook its advocacy. Its progress was, however, still slow; to the eleven existing granges of Jan. 1, 1869, 39 were added in that year and 38 in 1870. When Mr. Kelley returned to Washington in Jan., 1871, to become the secretary and executive officer

of the National Grange, there were at most not more than 88 subordinate and 3 State granges in existence. In 1871, 125 more were added. The Rubicon was now passed. In the West and South the importance and value of the order were beginning to be evident. In 1872, 1160 new granges were established; in 1873, 8600; in 1874, about 11,000; and in 1875 as many more. The whole number of active granges (of course some had become defunct) in Nov., 1875, was about 30,000, and the membership very nearly 2,500,000. There are now State and Territorial granges in nearly every State and Territory, Alaska, Arizona, and the Indian Territory being, we believe, the only exceptions, and there are a large number of granges in Canada and the maritime provinces. The benefits which these organizations have conferred on the agricultural community cannot be estimated in dollars and cents. In the States where they are most numerous they have completely revolutionized the condition of the farmers and their families. In 1870 and 1871 most of the farmers were in debt, usually for agricultural machinery, and in addition to paying exorbitant prices for mowers, reapers, cultivators, etc., they were paying from 15 to 25 per cent. interest on these purchases, and their notes were a lien on their farms. Their grain or other produce was shipped to Chicago, Milwaukee, or St. Louis, rated as No. 2 or No. 3, and paid for at the lowest price, mainly in goods at the highest prices; and whatever the amount of their crops, they could not meet their liabilities. Now, through the co-operative management of the State and subordinate granges, and in some instances of county councils organized for this purpose, most of them are out of debt; their agricultural machinery, sewing-machines, musical instruments, books, and provisions and clothing, are purchased for cash at from 25 to 50 per cent. discount from the prices they formerly paid; if there is any new and improved method of cultivating any crop, any change in the markets for what they produce, it is promulgated in their monthly meetings, and all know it at once; and by a system of agencies and exchanges the grain, flour, potatoes, fruit, wool, and packed meats of the North-west, the rice, cotton, and sugar of the South and South-west, are sold in the great markets of Boston, New York, Philadelphia, Baltimore, and New Orleans without the intervention of middlemen, and foreign groceries, dry goods, sewing-machines, musical instruments, books, and other articles returned to the sellers at the lowest wholesale prices; and where these are not needed, the money-value of their goods. These farmers and their wives and daughters, instead of being mere drudges, now find time for intellectual and social culture, for which the grange often furnishes abundant resources. In some sections the household wants are supplied by grange co-operative stores; in others they have an arrangement with the merchants by which, purchasing through the grange, they obtain a liberal discount from retail prices. In some of the grain States the State or county granges or councils own their elevators, and inspect, weigh, and ship the grain themselves, paying no tribute to the grain speculators. If it is objected that by these arrangements for dispensing with middlemen as far as possible, and selling in the highest and purchasing in the lowest market, they are subverting the laws of trade, the Patrons reply that they are not responsible for that; that if they, after submitting so long to the old rule of selling in the lowest and buying at the highest market, have at last come to the conclusion that their duty to themselves and their families requires them to reverse the process, and they choose to conduct their own business, and dealing with every man for ready money, with the strictest honesty, secure to themselves some of the profits which formerly went into the purses of those who cared only to make money out of them, they are not blameworthy, and those persons who complain can, by turning their own attention to the culture of the soil, themselves reap the same advantages.

We have said that the founders of the order had made it a part of its fundamental law that the order should not intermeddle with political questions. Tillers of the soil of all political parties and of none are equally welcome in the order, but they must bring into it no discussion of partisan politics or of party measures under the penalty of expulsion. The great principles of political economy and of national existence and well-being are not prohibited. It has been often intimated by politicians and political editors that this fundamental law was violated; that such or such a measure was supported by the granges; that the legislation hostile to railroads in some of the North-western States was the result of the interference of the order with the elections; and that certain candidates for judges, governors, U. S. Senators, or members of Congress have been designated and supported by the Patrons as a body. Such statements, in their broadest sense, are untrue. We hazard nothing in saying, that in no national, State, or subordinate grange in the U. S. has any action ever been taken for or against any political measure or any candidate of either party, nor has any question of party politics ever been discussed in the grange-room. But the members of the order are citizens as well as Patrons, and they have as citizens their preferences for candidates, which they have the same right as any other citizen to express at the polls. That as farmers they should desire that the railroads might be prohibited from charging excessive freight for their produce was natural, and in those States where a large proportion of the farmers are members of the order it was very natural that such measures and the men who were pledged for them should be supported by the farming class, and as a consequence by a large number of Patrons. But this was totally irrespective of their connection with the order. Indeed, in the States of Illinois and Wisconsin, where the most stringent restrictions were placed upon railroads, the order was not very numerous at the time this action was enforced, and the general sentiment of the leading members and officers of the order was opposed to it. In the *Declaration* of the National Grange which met at St. Louis in Feb., 1874, the following passages refer especially to this subject: "No grange, if true to its obligations, can discuss political or religious questions nor call political conventions, nor nominate candidates, nor even discuss their merits in its meetings. Yet the principles we teach underlie all true politics, all true statesmanship, and, if properly carried out, will tend to purify the whole political atmosphere of our country. For we seek the greatest good of the greatest number. . . . It should always be the principle of every Patron of Husbandry that the office should seek the man, and not the man the office. . . . We desire a proper equality, equity, and fairness, protection for the weak, restraint upon the strong; in short, justly-distributed burdens and justly-distributed power."

We have said very little in regard to the organization and ritual of the order, because we regard these as matters of minor importance, and intended merely to bind the members together more effectually for the grand objects of the organization. Still, a few words of description of the plan of organization may not be out of place. Though the National Grange was first in the order of time, the subordinate grange is really the unit of the organization. A subordinate grange must have at least 15 members, of whom not less than 4 should be women. A complete grange must have 13 officers—viz. a master, overseer, lecturer, steward, assistant steward, chaplain, treasurer, secretary, and gate-keeper—all men; Ceres, Pomona, Flora, and Lady Assistant Steward—all women. These have each their appropriate insignia of office and their well-defined duties. There is also an executive committee of three members. The officers of the grange are addressed as "Worthy." Every member of the grange must be inducted into the first four degrees of the order before taking part in its work or business. All business meetings are confined to the fourth degree. The meetings of the subordinate grange are held monthly or oftener, and may determine upon such measures as shall promote the interests of the grange and its members. The members of the grange are bound to render fraternal aid to each other, to warn each other of danger, to stand by each other without violation of the laws, and to aid each other in penury or distress. The grange when fully organized has its meetings for literary and scientific improvement, and those for social culture and enjoyment. (2) In those States where the co-operative feature of the order has been most fully developed there are county or district organizations called granges or councils, which conduct the secular business, buying, selling, shipping of produce, etc., for the subordinate granges which they represent. These granges are held in the fifth degree, and are composed of masters and past masters of subordinate granges and their wives who are matrons, and also of from 1 to 3 fourth-degree members of each subordinate grange elected thereto. Dispensations for these councils issue from the State grange. (3) The State grange is composed of masters of the subordinate granges and their wives who are matrons; past masters, and their wives who are matrons, are honorary members, but have no vote. It has the same number of officers as the national and subordinate granges, and an executive committee of five. It issues dispensations to district and subordinate granges, subject to the approval of the National Grange, and generally legislates at the annual meetings for the subordinate granges and for the good of the order. Its sessions are always held in the fifth degree. (4) The National Grange is composed of masters of State granges and their wives who have taken the fifth degree, or Pomona; past masters and their wives are honorary members, but not entitled to vote. Its officers are chosen for three years, and it has an executive committee of three members, who are charged with the general business in-

terests of the order, its discipline and management. It meets annually. Its meetings are conducted in the sixth degree, Flora or Charity. There is a seventh degree, to which all members of the National Grange who have served one year may be admitted on application. It is called Ceres, or Faith, and has charge of the secret work of the order, and forms, upon occasion, a court of impeachment for the trial of officers of the National Grange. Its members are honorary members of the National Grange, but are not entitled to vote. L. P. Brockett.

Pattagumpus, post-v., Penobscot co., Me. Pop. 94.

Pat'ten, post-v. and tp., Penobscot co., Me., has 3 churches, several schools, an academy, 1 hotel, and 1 weekly newspaper. P. 704.

Patten (David), D. D., b. Oct. 15, 1810; graduated at Wesleyan University in 1834; principal of the academy at Wilbraham, Mass., 1834; held various Methodist Episcopal pastorates in New England; was presiding elder of the Providence district 1852–53; professor of theology in the Biblical Institute, Concord, N. H., 1854–66; became in 1867 professor of homiletics and pastoral theology in the theological school now connected with Boston University.

Patten (George W.), b. in Newport, R. I., about 1808; graduated at Brown University 1825, and at U. S. Military Academy 1830, when he was appointed second lieutenant of infantry, lieutenant-colonel 1862; served in the Florida war and war with Mexico, losing a hand at Cerro Gordo, Apr. 18, 1847. In 1864 he was retired from active service. Author of *Army Manual; Tactics and Drill.* A collection of his poems was published in 1867.

Pat'tensville, v., Bloomfield tp., Jackson co., O. P. 38.

Pat'terson, post-v. and tp. of Putnam co., N. Y., on Croton River and the Harlem R. R. Pop. 1418.

Patterson, post-v. and tp., Caldwell co., N. C. P. 789.

Patterson, tp. of Orange co., N. C. Pop. 1092.

Patterson, tp. of Darke co., O. Pop. 978.

Patterson, tp. of Beaver co., Pa. Pop. 74.

Patterson, post-b. of Milford tp., Juniata co., Pa., on the Juniata River and Pennsylvania Central R. R. P. 659.

Patterson (Carlile Pollock), son of D. T., b. at Shieldsboro', Bay of St. Louis, Miss., Aug. 24, 1816; appointed midshipman Sept., 1830; joined the frigate Brandywine in October, and served in the Mediterranean squadron; in Feb., 1836, returned to the U. S. in the line-of-battle ship Delaware, carrying his father's flag as commodore; was passed midshipman June, 1836; entered and graduated from Georgetown College, Ky., with diploma as civil engineer early in 1838; joined the U. S. Coast Survey, and served until 1841; as second lieutenant of the U. S. brig Boxer cruised in the West Indies until Jan., 1844; again in Coast Survey in 1845, and conducted a hydrographic party in the Gulf of Mexico; took command of Pacific mail steamship Oregon in Jan., 1850; resigned as lieutenant in the navy Sept., 1853, and remained on the Pacific coast until Mar., 1861, in private business and in command of steamships running from Panama to Puget Sound. In May, 1861, hydrographic inspector U. S. Coast Survey, and so continued until Feb. 17, 1874, when he was appointed superintendent of that work.

Patterson (Daniel Tod), b. on Long Island, N. Y., Mar. 6, 1786; appointed midshipman in the navy in 1800; attached to the frigate Philadelphia when that vessel ran on a reef near Tripoli in Oct., 1803, and, being defenceless, surrendered to a flotilla of Tripolitan gunboats. Patterson remained a prisoner until peace was concluded in 1805; promoted to the rank of lieutenant in 1807, and to that of master-commandant in 1813. In 1814 he commanded naval forces at New Orleans, and for able co-operation with Gen. Jackson in defending that city received the thanks of Congress. He commanded the flotilla which captured and destroyed the forts and other defences of Lafitte the pirate on the island of Barataria; was appointed captain in Feb., 1815; commanded the frigate Constitution 1826–28 in the Mediterranean; served as navy commissioner 1828–32; commanded the Mediterranean squadron 1832–36; and from 1836 was commandant at the navy-yard, Washington, where he d. in 1839.

Patterson (Rev. James), b. in South Carolina 1773; d. in North Carolina July 1, 1858; entered the ministry in the South Carolina Conference in 1795; labored very efficiently in South Carolina, North Carolina, and Virginia, and did much to check the schism occasioned by the secession of the Rev. James O'Kelly. T. O. Summers.

Patterson (James W.), b. at Henniker, N. H., July 2, 1823; graduated at Dartmouth College 1848; professor of mathematics in that college 1854–59, since which time he has been professor of astronomy and meteorology; secretary of the board of education of New Hampshire 1858–61; in Congress 1862–66; U. S. Senator 1867–73.

Patterson (Gen. John), b. at New Britain, Conn., 1744; graduated at Yale College 1762; became a lawyer; removed to Lenox, Mass., 1774; was a member of the first and second provincial congresses of Massachusetts 1774–75; raised a Berkshire regiment of minute-men and started for Cambridge within eighteen hours of receiving news of the battle of Lexington; took part in the disastrous expedition against Canada and in the battles of Trenton and Princeton; was appointed brigadier-general Feb. 21, 1777; rendered important services at the battle of Stillwater; was present at Burgoyne's surrender and at the battle of Monmouth; remained in service throughout the war; was engaged in the suppression of Shay's rebellion 1786; settled soon afterwards at Lisle, Broome co., N. Y.; became a county judge, member of the State legislature, of the constitutional convention of 1801, and of Congress 1803–05. D. at Lisle July 19, 1808.

Patterson (Robert), LL.D., b. in Ireland May 30, 1743; removed to Philadelphia 1768; became in 1774 an instructor in Wilmington, Del.; was an officer of the Revolutionary army; was for a time vice-provost of the University of Pennsylvania and its professor of mathematics 1779–1814; became director of the U. S. Mint 1805; president of the American Philosophical Society. D. at Philadelphia July 22, 1824. Author of *The Newtonian System* (1808); of an *Arithmetic* (1819), and of many scientific papers; also editor of several volumes of the scientific writings of Ferguson, John Webster, Alexander Ewing, etc.

Patterson (Col. Robert), b. in Pennsylvania in 1753; emigrated to Kentucky 1775; settled near Dayton, O., 1804; was the original proprietor of the site of Lexington, Ky., and of one-third of the site of Cincinnati, O.; participated in Col. Clarke's three expeditions against the Western Indians 1778–82, being colonel in the latter; participated in Bowman's expedition against Chillicothe 1779; was second in command to Daniel Boone at the battle of the Lower Blue Lick Aug. 19, 1782, and in Logan's campaign against the Shawnees 1786. D. near Dayton Aug. 5, 1827.

Patterson (Robert), b. in Tyrone co., Ireland, Jan. 12, 1792; at an early age came to the U. S., and subsequently became a very successful merchant of Philadelphia. On the outbreak of the war with Mexico he was appointed a major-general of volunteers in the service of the U. S., and commanded a division under Gen. Scott, taking part in the battle of Cerro Gordo. On the breaking out of civil war in 1861 he was mustered into the service of the U. S. as major-general of Pennsylvania troops assembled under the President's first call on the States (Apr. 15, 1861) for 75,000 men for three months. Commanding the force on the Potomac in the neighborhood of Harper's Ferry, opposed to the Confederate force under Gen. J. E. Johnston, he was charged with neutralizing that force and preventing its junction with Beauregard at Manassas Junction. But Johnston succeeded in effecting a junction, his advance reaching Manassas on the 20th, the battle of Bull Run ensuing the next day. (See Bull Run.) On the expiration of his commission (July 27, 1861) Gen. Patterson was mustered out of service. He has since resided in the city of his adoption, Philadelphia, one of her most honored and influential citizens, and one of the largest mill-owners in the U. S. His advanced age does not debar him from the closest personal attention to his immense manufacturing interests, nor from still finding pleasure in the rites of a generous hospitality.

Patterson (Robert M.), M. D., b. in Philadelphia 1786, a son of Dr. Robert Patterson (1743–1824); graduated in 1804 at the University of Pennsylvania; took his medical degree in 1808; studied chemistry under Davy; became professor of chemistry, natural philosophy, and mathematics in his *alma mater;* occupied a chair in the University of Virginia 1828–35; was director of the Mint at Philadelphia 1835–53; author of addresses, scientific papers, etc. D. at Philadelphia Sept. 5, 1854.

Patterson (William), LL.D., b. at sea of Irish parents in 1745; was reared in New Jersey; graduated at Princeton 1763; was admitted to the bar 1769; was attorney-general of New Jersey 1776–86; member of the national constitutional convention 1787; U. S. Senator 1789–91; governor of New Jersey 1794; revised the laws of New Jersey 1798–99, and was a justice of the U. S. supreme court from 1794 to his death at Albany, N. Y., Sept. 9, 1806.

Patterson's, tp. of Alamance co., N. C. Pop. 717.

Pat'tersonville, post-v. of St. Mary's parish, La., on the Bayou Teche, near the Atchafalaya River.

Patteson (John Coleridge), D. D., b. in London, Eng., Apr. 1, 1827; educated at Merton College, Oxford; became a fellow of Merton 1850, curate of Alfington 1852; went in

1854, with Bishop Selwyn, to New Zealand, where he labored as a missionary until 1861, when he was made bishop of the Melanesian Islands; spent the remainder of his life visiting the islands under his episcopal charge, and endeavoring to suppress the kidnapping of the natives to be carried to Queensland, and was killed on the island of Santa Cruz by the Melanesians, Sept. 20, 1871. His *Life* has been written by Miss C. M. Yonge (2 vols., London, 1874) and by Francis Awdry, *The Story of a Fellow-Soldier* (1875).

Pat'ti, town of Sicily, province of Messina, situated on two hills on the west side of a small gulf, to which it gives its name. The *Timethus*, now called the *Naso*, enters the Tyrrhene Sea a mile and a half E. of the town. It seems probable that Patti was originally a suburb or outpost of the ancient *Tindaridus*, the name of which is still preserved in the little hamlet Tindari, standing in the midst of the stately ruins of the old town. The famous sanctuary of Maria Santissima towers above the poor village and brings its yearly throng of devotees. Patti itself was made an episcopal see by Roger in 1094. In the sixteenth century the town was burnt by the Turks. It is now a flourishing place, and its manufactures and commerce are considerable; 300 vessels enter the port annually, and the tunny fisheries also contribute to its prosperity. Pop. in 1874, 8191.

Patti (Adelina Maria Clorinda), b. at Madrid Apr. 9, 1843; was educated at New York, where, on Nov. 24, 1859, she made her début as a singer in Donizetti's *Lucia di Lammermoor*. On May 14, 1861, she made her first appearance in London in *La Sonnambula*, and next year, Nov. 16, 1862, she appeared at Paris in the same rôle. She afterwards sang alternately in Paris, London, and St. Petersburg with great success. July 29, 1868, she married in London the marquis de Caux.

Pat'tison (Granville Sharpe), M. D., b. 1791 near Glasgow, Scotland; became lecturer on anatomy in the Andersonian University; held successive professorships of Anatomy in Baltimore, Md., Medical College, in London University, in the Jefferson College, Philadelphia, and 1840–51 in the University of New York. Author of professional writings. D. in New York Nov. 12, 1851.

Pattison (Robert Everett), D. D., b. at Benson, Vt., Aug. 19, 1800; graduated at Amherst 1826; was tutor in Columbian College, D. C.; ordained to the Baptist ministry at Salem, Mass., 1829; became in 1830 pastor of the First church, Providence, R. I.; held a professorship in Waterville College, Maine, of which he was president 1836–40 and 1853–57; was professor of theology in the theological school at Covington, Ky., 1846–48; held a chair in the Newton (Massachusetts) Theological Institution 1848–53; was for a time president of the Oread Institute, Worcester, Mass., and in 1871 became a professor in the Chicago University. Author of a *Commentary on Ephesians* (1859) and of published addresses, reviews, etc. D. Nov. 21, 1874.

Patton, tp. of Ford co., Ill. Pop. 2726.

Patton, tp. of Allegheny co., Pa. Pop. 1193.

Patton, tp. of Centre co., Pa. Pop. 721.

Pat'ton (Rev. Samuel), D. D., b. in South Carolina Jan. 27, 1797; d. in Knoxville, Tenn., Aug., 1854; filled important stations in Tennessee and Holston conferences for thirty-five years; was editor of the *Holston Christian Advocate* at the time of his death. T. O. Summers.

Patux'ent, post-v. of Anne Arundel co., Md., on Patuxent River, at the junction of the Baltimore and Potomac with the Annapolis and Elk Ridge R. R.

Patuxent, tp. of St. Mary's co., Md. Pop. 1935.

Patuxent River rises 18 miles E. of Frederick, flows S. S. E. and S., and falls at last into Chesapeake Bay by a wide and deep estuary. Its valley is very narrow, and the river is for many miles a navigable tidal stream, abounding in oyster-beds of great value.

Patzum', town of Central America, state of Guatemala, has 5000 inhabitants.

Pau, town of France, capital of the department of Basses-Pyrenées, is most picturesquely situated on the Gave du Pau, with beautiful promenades presenting most striking views of the Pyrenées. It has a remarkable old castle built by Gaston de Foix in 1363, in which Henry IV. was born, several good educational institutions, linen and paper manufactures, and an active trade in wine, hams, leather, fruits, and corn. Pop. 24,800.

Paul (Saint), the apostle, b. at Tarsus, the capital of Cilicia, of Jewish parents, but a Roman citizen, and educated partly in his native city, which contained celebrated schools of rhetoric and philosophy, partly in Jerusalem, where he became the pupil of Gamaliel. We first hear of him as present at the martyrdom of Stephen, and a passionate adversary of Christianity. With a commission from the Sanhedrim, he was on the way to Damascus to stir up persecutions there too, when a vision overtook him, and he became at once converted to Christianity. He retired to Arabia, where he remained for three years in solitude. He then returned to Damascus, and began to preach there, in Jerusalem, and in Tarsus. Subsequently, Barnabas brought him to Antioch, and from this city, having made a new visit to Jerusalem in 44, he started on his three great missionary journeys. The first, on which he was accompanied by Barnabas, included Asia Minor, Pamphylia, Pisidia, and Lycaonia, and ended about 51. The second, on which he was accompanied by Silas, extended to Europe: Philippi, Thessalonica, Athens, and Corinth were visited. The third, which commenced about 54, embraced nearly the same districts, and terminated at Ephesus, where the apostle remained two years. From Ephesus he went up to Jerusalem; but in order to save him from the fury of the Jewish population, the captain of the Roman guard sent him to Cæsarea, the residence of the Roman governor, and here he was detained in prison two years. Having appealed to the emperor, he was sent to Rome, where he arrived in 61, suffering shipwreck at Melita. In Rome he was treated kindly and allowed to dwell "for two whole years in his own hired house," but it is uncertain whether he ever obtained his freedom. It is generally believed, however, that he made journeys both to the East and West, and, returning to Rome, suffered martyrdom during the persecutions in the reign of Nero about 67. (On the life and Epistles of Paul see the works of Conybeare and Howson, Lewin, Baur, the histories of the apostolic Church by Neander, Schaff, Lange, and the numerous commentaries on the Pauline Epistles.)

Paul I., Pope, a Roman, who succeeded his brother, Stephen III., in 757, and d. at Rome June 28, 767. He was an able prelate, and strengthened the papal authority in spite of its numerous enemies.—Paul II. (*Pietro Barbo*), b. at Venice Feb. 26, 1418; became bishop of Cervia, and in 1440 a cardinal; was chosen in 1464 to succeed Pius II. He first gave the red gown and hat to the cardinals. He preached a crusade against George Podiebrad, king of Bohemia, who favored the Hussites. D. at Rome July 28, 1471.—Paul III. (*Alessandro Farnese*), b. at Canino Feb. 29, 1468; became a cardinal 1493, bishop of Montefiascone 1499, and succeeded Clement VII. as pope in 1534. He pursued with address and vigor his two chief aims in life, the aggrandizement of the Farnese family and the suppression of heresy. Among the prominent events of his important pontificate were the excommunication of Henry VIII. of England 1538, the approval of the order of Jesuits 1540, and the convocation of the Council of Trent 1545. D. at Rome Nov. 10, 1549. —Paul IV. (*Gian Pietro Caraffa*), b. at Capriglio June 28, 1476; became bishop of Chiete 1507; was nuncio to London, and later had a high public office at Madrid; became archbishop of Brindisi 1518; founded the Theatines 1524; became cardinal 1536; succeeded Marcellus II. as pope 1555; joined France in the war for the conquest of Naples from Spain 1555–57; strove for the elevation of his family, and his impolitic course regarding England and Germany strengthened the Protestant cause. He was bitterly hated by the common people of Rome on account of his austere rule. D. at Rome Aug. 18, 1559.—Paul V. (*Camillo Borghese*), b. at Rome Sept. 17, 1552; became legate to Spain and cardinal 1596; succeeded Leo XI. as pope 1605. This pontificate was marked by the interdict laid upon Venice, the close of the Molinist controversy, the establishment of the Congregation of the Oratory and the orders of the Ursulines and the Visitation, and by great activity in the work of missions in heathen regions. D. at Rome Jan. 28, 1621.

Paul, czar of Russia, b. at St. Petersburg Oct. 1, 1754; was the son of Peter III. and Catharine II. Hated by both his parents and abused by his mother, he bore everything patiently, and in 1796 succeeded to the throne on Catharine's death. He immediately set about to reverse her policy in every particular. His reign began well. Kosciusko and the other Polish prisoners were liberated and treated with generosity. In 1799–1800 his troops served in Italy and Switzerland against France; but in 1800 he changed sides, embraced the cause of Napoleon, and challenged to personal combat any prince who refused to join him in a league against Great Britain. Meanwhile, the puerilities and tyrannies of his home rule begot a strong popular discontent, and he was murdered in his bedchamber by his nobles Mar. 24, 1801. Paul had some generous qualities. His own family he treated with a kindness before almost unknown in the Russian imperial house. He intended, it is said, to give Poland her freedom and autonomy; but his feeble intellect, his scanty educa-

tion, and an absurd and almost insane self-conceit led him into many acts of tyranny.

Paul (Gabriel R.), b. in Missouri Apr., 1813; graduated from the U. S. Military Academy, and became brevet second lieutenant of infantry July, 1834; served with his company in the Florida war; in the war with Mexico was wounded at Cerro Gordo and made brevet major for Chapultepec. On the outbreak of the civil war in 1861 he was major of the 8th Infantry, stationed in New Mexico; in Dec., 1861, was appointed colonel of the 4th New Mexico Volunteers; appointed brigadier-general of volunteers Sept., 1862, he was assigned to the army of the Potomac, and participated in the battles of Fredericksburg, Chancellorsville, and Gettysburg, where he was so severely wounded by a rifle-ball as to completely destroy his sight. Appointed colonel of the 14th Infantry in 1864, he was in 1865 retired on that rank; but in 1866 Congress granted him the full pay and allowances of a brigadier-general.

Paul (Vincent de), b. at Pony, Gascony, in 1576, in humble circumstances; received his first instruction from the Franciscan friars at Acqs; studied afterwards at Toulouse; took holy orders in 1600, and was captured in 1605 by pirates on a voyage from Marseilles to Narbonne, and carried as a slave to Tunis. In 1607 he succeeded in making his escape; visited Rome and then Paris; was appointed chaplain to the ex-queen Margaret of Valois, and in 1622 chaplain to the galleys at Marseilles; repaired in 1627 to Paris, where he developed an extraordinary activity in the establishment and management of charitable institutions, hospitals, asylums, etc., and in the foundation of religious fraternities, the Lazarists, the Sisters of Charity (which see); was a member of the "council of conscience," by which all ecclesiastical preferments were distributed. D. at St. Lazare Sept. 27, 1660. He was beatified by Benedict XIII. in 1729, and canonized by Clement XII. in 1737.

Paul'ding, county in N. W. Georgia. Area, 400 square miles. It is broken by wooded mountain-ranges, contains iron, limestone, and other valuable minerals, and has fertile valleys, producing cotton, corn, etc. Cap. Dallas. Pop. 7639.

Paulding, county of Ohio, bounded W. by Indiana. Area, 414 square miles. It is level, fertile, and in part covered by wooded swamps. Corn, wheat, and lumber are the leading products. The county is traversed by the Toledo Wabash and Western R. R., the Auglaize and Maumee rivers, and the Wabash and Erie Canal. Cap. Paulding. Pop. 8544.

Paulding, post-v., cap. of Jasper co., Miss. Pop. 262.

Paulding, post-v. and tp., cap. of Paulding co., O., on Crooked Creek, in an agricultural region, has 1 weekly newspaper. Pop. 448.

Paulding (Admiral Hiram), son of John, b. in Westchester co., N. Y., Dec. 11, 1797; entered the U. S. navy as a midshipman Sept. 1, 1811; was engaged in McDonough's victory on Lake Champlain 1814; became lieutenant 1816; accompanied Com. Porter in his cruise against the West Indian pirates 1823; became captain 1844; suppressed an intended expedition against Nicaragua, headed by William Walker, 1857; became rear-admiral on the retired list 1861; was in command of Brooklyn navy-yard 1862–65; rendered valuable service in equipping vessels for active employment in the navy and in protecting public property during the riots of 1863, and became governor of the Philadelphia Naval Asylum 1866.

Paulding (James Kirke), b. in Pleasant Valley, Dutchess co., N. Y., Aug. 22, 1779, the son of an active but unfortunate Revolutionary patriot of Dutch descent. The son received a scanty training in school, and in early life removed to New York City, where his sister had married William, an elder brother of Washington Irving, with whom he became associated in the authorship of *Salmagundi* (1807), but the second series of *Salmagundi* (1819) was by Paulding alone; became in 1814 secretary of the Board of Navy Commissioners; was secretary of the U. S. navy 1838–41, and for twelve years was navy agent in New York; was a facile essayist and humorist, and author of numerous works, among which were novels, political pamphlets, poems, etc. The best of his writings are *The Dutchman's Fireside* (1831), a powerful and well-written novel, and a valuable *Life of Washington* (1835). D. at Hyde Park, N. Y., Apr. 6, 1860.

Paulding (John), b. in New York 1758; served through the Revolutionary war, being three times taken prisoner; was one of the captors of Major André, for which service he received from Congress a silver medal, inscribed on one side "Fidelity" and on the other "*Vincit Amor Patriæ*," and was granted an annuity of $200. D. at Stoatsburg, N. Y., Feb. 18, 1818. A monument to his memory was erected at Peekskill over his remains in 1827 by the corporation of the city of New York, and his name has been given to one of the N. W. counties of Ohio, his companions, Van Wart and Williams, having been similarly honored.

Pau'li (Georg Reinhold), b. at Berlin May 25, 1823; studied philology and history at Berlin and Bonn; lived in Great Britain from 1847 to 1855, and was appointed professor in history at Rostock in 1857, at Tübingen in 1859, at Marburg in 1867, and at Göttingen in 1870. Besides several minor essays on various subjects, and some larger works relating to the history of England, he wrote *König Alfred und seine Stellung in der Geschichte Englands* (Berlin, 1851), translated into English by Thomas Wright (London, 1852), and *Bilder aus Alt-England* (Gotha, 1860), translated into English by E. C. Otté (London, 1861). The sharp criticism to which he subjected the policy of the government of Würtemberg in a review in the *Preussische Jahrbüchern* (1866) occasioned his removal from Tübingen to Marburg.

Pauli'cians, a Christian sect of the Eastern Church, originated in Armenia probably in the middle of the seventh century, but the origin of their name and the sources of their peculiar views are enveloped in obscurity. They rejected the worship of the Virgin and the saints, explained the sacraments spiritually, maintained no priesthood, and acknowledged only the New Testament as authoritative. After spreading quietly in Armenia for about two centuries, though now and then persecuted by the Byzantine emperors, the empress Theodora (841–855) undertook to suppress the sect. More than 100,000 are said to have been put to the sword, and the rest were exiled. Some fled to the Saracens, others to the Bulgarians, and in Bulgaria remnants of the sect were found as late as the sixteenth century. By Roman Catholic writers the Paulicians are generally brought into connection with the Manichæans, though, as it would seem, without sufficient reason.

Pauline Congregation. See Piarists.

Paul'ist Fathers, or **The Congregation of St. Paul the Apostle,** a missionary society of priests in the Roman Catholic Church, founded in 1858 by Rev. Isaac Thomas Hecker, and approved by Pope Pius IX. They are chiefly men who have abandoned Protestantism. The mother-house is in New York.

Paullinia. See Guarana.

Pau'lus (Heinrich Eberhard Gottlob), b. at Leonberg near Stuttgart, Würtemberg, Sept. 1, 1761; studied Oriental languages and theology at Tübingen, Göttingen, London, and Paris, and was appointed professor in 1789 at Jena, in 1803 at Würzburg, director of the department of public worship and education in 1808 at Bamberg, in 1809 at Nuremberg, in 1811 at Ansbach, but moved in the same year as professor to Heidelberg, where he d. Aug. 10, 1851. He was one of the most prominent representatives of the rationalistic theology in its historico-critical phase; but although his flat and barren principle often led him to the adoption of hypotheses and explanations which even his contemporaries found ridiculous, his integrity and courage, his sharp and acute judgment, and his great learning did good service on many occasions and commanded general respect. The most remarkable among his numerous works are *Clavis über die Psalmen* (1791); *Clavis über den Jesaias* (1793); *Commentar über das Neue Testament* (4 vols., 1800–07); *Leben Jesu* (1828); *Exegetisches Handbuch über die drei ersten Evangelien* (3 vols., 1830–33); Schelling's *Lectures on Revelation, with Critical Notes,* which implicated him in a lawsuit (1843); *Skizzen aus meiner Bildungs- und Lebens-geschichte* (1839).

Paulus (Lucius Æmilius), surnamed **Macedonicus,** b. at Rome about 230 B. C., a son of the consul of the same name, who fell at Cannæ 216; was prætor in 191; commanded afterwards as pro-consul in the province of Further Spain, where he put down a formidable insurrection and defeated the Lusitanians; was consul the first time in 181, and a second time in 168; censor in 164. D. in 160. During his second consulship he finished the third Macedonian war by his brilliant victory over Perseus at Pydna. The Macedonian kingdom was broken up into four independent republics with aristocratic governments, standing under the protectorate of Rome and paying a part of the land-tax into the Roman treasury. Also, the affairs of the other Greek states in Europe were regulated at the same time by a Roman commission under the presidency of Paulus.

Pau'lus Ægineta, a famous Greek physician and author, b. in Ægina at an unknown date, but Abulfaragius places him in the seventh century A. D., which is probably correct. His *De Re Medica Libri Septem* had great influence among European and Arabian physicians in the Middle Ages, and several Latin and Arabic versions were

made. Of the Greek text the edition of 1528 (Venice) and 1538 (Bâle) are complete. The Sydenham Society published (London, 1847) an improved edition of Francis Adams's complete translation, with abundant notes, in 3 vols. 8vo. Several other works of Paulus are mentioned by old writers.

Paulus Diaconus, or **Levita,** b. at Cividale in Friuli about 730; educated at the Lombard court at Pavia; became tutor to the daughter of King Desiderius, for whom he compiled his *Historia Romana*, parts of which are given in Muratori's *Rerum Italicarum Scriptores*, vol. i. (Milan, 1728); was ordained deacon, not later than 763; entered the monastery of Monte Casino, whence he addressed a letter to Charlemagne in 781; lived afterwards for several years at the court of Charlemagne, where he collected his *Homiliarius*, which was often reprinted in the fifteenth and sixteenth centuries and translated into German and Spanish, and wrote his *Gesta Episcoporum Mettensium*, printed in Pertz's *Monumenta Germaniæ Historica*, vol. ii. (Hanover, 1827); made an abridgment of Festus's *De Significatione Verborum* (see FESTUS): returned to Monte Casino in 787. D. there about 797. His last and most important work was his *De Gestis Longobardorum Libri VI.*, which ends at 744, and is published in the above-mentioned collection by Muratori, and in *Hist. Gotth. Vandal. et Longobard.*, ab H. Grotio (Amsterdam, 1655).

Paul Veronese. See CAGLIARI.

Paul'ville, v. of Salt River tp., Adair co., Mo. P. 100.

Pau'pack, tp. of Wayne co., Pa. Pop. 642.

Pau'perism is said not to be a word derived from the Latin through the Norman-French, but to have arisen in England in the seventeenth or eighteenth century to express a condition of things which was modern and characteristically English. It describes, in one aspect, that degraded condition of poverty where the habit of self-support and the attending mental state of self-respect have been much impaired and lost—a condition in which the lowest vices are bred, and which gradually degenerates into mental and physical weakness and extinction. In a more general sense, pauperism merely describes the settled condition of large masses of people, who are more or less dependent on the alms of the community for their support. It is not poverty simply: it is that degree of penury which demands public aid, and which has acquired the habit of dependence.

Poor Laws in England.—Laws for compulsory charity, or the so-called "Poor Law" of England, date back from Henry VIII. Before and during his reign the breaking up of the feudal system, the dispersion of noblemen's retainers, and the destruction of the monasteries had turned adrift very many dependent persons, who were obliged to support themselves, and who often fell into great poverty. At the same time, the rise of prices consequent on the large introduction of the precious metals from America into Europe pressed heavily on the working-classes. Much pauperism was in consequence created. The statutes for relief usually contained a preamble, stating that these laws were passed "to the intent that valiant beggars, idle and loitering persons may be avoided, and the impotent, feeble, and lame provided for which are poor in very deed," thus early indicating the different treatment to be given to voluntary and involuntary poverty. These statutes of Henry VIII. rendered each locality responsible for the support of its own poor, and regulated the giving of alms. The impotent poor were to be sent to the place where they were born, but the able-bodied were to be set to work; and if they did not accept it, they were to be severely punished. In regard to alms-giving, money was to be collected in each parish by voluntary subscriptions; but if these were refused, there were modes of compulsory collection by ministers and churchwardens. Any one giving alms privately rendered himself liable to a fine equal to ten times the amount of what he had given away. No tax, however, was laid for compulsory charity till the reign of Elizabeth. The celebrated 43 Eliz. c. 2 is the foundation of the present system of poor-rates. This act for the first time gave every one a legal right to claim relief. In order to obtain funds for the affording of this relief, the local authorities were empowered to lay a tax on all real property, such as land and houses. Overseers were to be appointed, who should be responsible for the collection of rates and the administration of relief. Apart from these, the main features of the law were the legal recognition of the primary liability of children, parents, and grandparents to support one another, the obligation of able-bodied paupers to work as a condition of obtaining relief, the necessary relief of the aged, impotent, and poor "unable to work," and the apprenticeship of poor children. The great defect of the act, apart from its publishing to the poor their "right of relief," was that it threw on the parochial authorities the responsibility of finding work for the unemployed—a provision which, without the "workhouse test," did so much to demoralize the working-classes of England previous to the reforms of 1834. To carry out the act, the local authorities were obliged to establish workhouses and hospitals; and finally, in 1723 (9 Geo. I. c. 7), a union of parishes was empowered to build a workhouse, and the offer of residence, if not accepted, was a bar to relief. The "workhouse test" for a time diminished pauperism; but gradually the management of these workhouses degenerated: they became mere asylums for the idle and worthless, or else parish-manufactories managed in the interest of individuals. The poor relief became discredited, and out-door relief was encouraged both by public opinion and by legislation. At length, in 1815, the workhouse test was altogether abolished and no able-bodied laborer was compelled to enter the workhouse, and justices were empowered to distribute money-alms to the poor at their own homes. If wages in any parish were below what was considered a reasonable maintenance, the local authorities were empowered to grant "allowances" or to supplement wages. Very strict laws of "settlement" also were passed, forbidding the free migration of poor laborers from one parish or county to another. The poorest class of laborers were in consequence kept in their own localities, as they had no motive, or even the power, to go where their labor might be in demand. Parochial relief became a vast system of indiscriminate alms-giving: the independent workman's condition was often inferior to that of the pauper. An artificial stimulus was given to population by increasing the parish-allowance in proportion to the number of children, and immorality was encouraged by the parish granting more money for an illegitimate than a legitimate child. Pauperism became a paying profession, and was sometimes followed by several generations of the same family. With increased dependence of the poor increased immorality and disorder resulted; and finally, in 1832, riots and incendiary fires became of common occurrence in the districts where pauperism was most rife. The distributors of relief became also demoralized, and various forms of peculation were discovered among them. The cost of pauperism also increased, and in some districts the taxes absorbed all that remained from the produce of the soil after the expenses of cultivation were paid. Many of the clergy gave up their land, and much fertile land was thrown out of tillage. Many English authorities maintain that the old Poor Law nearly ruined the country, and there can be no doubt that under it the evil of pauperism had reached gigantic dimensions.

In 1832, however, a commission of inquiry was appointed by Parliament, whose labors resulted in the celebrated Poor Relief act of 1834, the basis of the present poor-law system of England, and in a report still a standard of authority and reference in all discussions on this subject. By the act of 1834 a central controlling body was established with extensive powers in regard to the relief and management of the poor. The workhouse test was renewed, the granting of "allowances" in aid of wages was abolished, the appointment of paid overseers was provided for and an official audit of accounts secured. Illegitimacy was sought to be checked by making the father responsible for the support of the child instead of paying the mother, as had been the rule. The laws of settlement were made much more easy, so that laborers could move with more freedom from one parish to another. The general drift of the legislation was in favor of in-door relief as opposed to out-door relief, especially as regards able-bodied paupers. Its influence was to lead the industrial classes to rely on their own labor rather than on the rates. There were some hardships at the first execution of the law, when families were refused out-door relief, but these gradually righted themselves. The laboring classes became freed from contact with the pauper class, and their relations with employers were put upon the universal customary footing. It has now become exceedingly rare outside of London for parish authorities to administer out-door relief to able-bodied paupers. Under the new act the cost of pauperism diminished remarkably, the annual expenditure falling from £6,750,000 in the five years preceding the passage of the act to £4,500,000, while the average cost per head of the whole population fell from 8*s*. to 6*s*. and 5*s*. An even more stringent act was passed in Ireland in 1838, which entirely superseded out-door relief by workhouse relief, which was adhered to till the famine of 1847, when its restrictions were for a time thrown down. At present out-door relief is granted much less in Ireland than in England. In Scotland an act was passed in 1845, which allowed out-door relief even more than it was permitted under the English Poor Laws. This is believed to have planted among the Scotch population many of the evils of pauperism; and numerous workhouses have been obliged to be built in order to obviate its evils and apply the workhouse

test. In England the act of 1834 and the regulations following it remain practically unextended, but, at the same time, unrestricted. Under it, despite the improvement on the former state of things, a gigantic pauperism remains, or a population of 998,484 paupers in 1873 in England and Wales, out of a total population of 22,704,000, making one person in 23 a pauper. It is true that this pauperism is diminishing, as will appear in the statistics on a following page. In three years before 1873 there was a decrease of 194,000, or 18½ per cent., in the number of paupers, being a decrease of 7 per cent. in out-door cases and of 20½ per cent. in in-door, these estimates not including lunatics and vagrants relieved by the poor-rates. In one year (1873) there was a decrease, as compared with the preceding, of 54,126, or 6 per cent.

Out-door and In-door Relief.—Many of the English authorities are inclined to attribute the enormous extent of pauperism in England to the out-door relief granted still under the Poor Law Amendment act, and hold that if out-door relief were entirely cut off there would be a marvellous diminution of pauperism. This is apparently a theoretical view, which facts do not sustain. It is true that in Ireland the in-door paupers are to the out-door in the proportion of nearly 5 to 1, while in England the out-door are to the in-door as 8 to 1, and in England 1 in 25 is a pauper, while in Ireland the proportion is, according to Prof. Fawcett, 1 in 74, or, more exactly, 1 in 90. But it would be necessary to inquire how much of the diminution of pauperism in Ireland is due to the immense emigration which has been relieving the country, and how much its extent in England to the Poor Law on the one side and the very unequal distribution of property on the other. The American system is to mingle out-door and in-door relief, which seems more judicious than the absolute exclusion of the former. It often happens that a little relief given judiciously by a relieving officer in a small community will keep a family suddenly stricken by misfortune from absolute dependence. The residence in an almshouse degrades and pauperizes, and on no account should children ever be kept long in a poorhouse, but should speedily be apprenticed or placed out. It is for the interest of every community that no member of it should acquire the habits of pauperism. No disease is so dangerous. For that reason it may often be better for a village or small town to spend considerable sums in out-door relief, rather than have a portion of the population accustomed to the degradation and dependence of the almshouse.

Out-door relief in large communities by public authorities is, however, extremely dangerous, both on account of the difficulty of ascertaining the deserving character of the claimants and because it is peculiarly liable to be misused as a means of bribery and corruption. The true principles would seem to be (1) that in no case should out-door relief be given to the able-bodied male poor, but they should be required to earn their support in workhouses; (2) that out-door relief should not be given by public authorities in cities, but should be left to organized voluntary associations; (3) that out-door relief should be given in villages and small towns only on such conditions and in such modes as would prevent future pauperism, and to cases of sudden misfortune, as to widows deprived by sudden death of their husbands, to families of young children struggling to maintain themselves during the sickness of parents, or to the aged and impotent poor. The error of the English administration does not seem to have been so much in the excessive giving of out-door relief as in the feeling implanted in the poor of a "right of relief," and in the early giving of alms to the masses instead of education. Had the immense sums spent in England on the poor-rates been but in part devoted to popular education, the past year would not have seen more than 850,000 paupers in that country, calling for an expense of more than $35,000,000, and had the feeling of a "right to education" been implanted in the English laboring-classes, rather than a "right to relief," the most gigantic evil in English society would have been greatly lessened. The words of a writer (Malthus) who has been only too little appreciated are still true of Poor Laws in all countries: "The kind of despotic power essential to voluntary charity gives the greatest facility to the selection of worthy objects of relief, without being accompanied by any ill consequences, and has further a most beneficial effect from the degree of uncertainty which must necessarily be attached to it. It is in the highest degree important to the general happiness of the poor that *no man should look to charity as a fund on which he may confidently depend.*" (*Essay on Population*, v. ii. p. 430.)

Pauperism in the U. S.—There is very little of native pauperism in this country. The great proportion of paupers in the U. S. are foreign-born or of foreign descent. Many villages and towns are known where not a single pauper exists. The statistics on the subject, both in the census and in the reports of the State boards of charity, are utterly untrustworthy, owing to the method of counting, which often includes the same person a number of times. If the average number by the day could be taken, a fairer estimate would be given of the true number of paupers. The comparatively equal distribution of property in the U. S., the cheapness of arable land, the dignity imparted by political privileges, the absence of strict Poor Laws, and, above all, the influence of popular education, have tended to prevent the growth of pauperism. The only places where there is danger of its appearance is in the large cities. Here the occasional business calamities and the indiscriminate charity of the fortunate classes, with the careless mode of distributing public alms, all tend to form a pauper class. A Poor Law may be said to exist almost everywhere in the U. S.; that is, the local communities are required to support their own poor by taxation. Similar features also are found to those in the English law, requiring near relatives to be responsible for one another in case of pauperism resulting from misfortune, providing for the apprenticeship of pauper children, and distinguishing between voluntary and involuntary poverty.

American Settlement Laws for Paupers.—The legal settlements of paupers, such as oblige parishes or towns and villages to relieve or support them, have always been a prolific source of dispute and litigation. The laws for settlement in this country are mainly derived from those of England, yet they vary in different States. In Massachusetts a married woman follows the settlement of her husband if he has any, otherwise that of her own at the time of her marriage. Legitimate children follow the settlement of the father, or, if he have none, that of the mother. Illegitimate children follow that of the mother. Similar provisions exist in other States. But in Indiana, Wisconsin, and Kansas a married woman whose husband has no settlement in the State may acquire one on the same conditions with other persons. In Iowa and some other States a woman abandoned by her husband may acquire a settlement. In Indiana, Iowa, Wisconsin, and Kansas minors whose parents have no settlements are allowed to acquire one on the same terms as adults. In New York and Michigan "emancipated" minors may acquire settlements as follows: (1) If a female, by marriage and living with her husband a year; (2) if a male, by marriage and residence separately from his father's family for a year; (3) by being bound as an apprentice and serving for a year; (4) by being hired and actually serving for a year on wages paid to himself.* In Indiana, Iowa, Kansas, and other States an apprentice acquires a settlement at once on becoming bound. In regard to settlements from property and residence, the Massachusetts law (1868) provides that living on a freehold property for three years shall constitute settlement, or the ownership of property valued by assessors at $200, or whose income is set down at $12 for five successive years, or residence in any place within the State for ten years and payment of all taxes for five years. Women may acquire settlement by a residence of ten years without payment of taxes. The only other States which make the ownership of property a means of acquiring settlements are Vermont, New Hampshire, Rhode Island, Connecticut, Pennsylvania, and Delaware. The latter three States alone require that the person shall live upon the estate, and most of them provide a briefer period of residence, with or without the payment of taxes. All the other States merely require a certain period of continuous residence, without consideration of property or the payment of taxes. The longest period is in Maine, five years; the shortest in Nebraska, thirty days. Settlements are also derived from the holding of public office in Massachusetts, Vermont, Pennsylvania, and Delaware. In Massachusetts alone a clergyman acquires a legal settlement where he is settled as a minister. In three of the New England States a person acquires a settlement who is admitted an inhabitant by any town at a legal meeting. Apprenticeship also gives settlement in many of the States, even to minors, though in Massachusetts the apprentice must be of age and continue in the same place at his trade for five years. In some of the States a soldier acquires a legal settlement wherever he enlists, so that a town becomes liable for the support of persons by whom its quota is filled.

The final extinction of pauperism can only come through individual improvement. Where education sharpens the mental faculties, where religion elevates the moral character, or political rights increase personal dignity, with a fair distribution of property or an easy acquisition of arable land possible to each, there the peculiar debasement, dependence, weakness, and misery which constitute pau-

* *Report of Massachusetts State Board of Charities for 1871*, p. 12.

perism will in all probability be avoided. Contrary to the reasonable though gloomy forebodings of Malthus, the production of the human race has thus far increased faster than population, and the condition of the masses improves yearly in all the leading countries of the world. Even in England, the centre of this evil, pauperism is checked by popular education and by improved production. The statistics of pauperism in all countries are exceedingly untrustworthy, owing to the repetition, in the numbering of the cases, of the same persons. The only perfectly fair method would be to take the average number of cases per diem. Thus in Ireland in 1869, out of a total population of 5,799,000, there were during the year 235,562 paupers, or 1 in 20; but the daily average was only 52,240, or 1 in about 111.

Statistics of Recent English Pauperism.

Year.	In-door.	Out-door.	Total paupers.
1870	158,381	889,281	1,047,662
1871	150,846	847,638	998,484
1872	143,541	764,274	907,815
1873	147,319	706,370	853,689
1874*	137,944	646,404	784,006

In 1871, with a population of 22,704,000, there was a proportion in England of 1 pauper in nearly 23; in London, 1 in 27. According to a trustworthy writer (Emminghaus), there were the following proportions of paupers in these countries:

Great Britain......	1855–65, 1 to 20.83, or 22.22, or $4\frac{3}{8}$ per cent.	
Prussia	1849–61, 1 to 20.60 to 56.05,	or about $2\frac{1}{4}$ per cent.
Saxony................	1856–64, 1 to 54.94 to 56.18,	
Würtemberg........	1856–64, 1 to 29.94 to 52.01,	
Bavaria...............	1855–67, 1 to 38.91 to 56.85,	
France................	1853–60, 1 to 35 to 35.14 (3 per cent.).	

Cost per capita.

Great Britain, per annum......................................	$36.25
Germany, " "	7
France, " "	2.50

During the years 1867, '68, and '69 the annual cost in Great Britain for paupers was some $36,885,000, or an average cost per head of about $37.60. The poor-rates of London amounted in 1868 to $6,582,795, or an average cost per annum for each of about $22; not including those in asylums or the vagrants sheltered by the police. In 1847, England and Wales, with a population of 19,000,000, contained 1,876,541 paupers, or 1 to 10. The cost that year of the poor administration in England was $30,000,000, or about $16 per head; in France, $3,400,000, and the cost per capita $2.64. In London, with 2,500,000 of population that year, there were 300,000 paupers, or 1 in 8; in Paris, with 1,000,000, 75,000, or 1 in 13. The following proportions in the two countries for that year are given by De Watteville:

Lancashire	1 in $14\frac{2}{7}$
Department of Rhone............................	1 " $12\frac{1}{2}$
Department of the North.......................	1 " $4\frac{8}{23}$.
Wilts county (Eng.)..............................	1 " $6\frac{1}{4}$
Lille...	1 " [illegible]
Marseilles..	1 " 7
Bordeaux...	1 " 7
England (out of London)......................	1 " $12\frac{1}{2}$
France (out of Paris)............................	1 " $12\frac{1}{2}$

In these estimates the poor are supposed to be more closely reckoned in England than in France. In both countries the agricultural counties are the poorest; in France some rural communes contain more paupers than the towns. (*Rapport sur la Situation du Paupérisme en France*, par M. le Baron de Watteville, Paris, 1854.) But it is probable that many are included who only receive temporary help, and many are numbered more than once.

We append a table of statistics of comparative pauperism in three of the most populous States and large cities of the American Union. It should be remarked, however, that all such figures have comparatively little statistical value in the U. S., as the classification varies in different States, and all do not distinguish between names and persons in their tables:

Pauperism (1870).

State and City.	Wholly supported.				Partially supported.				Total.			
	No. of in-door.	Proport'n to population.	Cost of whole support.	Cost per capita.	No. partially sup.	Proport'n to population.	Cost of partial support.	Av. cost per capita.	Tot. No. relieved & sup.	Proport'n to population.	Total cost.	Av. cost per capita.
State of New York....	59,136	1 in 74 1-10	$1,681,470.29	$28.43	101,796	1 in 43 1-20	$911,855.15	$8.95½	160,932	1 in 27 1-5	$2,613,324.44	$16.31
" Pennsylvania.	19,010	1 in 185 1-4	664,471.92	34.95½	38,821	1 in 92 1-8	231,296.05	5.96	57,821	1 in 60 3-4	895,667.97	15.49
" Massachusetts	†9,875	1 in 147 6-10	847,858.34	85.86	23,775	1 in 61 1-3	303,670.73	12.76	33,650	1 in 43 3-10	1,150,529.07	34.19
City of New York....	‡29,761	1 in 31 2-3	688,903.00	23.14	5,834	1 in 161 1-2	126,360.52	21.65	35,595	1 in 26 1-2	815,263.53	22.90½
" Philadelphia..	§9,931	1 in 67 4-5	324,040.56	32.63	4,388	1 in 153 1-2	113,608.59	23.63	14,319	1 in 47	[illegible]	30.56
" Boston........	988	1 in 253 2-3	97,686.14	98.77¾	5,536	1 in 45 1-4	46,616.33	8.42	6,524	1 in 38 5-6	144,302.47	22.14

C. L. BRACE.

* July 1, 1874.
† Average No. 5814.
‡ Average No. 6141.
§ Average No. 2985.

Paulown'ia Imperialis, a fine park tree of the order Scrophulariaceæ, a native of Japan. It has something the habit of a catalpa, the leaves being large and heart-shaped, the branches being crooked and nearly horizontal, the flowers are in large clusters of a pale violet color, and precede the leaves. The tree rarely exceeds 40 feet in height, and its trunk is usually less than a foot in diameter. It is hardy as far N. as New York.

Pausa'nias, a son of Cleombrotus and regent of Sparta during the minority of his cousin, Plistarchus, the son of Leonidas; commanded the confederate Greeks at Platææ 479 B. C., and achieved several brilliant victories during the following years. But, elated by these successes and seduced by an exorbitant ambition and vanity, he entered into treasonous negotiations with the Persians. He desired to bring the whole of Greece under his sway, and he hoped to realize this plan by the aid of Xerxes, which he proposed to buy by placing his future kingdom under Persian authority. Meanwhile, he assumed Persian dress, surrounded himself with a body-guard of Persian and Egyptian troops, and introduced Persian ceremony and Oriental luxury in his household. The Athenians denounced him and the Spartans suspected him. Twice he was recalled from the army and arraigned before the ephors, but no proofs could be presented and he was acquitted. He continued the negotiations with Xerxes, and even began to form a conspiracy with the Helots. But at last a letter from him to Xerxes was delivered over to the ephors by the slave entrusted to carry it to the Persian camp, and when he learned that his treason was discovered and his plan frustrated, he took refuge in the temple of Athene Chalciœcus, where the people shut up the entrance by a pile of stones, to which his own mother carried the first, and he d. of hunger about 468 B. C. The date of his death is uncertain, and there is also some discrepancy between the reports given by Nepos, Ælian, and others of the manner in which his death took place.

Pausanias, probably a native of Lydia, Asia Minor, flourished in the middle of the second century after Christ. His Ἑλλάδος Περιήγησις, in ten books, is an itinerary, in which he describes, often minutely and with great precision, the temples and other monumental buildings, the statues and pictures, the cities, rivers, mountains, springs, etc., which he saw on his journey through Greece, and the local traditions pertaining to these objects. The work, which is invaluable, is a source for the history of the legends, objects of antiquity, and works of art of ancient Greece, and was first printed by Aldus (Venice, 1516). The best editions are by Siebelis (5 vols., Leipsic, 1822–28), by Schubart and Walz (3 vols., Leipsic, 1838–39), and by Dindorf (Paris, 1845). There is an English translation by Thomas Taylor (3 vols., London, 1793–94).

Pausu'la [anc. *Pausulæ*], or **Montolmo,** town of Italy, province of Macerata, situated on a hill near the right bank of the Chienti, about 6 miles S. E. of the town of Macerata. It is a strongly-walled place, and contains several large churches, convents, and other public buildings. Pausula was an episcopal see as early as the beginning of the fifth century, and the strength of its castle and walls during the Middle Ages often enabled it to hold out successfully against its assailants. Pop. in 1874, 8145.

Pauw, de (CORNELIS), b. at Amsterdam in 1739; educated at Göttingen; became canon of Xanten near Cleves; was afterwards reader to Frederick II. of Prussia; published *Recherches sur les Américains* (Berlin, 1769), designed to prove that men and animals have degenerated in the New World, a treatise which elicited many answers, *Recherches sur les Égyptiens et les Chinois* (2 vols., 1774), and *Recherches sur les Grecs* (2 vols., 1788), works which were translated into English and enjoyed a high repute. De Pauw was uncle to the celebrated "friend of mankind," Anacharsis Clootz, and, like him, was noted for eccentricity. When the French invaded Cleves, De Pauw became insane, and burned the manuscript of a work on the Germans. D. at Xanten July 7, 1799.

Pau'wels (Ferdinand), b. at Antwerp April 13, 1830; studied the art of painting under Wappers, afterwards in Rome from 1852 to 1857; was professor at the academy of art in Weimar 1861 to 1872; but returned in the latter year to his native city. The most celebrated of his pictures are *Coriolanus* (1851), *Banished by Alva* (1861), *Hans Pleinhorn* (1868), *The Youth of Luther*, for Wartburg.

Pavement. See Roads and Pavements, by Gen. Q. A. Gillmore.

Pavi'a [anc. *Ticinum;* med. *Papia*], town of Northern Italy, lat. 45° 10′ N., lon. 9° 9′ E., on an elevation of the left bank of the Ticino, near its junction with the Po. A navigable canal connects the town with Milan (20 miles N.); it has direct water-communication through the Po with the Adriatic, and through the Ticino with Lago Maggiore, and is easily accessible by rail from all the large Italian towns. The view of Pavia seen from the Voghera railway where it passes over the new bridge (2400 feet long) is very striking, and the antique aspect of the town is heightened by a quaint old covered bridge of the fourteenth century uniting it with Borgo Ticino. Though defended by the Po and the Ticino, Pavia is surrounded by a wall (now somewhat ruinous), and with bastions of great strength. Of its 500 towers of mediæval celebrity only four remain, the highest 250 feet. The finest streets are: Corso Vittorio Emmanuele (Strada Nuova), Corso Cavour (Porta Borgorata), Corso Garibaldi (S. Giovanni). The churches of Pavia are of great historic and architectural interest; San Michele Maggiore, of the sixth or seventh century, is perhaps the most striking specimen of Lombard architecture existing; San Pietro in Cielo d'Oro, now a ruin, from which the superb monument (fourteenth century) to St. Augustine and the remains of Boethius have been transferred to the cathedral; the Duomo or cathedral, of the fifteenth century, and many others very noticeable. Of the old Castello, on the site of the ancient Lombard royal palace, little of interest is left except the grand half-ruined gateway. The University of Pavia, the *alma mater* of so many illustrious men, is said to have been founded by Charlemagne, and Maria Theresa and Joseph II. lavished favors upon it. The Museo Malespina contains some good pictures, a fine collection of engravings, and a block-book of great interest to students of the history of printing. Near Pavia is the beautifully picturesque old church Beato Lanfranco; but the great attraction of the neighborhood is the magnificent Certosa of Pavia, 4½ miles from the town, founded by the famous Gian Galeazzo Visconti, and probably the finest monastic building in the world. Pavia is of very ancient, probably Ligurian, origin. It was of some importance under the Romans, had a Christian church in 326, and though often sacked by the barbarians always recovered itself. Theodoric the Great, having taken Pavia from Odoacer, made it his first capital before fixing upon Ravenna. In 573 it became the Lombard capital, and for 200 years was a rich and great city. The subsequent mediæval history of Pavia is full of vicissitudes, it being, with the exception of a brief period of self-government, alternately under the dominion of foreign sovereigns and domestic despots. In 1524, Francis I. of France suffered a terrible defeat under the walls of Pavia, and was taken prisoner by the troops of Charles V. Three years later the town was barbarously sacked by the French, but it soon afterwards fell into the hands of Austria. Bonaparte, having taken Pavia (1796), at the prayers of the citizens limited his soldiers to a sack of three hours, so that the town was not totally destroyed. By the Peace of 1814 it returned to Austria, but, always foremost in patriotic uprisings, it became a part of the kingdom of Italy in 1859. Pavia has considerable internal trade in rice, hemp, silk, wines, etc. Pop. in 1874, 29,618.

Caroline C. Marsh.

Pavie' (Theodore Marie), b. at Angers, in the department of Maine-et-Loire, France, Aug. 16, 1811; travelled much in North and Central America, in China and the East Indies; lectured on Sanskrit from 1853 to 1857 at the Collége de France at Paris, and wrote, besides a number of minor essays on subjects from Chinese and Sanskrit literature, *Voyage aux États Unis et au Canada* (2 vols., 1828–33), *Krichna et sa Doctrine* (1852), etc.

Pavil'ion, post-v. and tp. of Kalamazoo co., Mich., near the Peninsula R. R. Pop. 1208.

Pavilion, post-v. and tp., Genesee co., N. Y. P. 1614.

Paving. See Roads and Pavements, by Gen. Q. A. Gillmore.

Pavlograd', town of European Russia, government of Yekaterinoslav, on the Voltcha, an affluent of the Dnieper, has some manufactures and 6929 inhabitants.

Pavon'inæ [from *pavo*, the ancient name of the peacock], a sub-family of Phasianidæ, distinguished by the development and lateral extension of the tail and its coverts. It embraces the genera *Pavo*, *Polyplectron*, and *Argus*, and, according to recent authors (Elliot and Gray), embraces fourteen species, distributed through Southern Asia. (See Phasianidæ and Peacock.) Theodore Gill.

Pavullo nel Frignano, town of Italy, province of Modena, situated in a plain surrounded by mountains. It was formerly the summer residence of the dukes of Modena. Pop. in 1874, 9772.

Pawcatuck' River is formed in Washington co., R. I., by the union of the Charles and Wood rivers. It is navigable for small vessels for several miles, and forms the S. portion of the E. boundary of Connecticut.

Paw Creek, p.-v. and tp., Mecklenburg co., N.C. P. 1591.

Pawhe'a, town of Guinea, on the route from the coast to Dahomey, is situated in a mountainous district, has rich iron-mines, and manufactures iron goods of different descriptions with considerable skill. Pop. about 16,000.

Paw'let, post-v. and tp. of Rutland co., Vt., on the Rensselaer and Saratoga R. R. Pop. 1505.

Paw'ling, post-v. and tp. of Dutchess co., N. Y., on the Harlem R. R., 65 miles N. of New York City, has an institute of learning, 7 churches, 2 banks, 1 newspaper, a large mill, and stores. Principal business, farming and dairying. Pop. 1760. P. H. Smith, Ed. "Pioneer."

Pawn. See Pawnbroking.

Pawn'broking, the business of lending money upon the security of goods and chattels pawned or pledged with the creditor. Institutions for the loan of money to the poor upon such security have existed in various parts of Europe for several hundred years, and were at first regarded more as charities than as purely business establishments. The earliest of which any account is preserved were founded during the latter half of the fifteenth century in Italy; in the succeeding century the pawnbroker had become common in the Flemish and Belgian cities; in 1777, by virtue of letters patent, similar institutions, under the fanciful name of *monts-de-piété*, were authorized in Paris and other cities of France. In order that the pawnbroker may lawfully demand more than the ordinary rate of interest and escape the penalties of usury, he must receive express permission from the legislature, and the business is everywhere, therefore, the object of special statutory regulation. In England it is conducted in pursuance of a statute passed during the reign of George III. (39, 40 Geo. III. c. 99), which prescribes the rate of interest, defines the modes of carrying on the business, even to the minutest detail, authorizes the articles pledged to be sold at public auction after the expiration of one year, and adds numerous penalties for the violation of these provisions. The pawnbroker is required to procure a license, and his operations are carried on under a close surveillance of the police. The system, so far as it exists in this country, is borrowed directly from that which prevails in England. Statutes similar to the one described have been enacted in several States, while in others, as, for example, in New York, there is no general law affecting the entire State, but the subject is left to be regulated in each city by the local government thereof under its authority to make by-laws. John Norton Pomeroy.

Pawnee', county of Central Kansas. Area, 900 square miles. It is traversed by the Arkansas River and by the Atchison Topeka and Santa Fé R. R., and is well adapted for grazing. Cap. Larned. Pop. 179.

Pawnee, county of S. E. Nebraska, bounded S. by Kansas. Area, 432 sq. m.; is a beautiful undulating region, well watered, adapted to wheat, live-stock, hay, and wool. Coal and building-stone, fire-clay, and peat are found. Cap. Pawnee City. Pop. 4171.

Pawnee, post-v. and tp., Sangamon co., Ill. P. 1293.

Pawnee, tp. of Bourbon co., Kan. Pop. 630.

Pawnee City, post-v., cap. of Pawnee co., Neb., has a high school, 4 churches, a State bank, 1 newspaper, and 2 hotels. Business, farming and stock-raising. P. about 1900. A. E. Hassler, Ed. "Republican."

Pawnees (*Pani* of French authors), a tribe of warlike aborigines, hereditary enemies of the Dakotas, formerly residing chiefly in Central Nebraska. Their language is thought by some to have Dakota elements. Physically, they are superior to most of the Indians of the Plains. They are divided into four bands, Tsawé, Tsitkakish, Skeres, and Tapahowerats. They have always been friendly to the U. S., and numbered at one time 2000 warriors, but have been much reduced by constant wars with the Sioux. In 1875 they removed to the Indian Territory.

Paw Paw, v. and tp., De Kalb co., Ill., on Chicago Burlington and Quincy R. R. P. 978.

Paw Paw, p.-v. and tp., cap. of Van Buren co., Mich., on branch of Michigan Central R. R., has an excellent school system, 6 churches, 1 bank, 2 weekly newspapers, several flouring, saw, and planing mills, 1 sash, door, and blind factory, a carriage and bracket shop, and 1 printing-office. There is good water-power, and trade is carried on in wheat and wool. P. of v. 1428; of tp. 2670.

MISS LYDIA L. CONWAY, ED. "TRUE NORTHERNER."

Paw Paw, tp. of Marion co., West Va. Pop. 1653.

Pawtuck'et, post-v. of North Smithfield tp., Providence co., R. I., on the Providence and Worcester and the Boston and Providence R. Rs., 4 miles N. of Providence, contains a fine library, a high-school building, 12 churches, 3 national and 3 savings banks, a handsome park, several hotels, 1 newspaper, and a horse-railway, connecting it with Providence. It has a paid fire department, with an electric fire-alarm telegraph, the Dunnell print-works, hair-cloth, cotton, woollen, and thread factories, 2 manufactories of steam-engines, several iron-foundries and machine-shops, and numerous other industries. It was here that Samuel Slater, the father of American cotton manufactures, commenced operations with water-power in 1790. Pop. 6619. A. D. NICKERSON, ED. "GAZETTE AND CHRONICLE."

Pax'o, one of the Ionian Islands, situated 10 miles S. of Corfu, is 5 miles long and 2 miles broad, and has a population of 5287. Its oil is very celebrated.

Pax'ton, post-v. of Patton tp., cap. of Ford co., Ill., on the Toledo Wabash and Western and the Chicago branch of the Illinois Central R. R., has 2 newspapers, some manufactures, a considerable trade, and is the seat of the Swedish institution called the Augustina College of N. America, to the library of which the king of Sweden presented 5000 volumes. Pop. 1456.

Paxton, post-v. and tp. of Worcester co., Mass. P. 646.

Paxton, tp. of Ross co., O., on Paint Creek. Pop. 1738.

Paxton (Gen. ELISHA FRANKLIN), b. in Rockbridge co., Va., Mar. 4, 1828; graduated at Yale College 1847; studied at the Virginia Military Academy at Lexington, Va.; became president of a bank at Lynchburg; was brigadier-general and adjutant-general to "Stonewall" Jackson; commanded the "Stonewall brigade" and subsequently an army corps; served at Antietam, Fredericksburg, and Chancellorsville, being killed in the latter battle on the same evening that Jackson was mortally wounded, May 2, 1863.

Paxton (Sir JOSEPH), b. at Milton-Bryant, Bedfordshire, England, Aug. 3, 1803, of humble parentage; educated in the free school at Woburn, and obtained employment at Cheswick as a gardener in the service of the duke of Devonshire, where he displayed such remarkable talent for landscape-gardening that the duke made him manager of his Derbyshire estates and commissioned him to remodel the grounds at Chatsworth. Under his care that mansion soon became the most renowned country-seat in England, the great conservatory especially being regarded as a wonderful triumph of art. This building became the germ of the idea which culminated in the plans for the "Crystal Palace," the vast edifice of iron and glass erected from his designs for the great Universal Exposition of 1851. For this service he was knighted and received honors from several European sovereigns. He removed the buildings to Sydenham, erected a magnificent mansion for Baron James Rothschild, entered Parliament 1854, and published several works on botany, horticulture, and floriculture. D. at Sydenham June 8, 1865.

Payatte, tp. of Pulaski co., Ark. Pop. 659.

Payenne, tp. of Manitou co., Mich., comprises South Manitou Island in Lake Michigan. Pop. 287.

Pay'ment (law), in its widest signification, the discharge of a legal obligation by a performance thereof according to its very terms—that is, by doing exactly what the person upon whom the duty rests is bound to do; in a narrower but more ordinary sense, it is the discharge of an obligation by the delivery of money or of some equivalent accepted instead thereof. In all obligations which create a liability either in the form of debt or of damages—that is, in all which do not expressly prescribe some other mode of discharge—the law requires payment to be made in money, unless the creditor waives his right and consents to receive something else in satisfaction of his demand; but when the defence of payment simply is pleaded in an action the defendant may show the delivery to and acceptance by the plaintiff of goods or securities, or any other articles in place of money. The Constitution of the U. S. confers upon Congress the supreme and final authority over the subject, and prohibits the State legislatures from making anything but gold and silver coin a legal tender in payment of debts. Congress, by virtue of its exclusive power to regulate the national coin and the value of foreign coin, may declare what coined money shall be a lawful tender, and has repeatedly exercised this function from the earliest periods of the government. In the year 1862 a statute was passed which enacted that the treasury notes of the U. S., issued in pursuance thereof, should be a legal tender in payment of all debts, public and private, with the exception of duties on imports and interest on the public debt. The validity of this legislation has been sustained by the Supreme Court of the U. S., although a bare majority only of the judges concurred in the decision, which overruled a contrary judgment previously announced by the same high tribunal. Payment may be made by the debtor or by a person acting on his behalf, and must be to the creditor or to his authorized agent.

JOHN NORTON POMEROY.

Payne (JOHN HOWARD), b. in New York June 9, 1792; began to edit a weekly paper, *The Thespian Mirror*, when thirteen years old, and two years later published twenty-five numbers of a periodical called *The Pastime*; made a successful début as an actor at the Park Theatre, New York, Feb. 26, 1809, in the character of *Norval*; appeared on the stage at Boston and other American cities, also in London 1812–13, where he produced many new dramas, chiefly imitated from the French, for one of which, called *Clari, or the Maid of Milan*, he wrote the song *Home, Sweet Home*; published a volume of juvenile poems, *Lisping of the Muse* (1815); successfully produced his tragedy *Brutus* at Drury Lane 1818; was a friend and correspondent of Coleridge and Charles Lamb; edited in London a dramatic paper called *The Opera-Glass* 1826–27; returned to the U. S. 1832; was U. S. consul at Tunis, Africa, 1841–45; again appointed 1851, and d. there Apr. 10, 1852. Among his best writings were the plays *Virginius* and *Charles the Second*.

Payne's Creek, tp. of Tehama co., Cal. Pop. 80.

Paynesville, post-v. and tp., Stearns co., Minn. P. 318.

Payneville, tp. of Sumter co., Ala. Pop. 1405.

Pay'son, post-v. and tp. of Adams co., Ill. Pop. 1881.

Payson (EDWARD), D. D., b. at Rindge, N. H., July 25, 1783; was a son of Rev. Dr. S. Payson (1758–1820); graduated in 1803 at Harvard; was three years teacher of an academy at Portland, Me., where he was in 1807 ordained to the Congregational ministry as colleague pastor with a Mr. Kellogg until 1811, when he became sole pastor. Here he remained till his death, Oct. 22, 1827. He was a man of great zeal and of saintly devotion. His sermons, etc. (3 vols., 1846) have been published, together with a *Life* by A. Cummings, D. D.—His uncle, PHILLIPS PAYSON, D. D. (1736–1801), for many years Congregational minister of Chelsea, Mass., was one of the most scholarly and influential divines of the Revolutionary period.

Pay'ta, town of Peru, in lat. 5° 5′ S., on a bay of the same name, has a good harbor and carries on some trade. Salt, cotton, hides, and straw-mattings are exported. The harbor is visited by many whalers, who come to take in provisions; they cannot get fresh water here, however, as the town is obliged to have its entire supply of drinking-water brought to it on mules. Pop. 9000.

Pea, the plant and seed of *Pisum arvense* (field-pea) and *P. sativum* (garden-pea), annual plants cultivated in nearly all countries, doubtless forms of one species. The pea is of the order Leguminosæ, and is valuable not alone for the seed (which is used as food for man and beast, and is of the greatest excellence), but also as a forage-plant, for which use some of the very numerous varieties are especially adapted. Peas are cooked and eaten green or dry, and are largely exported from the U. S. to England, where dry peas are much more extensively used than in this country. Many other kinds of pulse are called peas, such as chick-pea (*Cicer*) and the cow-pea (*Dolichos*), a valuable forage-plant in the U. S.

Pea'body, post-v. and tp., Marion co., Kan., on the Atchison Topeka and Santa Fé R. R.

Peabody (formerly SOUTH DANVERS), post-v. and tp., Essex co., Mass., on the Eastern R. R., 5 miles W. of Salem, has 2 national banks, 6 churches, and large manufactures. Birthplace of George Peabody, who founded here in 1852 the Peabody Institute, to which at different times he gave $200,000. Pop. 7343.

Peabody (ANDREW PRESTON), D. D., LL.D., b. at Beverly, Mass., Mar. 19, 1811; graduated at Harvard in 1826; was three years a teacher; studied divinity at Cambridge, Mass.; was tutor at Harvard College 1832–33; was (Unitarian) minister of the South parish, Portsmouth, N. H., 1833–60, and in 1860 became Plummer professor of Christian morals and preacher to Harvard University; edited the *North American Review* 1852–61, and has long been a

leading contributor to the religious periodical press. Author of *Lectures on Christian Doctrine* (1844), *Sermons of Consolation* (1847), *Conversation* (1856), *Christianity the Religion of Nature* (1864), *Sermons for Children* (1866), a book of European travel (1868), *Christianity and Science* (1874), besides many published sermons, reviews, biographical and other writings, etc.

Peabody (Elizabeth Palmer), b. at Billerica, Mass., in 1804; spent her childhood in Salem; became a teacher at Boston 1822; wrote articles, chiefly on educational topics, for the *Journal of Education*, the *Christian Examiner*, the *Dial*, and the *Democratic Review;* translated De Gerando's *Moral Self-Education;* edited *Æsthetic Papers* (1849), *Crimes of the House of Austria against Mankind* (1850); published *R. G. Hazard's Essay on Language and Other Papers* (1857), *Records of a School*, *First Steps to History* (1833), *Chronological History of the U. S.* (1856), and other works, and with her sister, Mrs. Mary (Peabody) Mann, published *Moral Culture of Infancy* and *The Kindergarten Guide* (1863). Miss Peabody has been prominent in the successful introduction of "object-teaching" into infant schools, and a leading authority upon the methods of the new system. Two of her sisters were married—one to Horace Mann, the other to Nathaniel Hawthorne.

Peabody (Ephraim), D. D., b. at Wilton, N. H., Mar. 22, 1807; graduated at Bowdoin College 1827; studied theology at Cambridge; preached at Meadville, Pa., at Cincinnati, and at Boston; was pastor of a Unitarian church at New Bedford, Mass., 1838–46, and for the remainder of his life pastor of King's chapel, Boston; was the originator of the Boston Provident Society, eminent as a pulpit orator and a philanthropist. D. at Boston Nov. 28, 1856. A selection of his sermons, with a memoir, was published in 1857, and a volume of his writings, *Christian Days and Thoughts* (1858).

Peabody (George), D. C. L., b. at South Danvers (now Peabody), Mass., Feb. 18, 1795, of poor parents; received a scanty education; was a mercantile clerk at Thetford, Vt., and Newburyport, Mass., and at Georgetown, D. C., where he became partner with Elisha Riggs in mercantile business 1814; removed to Baltimore 1815; soon afterwards opened branch houses at New York and Philadelphia; made several voyages to Europe on commercial business; became head of the firm 1829; removed to London, England, 1838; withdrew from the house of Peabody, Riggs & Co., and established a celebrated banking-house 1843; accumulated a large fortune; aided Mr. Grinnell in fitting out Dr. Kane's Arctic expedition 1852; founded in the same year the "Peabody Institute" in his native town, the endowment of which he subsequently increased to $200,000; visited the U. S. in 1857; gave $300,000 for the establishment at Baltimore of an institute of science, literature, and the fine arts; in 1862 gave $2,500,000 as a fund for building lodging-houses for the poor in London; gave in 1866, during another visit to the U. S., $150,000 to establish at Harvard College a museum and professorship of American archæology and ethnology, an equal sum for the endowment of a department of physical science at Yale College, and created a "Southern educational fund" of $2,100,000, besides devoting $200,000 to various objects of public utility. In recognition of his munificence, Queen Victoria offered him a baronetcy, which he declined, and presented him with her portrait; the corporation of London conferred upon him the freedom of the city, and the citizens ordered a statue by W. W. Story, which was unveiled in the Royal Exchange July 23, 1869, by the prince of Wales, during Mr. Peabody's absence on a final visit to the U. S. On this occasion he raised the endowment of the institute at Baltimore to $1,000,000; created the Peabody Museum at Salem, Mass., with a fund of $150,000; gave $60,000 to Washington College, Virginia, $50,000 for a "Peabody Institute" at North Danvers, $30,000 to Phillips Academy, Andover, $25,000 to Kenyon College, Ohio, and $20,000 to the Maryland Historical Society, besides conferring munificent reminders of his former residence upon several other localities. In the previous year he had endowed an art school at Rome. D. at London Nov. 4, 1869, less than a month after returning from the U. S. His remains, after funeral honors in Westminster Abbey (Nov. 12), were brought to the U. S. in a British vessel-of-war and buried in his native town, now called Peabody. Several other bequests to objects of public utility were made by his will, in which his remaining fortune, about $5,000,000, was left to his relatives.

Peabody (Gen. Nathaniel), b. at Topsfield, Mass., Mar. 1, 1741; settled at Plaistow, N. H., as a physician 1761; became lieutenant-colonel of militia; was one of the captors of Fort William and Mary at Newcastle Dec., 1774; was an active and influential member of the legislature, of several conventions, and of the committee of safety during the Revolutionary war; became adjutant-general of the State militia 1777; delegate to the Continental Congress 1779–80; filled nearly every State office during a long course of public service, including those of Speaker of the house 1793 and major-general 1793–98, and was one of the founders of the New Hampshire Medical Society 1790. D. at Exeter, N. H., June 27, 1823.

Peabody (Oliver William Bourn), b. at Exeter, N. H., July 9, 1799; studied at Phillips Exeter Academy; graduated at Harvard College 1816; studied law at Cambridge; practised law at Exeter 1819–30; served in the State legislature; edited the *Rockingham Gazette* and *Exeter News-Letter;* removed to Boston 1830; aided his brother-in-law, Alex. H. Everett, in editing the *North American Review;* was for several years an editor of the *Daily Advertiser;* was register of probate of Suffolk co. 1836–42; was professor of English literature at Jefferson College, La., 1842–43; wrote the *Lives* of Gens. Putnam and Sullivan in Sparks's *American Biography;* published an edition of Shakspeare, with a *Life* and notes (7 vols., 1844); was licensed as a Unitarian preacher 1845; became pastor of a church at Burlington, Vt., in August of the same year. D. at Burlington July 5, 1848. (See a *Memoir* by E. E. Hale in *Christian Examiner*, xlv.)

Peabody (William Bourn Oliver), D. D., twin-brother of O. W. B. Peabody, b. at Exeter, N. H., July 9, 1799; graduated at Harvard College 1816; was assistant instructor at Exeter Academy 1817; studied theology at the Cambridge Divinity School under Dr. Henry Ware; was licensed as a preacher 1819, and ordained in Oct., 1820, pastor of the Unitarian church at Springfield, Mass., where he remained through life. Dr. Peabody was a man of ripe, scholarly culture and tastes, of extensive knowledge, of gentle nature, and winning manners. He wrote much on various branches of natural history; was one of the commissioners of the Massachusetts zoological survey, for which he prepared a *Report on the Birds of the Commonwealth* (1839); wrote the *Lives* of Alexander Wilson, Cotton Mather, David Brainerd, and James Oglethorpe in Sparks's *American Biography;* was well versed in landscape-gardening, and was an able lecturer upon scientific topics, especially his favorite subjects of forest trees, insects, and birds. D. at Springfield May 28, 1847. His *Sermons*, with a prefatory memoir by his brother, were published in 1849, and his *Literary Remains* in 1850.—His son, Everett Peabody, b. 1831, graduated at Harvard College 1849; edited the posthumous works of his father; completing the biography of his uncle; became a railway engineer, and colonel of Missouri volunteers; was killed at the battle of Shiloh, Apr. 6, 1862.

Peace is not merely a suspension of war, but a return to a state of intercourse such as existed before war, and to *amnesty*, or the oblivion, the waiving, of all future claims on account of those particular acts of injury for which a war was initiated. For the existence of peace a treaty is necessary: such a treaty, if there be a number of belligerents, may be made by all the parties on one side with all on the other; or each on one side may make a treaty with every other. The great treaties, such as the Treaty of Westphalia and the final act of the Congress of Vienna, are complicated documents; the first combining in two separate treaties—one between France and the German powers, and the other between Sweden and the same powers—the results of negotiations in two separate places; while the other contains the results of a great number of special treaties with powers not properly parties to the congress, or of such powers with one another, as well as of treaties between the parties to the congress themselves. T. D. Woolsey.

Peace, post-v. of Rice co., Kan., on the Atchison Topeka and Santa Fé R. R., 150 miles W. of Topeka, the capital of the State, has 2 churches, 1 newspaper, 2 lumber-yards, a steam flouring-mill, and stores. Principal business of county, farming and stock-raising. Pop. about 300. W. F. Wallace, Ed. "Herald."

Peace, Breaches of (law), violations of the public order and quiet done with force, actual or constructive. As the object of all law, and especially of the criminal law, is to produce and maintain public order, tranquillity, and decorum, any wilful act which disturbs, or in its consequences directly tends to disturb, this normal condition of order and peace is an indictable offence; and this element of breaking in upon or interfering with the peace and good order of the community lies at the basis of a very large class of crimes. Among the most familiar examples are unlawful assemblies, routs, riots, affrays, assaults and batteries in public, forcible entries or detainers of land, and sometimes the forcible taking of personal property from the possession of another, trespasses done

in public and with such force as to create a disturbance and cause fear, and many other similar acts of wrongful violence to person or to property. It is not necessary that the public peace should be broken in fact, if the unlawful act, or the attempt when carried out, directly tends to produce that result. Upon this principle, challenges to fight duels, carrying dangerous weapons, furious driving in frequented streets, the publishing of libels, the spreading of false news, fall within the same class of offences. The common law even regarded eavesdropping and the being a common scold as criminal breaches of the peace. In most of these instances the crime is now defined, and the punishment, which consists of imprisonment or fine, is regulated by statute. JOHN NORTON POMEROY.

Peace Creek, post-v., cap. of Polk co., Fla., near the centre of the peninsula.

Peace Dale, post-v. of South Kingston tp., Washington co., R. I.

Peace River, a river of British America, rises in the Coast Range Mountains N. of British Columbia, and flows N. E. through the Rocky Mountains to Athabasca Lake, more than 600 miles. It is navigable through most of its extent, and passes through a fertile valley, now without civilized inhabitants.

Peach [Fr. *pêche*], a small tree and its fruit, the *Amygdalus persica*, of the order Rosaceæ, a native of Central Asia. Of the peaches proper there are two principal varieties, the freestones and the clingstones, and of each there are many sub-varieties. The peach is extensively cultivated in most of the warmer temperate regions; but it is not perfectly hardy in some of the colder parts of the U. S., nor in most parts of Great Britain. Peaches are extensively sold both fresh and when sliced and dried. Great quantities are preserved by hermetical sealing in tin and glass cans. The ripe fruit is extensively distilled, making peach brandy. In the valley of the La Plata and on the treeless plains of some of the Western States peach trees are grown as fuel. They grow rapidly and afford a good fire. The leaves, bark, and kernel are poisonous from the presence of hydrocyanic acid. The NECTARINE (which see) doubtless originated from the peach.

Peach'am, post-v. and tp., Caledonia co., Vt. P. 1141.

Peach Bottom, post-v. and tp., York co., Pa., on the Susquehanna River and the Tide Water Canal. Pop. 2366.

Peach Orchard, tp. of Ford co., Ill., on the Gilman Clinton and Springfield R. R. Pop. 374.

Pea'cock, the name given to species of the *Pavo* and family Phasianidæ. The several species are remarkable for the long and showy tail-coverts of the male. Three species are now recognized: 1. The common peacock (*Pavo cristatus*); 2. The black-shouldered peacock (*Pavo nigripinnis*); and, 3. The Jason peacock (*Pavo muticus*). The common peacock is a remarkably vain and ostentatious bird, and is a native of Southern and South-eastern Asia, but is now naturalized in many parts of the world. Its flesh was formerly employed for food; but, except when young, it is scarcely palatable. The white peacock is an albino of the ordinary species. The name peacock is also sometimes applied to the species of the allied genera, *Polyplectron* and *Crossoptilon*. (See PAVONINÆ.)

Peacock (THOMAS LOVE), b. at Weymouth, England, Oct. 18, 1785; entered the civil service of the East India Company 1818; was employed in the London office of that corporation until 1856; was a friend of Lamb and Shelley, and author of several volumes of poems and romances which met with favor at their first appearance, were forgotten for many years, and obtained a renewed popularity on their republication in 1875 by Lord Houghton, accompanied by a biographical sketch. His most successful works were *Headlong Hall* and *Gryll Grange*. D. at London Jan. 23, 1866.

Peacock-stone, sometimes used by jewellers as a gem, is the dried and opalescent ligament of the pearl oyster's shell, or that of some other large conchiferous mollusk.

Peak Creek, tp. of Ashe co., N. C. Pop. 1005.

Peale (CHARLES WILLSON), b. at Chestertown, Md., Apr. 16, 1741; was successively a saddler, silversmith, watchmaker, and carver; studied painting under Hesselius about 1767; afterward under Copley at Boston and at the Royal Academy, London, under Benjamin West 1770–71; painted the first portrait of Washington as a Virginia colonel 1772; commanded a company at the battles of Trenton and Germantown; was a member of the Pennsylvania Convention of 1777; painted the portraits of the most prominent officers of the Revolution; was a leading promoter of the Pennsylvania Academy of Fine Arts; was the first American popular lecturer on natural history; opened the first American museum; was the first American manufacturer of enamel teeth; invented a great variety of machines, and published a number of scientific essays. D. at Philadelphia Feb. 22, 1827.

Peale (REMBRANDT), son of Charles W. Peale, b. in Bucks co., Pa., Feb. 22, 1778; received an artistic training from his father; painted a portrait of Washington Sept., 1795; opened a studio at Charleston, S. C., 1796; studied under West at London, 1801–04; spent several years at Paris, where he executed portraits of prominent characters for his father's museum; returned to Philadelphia 1809; achieved eminence as a portrait-painter; executed the well-known pictures *The Roman Daughter* and *The Court of Death*, of which the latter was profitably exhibited in the chief cities of the U. S. for a number of years; lectured on the portraits of Washington, and published a *Biography of Charles W. Peale*, *Notes on Italy* (1831), *Portfolio of an Artist* (1839), and other works on art. D. at Philadelphia Oct. 3, 1860.

Peanut. See GROUNDNUT.

Pear (*Pyrus communis*), one of the most common and most appreciated fruit trees of the temperate zones, belonging to the division Pomeæ of the family Rosaceæ. It is closely allied to the apple tree, from which it is distinguished by the pyramidal tendency of its growth: its inclination to become thorny; its ovate and serrated leaves, smooth on both surfaces and without glands; its flowers, smaller than those of the apple tree, of a pure white color with purple anthers; and its fruit, hemispherical at the one end, tapering at the other, and produced on a stem, which is generally not sunk into a cavity like that of the apple. It is a long-lived tree, with a hard, close-grained wood, which is much used by turners. It is found wild in Southern and Central Europe and in the temperate regions of Asia; and in this state it is generally either a small tree or a large shrub, while in a cultivated state it often becomes forty or fifty feet high. It was cultivated in antiquity, but seems not to have reached any high degree of development. Pliny says that pears must be well boiled or baked in order to become thoroughly enjoyable, and Horace's famous lines do not sound very appreciative. Now it is known in over 1000 varieties, and some of them, such as the Bartlett, duchesse d'Angoulême, beurré, bergamot, etc., are reckoned among the most delicious fruits. It requires good, strong soil and frequent manuring in order to produce good and plentiful fruit, but in other respects it is quite a hardy tree. It is cultivated both as a standard, budded or grafted on pear seedlings, and as a dwarf, grafted on the quince, the thorn, or the mountain-ash. When grafted on the apple tree it rapidly degenerates, while some varieties, such as the duchesse d'Angoulême, produce better fruit on the quince than on their own root. The fruit of most varieties is improved by being picked from the tree when mature and allowed to ripen in the house; and of some varieties the fruit becomes quite worthless when allowed to ripen on the tree. The best *perry* is not made from the finest kinds of pears, but from coarser varieties, whose fruit has a rather austere taste. (For further details see Downing, *Fruits and Fruit Trees of America* (1869); Field, *Pear-Culture;* and Quinn, *Pear-Culture for Profit.*)

Pearce (JAMES A.), b. at Alexandria, Va., Dec. 14, 1805; graduated with first honors at Princeton 1822; became a lawyer and agriculturist of Maryland; was in Congress 1835–39, 1841–43; U. S. senator 1843–62; also law professor in Washington College, Chestertown, Md., where he d. Dec. 30, 1862.

Pearce (ZACHARY), D. D., b. at London, England, Sept. 8, 1690; educated at Trinity College, Cambridge; took orders in the Church of England; was made dean of Winchester 1739, bishop of Bangor 1748, bishop of Rochester and dean of Westminster 1756; declined the bishopric of London; wrote *The Miracles of Jesus Vindicated* (4 vols., 1727–28), a *Commentary on the Four Evangelists and the Acts of the Apostles* (2 vols., 1777), and other theological works. D. at Little Ealing June 29, 1774.

Pea Ridge, a range of hills in Benton co., Ark., near the N. W. corner of the State, noted for the important battle fought there Mar. 6–8, 1862, between the Union forces under Gen. Curtis and the Confederates under Gen. Van Dorn, resulting in the defeat of the latter.

Pea Ridge, tp. of Brown co., Ill. Pop. 1011.

Pea'risburg, post-v., cap. of Giles co., Va., 21 miles from the Virginia and Tennessee R. R., has 3 schools, 4 churches, 1 weekly newspaper, 2 hotels. Deposits of iron ore and other minerals exist here. Grain and cattle are raised. P. 16[illegible]. T. J. PEARSON, ED. "GAZETTE."

Pearl. See PRECIOUS STONES.

Pearl, county of S. Mississippi, having Pearl River on its W. Area, 520 sq. m. It is covered with large tracts of pine forests. Cap. Riceville.

Pearl, tp. of Pike co., Ill., on the Chicago and Alton R. R. Pop. 628.

Pearl′ash. In common parlance, this term is often applied to the commercial bicarbonate of potash or SALÆRATUS (which see). Pearlash, however, is properly the same substance as commercial potash, which has merely been subjected to a somewhat more careful preparation. The "black salts," or crude black potash obtained by the boiling down of ley from wood-ashes, instead of being simply fused, is stirred for some time with an iron rod upon the hearth of a furnace in which a flame is made to play over the mass. The carbonaceous impurities are thus burned out, and the mass becomes of a more or less bluish-white color. (See POTASH.) H. WURTZ.

Pearl′ington, post-v. of Hancock co., Miss., on Pearl River. Pop. 479.

Pearl River is formed by several head-streams which unite in Leake co., Miss. It flows in a general S. course, and is for some distance the E. boundary of Louisiana. It is some 250 miles long. Its navigation is impeded by snags and sand-bars. Its valley is subject to floods in the S. portion. The river flows into Mississippi Sound.

Pearl White. See BISMUTH.

Pear′sall's, post-v. of Queens co., N. Y., on the Southern R. R. of Long Island, 16 miles from Brooklyn, has several churches, a carriage-factory, 1 newspaper. Principal business, oyster-planting.
GEO. A. MOTT, ED. "QUEENS CO. ADVANCE."

Pear′son (JOHN), D. D., b. at Snoring, England, Feb. 12, 1613; educated at King's College, Cambridge, where he became fellow 1635; was afterwards divinity professor and master of Trinity College (1662), and became in 1672 bishop of Chester. D. at Chester July 16, 1686. Author of *Exposition of the Creed* (1659), still held in esteem by theologians.

Pearson (RICHMOND MUMFORD), b. in 1805; studied law, practised at the bar, and was appointed judge of the superior court of N. C. in 1836, associate justice of its supreme court in 1848, and chief-justice of that court in 1858. His office having been vacated in 1865, he was reappointed in 1868. He prepared perhaps nine-tenths of the lawyers of North Carolina for the bar at his country residence, Richmond Hill, Yadkin co. D. Jan. 5, 1878.

Pearson's Mills, tp. of Putnam co., Fla. Pop. 760.

Peasants' War is the name generally given to the revolutionary rising of the peasants which took place in 1525 throughout the whole of Southern and Central Germany. The Reformation was the immediate occasion of this movement, but not its real cause. Similar risings on a smaller scale were of frequent occurrence previously to the Reformation everywhere in Germany, and the real cause of all these risings was the miserable social position of the peasants. They were serfs; that is to say, they belonged to the soil on which they were born, and through that to the lord who owned the soil. They were not exactly his property, his slaves—he could not sell them or dispose of them at will—but they had no right to move, and under no circumstances was there any legal appeal from his authority. When he appropriated for his own use the common pasture-grounds of the village, when he forbade them to fish in the streams and hunt in the woods, when he increased the ground-rent, the tithe, the socage service, according to his own need, they had to submit or to revolt. But it was quite natural that any such revolt should assume a religious coloring, for the whole mental life of the peasantry of that time was confined within the narrow pale of a few religious ideas. The inundation of a river, the miscarriage of a cow, a fever epidemic—in short, anything—was explained by the immediate application of religious categories. The peasant knew only two reasons for all that he observed within and without himself—God and Satan; and whatever he undertook to do, he did it in the name of the one or the other. Thus it was utterly impossible for the Reformation, as far as the peasantry was concerned, to accomplish a reconstruction of the religious consciousness of the age without at the same time putting all other spheres of human life into violent commotion; and with respect to the Peasants' War many special circumstances contributed much to produce such a result. The landlord was in many cases an ecclesiastic; and one of the most conspicuous shortcomings of the clergy was that its members had become landlords. In spite of the warnings, and even denunciations, of Luther and Melanchthon, several of the Reformers, such as Karlstadt, and many of their adherents among the nobility, aimed at once at a social and religious reformation. In 1524 a general fermentation spread among the German peasantry; and when, Jan. 1, 1525, the convent of Kempton was captured and plundered by a swarm of revolting peasants, this event became the signal for a general rising of the peasantry from the Alps to the Harz and from the Rhine to the Bohemian frontier. But with the exception of a few cases—MÜNZER, THOMAS, BERLICHINGEN, GÖTZ VON, etc. (which see)—the peasants had no leaders and no organization. They gathered together in large, uproarious multitudes of from 8000 to 30,000, and roved around like huge gangs of robbers. Castles were burnt, monasteries destroyed, cities plundered; the most disgusting excesses and the most atrocious cruelties were committed. As soon, however, as they fell in with regular armies—in the S. under Truchsess von Waldburg, in the N. under Philip of Hesse—they were routed, dispersed, or massacred in spite of their fierce and often furious resistance; and the revenge which the ruling classes took upon them was as cruel and as barbarous as their own behavior. The whole war lasted only a few months, and the only result of it was an enormous loss of life and property. The social position of the peasantry remained the same, or became even worse. (See Oechsle, *Beiträge zur Geschichte des deutschen Bauernkriegs* (1829); Wachsmuth, *Der deutsche Bauernkriegs* (1834); Bensen, *Geschichte des Bauernkrieg in Ostfranken* (1840); Zimmermann, *Allgemeine Geschichte des grossen Bauernkriegs* (1841–43); Cornelius, *Studien zur Geschichte des Bauernkriegs* (1862); Schreiber, *Der deutsche Bauernkrieg* (1864).)
CLEMENS PETERSEN.

Pease, tp. of Belmont co., O., on the Ohio River, opposite Wheeling, W. Va. Pop. 5211.

Pease (CALVIN), D. D., b. at Canaan, Conn., Aug. 12, 1813; graduated at the University of Vermont 1838; was professor of Greek and Latin in that institution 1842–55; became its president 1855–61, and pastor of the First Presbyterian church at Rochester, N. Y., 1862. D. at Burlington, Vt., Sept. 17, 1863.

Peaslee (EDMUND RANDOLPH), M. D., LL.D., b. at Newton, N. H., Jan. 22, 1814; graduated at Dartmouth College in 1836; was tutor there 1837–39; graduated in medicine at Yale in 1840, and in 1841 commenced practice at Hanover, N. H. He was appointed lecturer at Dartmouth in anatomy and physiology in 1841, and was professor of the same 1842–70. At Bowdoin College he was appointed lecturer on anatomy and surgery in 1843, and was professor of the same 1845–57, when he gave up anatomy, and remained professor of surgery till 1860. In the New York Medical College he was appointed professor of physiology and general pathology in 1851, and was professor of obstetrics 1858–60. He was made professor of gynæcology at Dartmouth (in 1872) at the Bellevue Hospital Medical College in New York (in 1874). In 1858 he took up his residence in New York. The degree of LL.D. was conferred upon him by his alma mater in 1859, and in 1870 he was made a trustee of the college. He had been president of the New Hampshire State Medical Society, and of several other medical associations, and was an honorary member of gynæcological or obstetrical societies in Boston, Berlin, Philadelphia, and Louisville. He published *Human Histology* (1857), *Ovarian Tumors and Ovariotomy* (1872), besides numerous articles in the medical journals. D. in New York City Jan. 21, 1878.
R. D. HITCHCOCK.

Peat. See FUEL, by PROF. B. SILLIMAN.

Pea Vine, tp. of Washoe co., Nev. Pop. 10.

Pea Weevil, or **Pea Bug,** the *Bruchus pisi*, a small dark beetle well known for its ravages among dried peas. It may be destroyed by scalding the peas before planting. The insect lays her egg in the flower, and the grub passes into the pea while it is still growing.

Peb′ble [Ang.-Sax. *pabol*], a small water-worn stone of any variety. Scotch pebble is simply agate. Brazilian pebble is a very transparent rock-crystal sometimes used by spectacle-makers as a material for their lenses. It is, however, much inferior to good glass. Most of the so-called pebble-spectacles are of common glass.

Pebble, post-v. and tp., Dodge co., Neb., on Elkhorn River and the Sioux City and Pacific R. R. Pop. 521.

Pebble, tp. of Pike co., O. Pop. 1422.

Pecan′ [Fr. *pecane*], a tree and its fruit, the *Carya olivæformis*, a species of hickory growing on river-banks from Indiana to Texas. It is well known for its fine, delicious nuts, which constitute a considerable article of commerce. The tree is tall, slender, and has a hard timber.

Pecan, tp. of Mississippi co., Ark., on the Mississippi River. Pop. 155.

Pecaton′ica, post-v. and tp. of Winnebago co., Ill., on the Galena division of the Chicago and North-western R. R., midway between Freeport and Rockford, has an excellent graded school, 5 churches, 1 bank, 1 weekly

newspaper, a pork-packing establishment, and several manufactories. Pop. 1780. COLBY BROS., EDS. "NEWS."

Pec'cary [S. American name], the vernacular name of swine-like, artiodactylate ungulates, composing the family Dicotylidæ. The peccaries are of two species, both American. The collared peccary (*Notophorus torquatus*) ranges from Arkansas south-westward through Mexico and over a great part of S. America. It is 3 feet long and sometimes weighs 60 pounds. It is of a dark gray color, and has a gland upon the loins which secretes a fetid substance. It is gregarious, and is a dangerous animal to attack, as the herd often assails the offending huntsman most vigorously and persistently with their strong tusks. The white-lipped peccary (*Dicotyles labiatus*) is a larger S. American species. Both kinds are very destructive to growing crops, both are swine-like in habits and appearance. Their flesh is somewhat like pork, but not so good.

Pec'chio (GIUSEPPE), b. at Milan 1785; took his degree at Pavia, and in 1810 returned to Milan, where he was appointed to an important post in the department of finance and of the interior. In 1820 he published his *Saggio Storico sull' Amministrazione Finanziaria dell' Ex-Regno d'Italia dal 1802 al 1814.* In 1821 he was banished, took refuge in Switzerland, then in Madrid, where he published a book entitled *Sei Mesi in Ispagna nel 1821.* From Madrid he accompanied Dr. Bowring to Lisbon, where he wrote his *Tre Mesi in Portogallo.* In 1826, Pecchio was called to a professorship of modern languages at Manchester. D. at Brighton 1835. Among his other works are *Relazione degli Avvenimenti della Grecia nella primevera del 1825; Storia dell' Economia Publica in Italia; Vita di Ugo Foscolo; Storia critica della Poesia Inglese* (incomplete), etc.

Pèc'cioli, town of Italy, province of Pisa, on a hill about 24 miles from the city of Pisa. During the Middle Ages it was sometimes subject to Pisa, sometimes to Florence, and remains of its old fortifications still exist. Pop. in 1874, 6409.

Pe-Chee-Lee, the northernmost province of China, comprises an area of 59,934 square miles, with 46,313,360 inhabitants. It is lowland, not very fertile, with a hot summer and a cold winter, but it is cultivated with the utmost care. The capital of the Chinese empire, Peking, is situated in this province.

Peck (GEORGE), D. D., b. in Middlefield, N. Y., Aug. 8, 1797; travelled and preached extensively; was principal of Oneida Conference Seminary 1835–39, then editor of the *Methodist Quarterly Review* (1840) and of the *Christian Advocate* (1848); wrote *Wyoming, its History*, etc. (1858), and works on Methodist doctrine, etc. D. May 1, 1876.

Peck (JESSE TRUESDELL), D. D., b. at Middlefield, N. Y., Aug. 4, 1811; joined the Methodist ministry in 1832; became principal of the Methodist seminary at Gouverneur, N. Y., in 1836, and of Troy Conference Academy at West Poultney, Vt., in 1840; in 1844 he was elected president of Dickinson College, Carlisle, Pa., but after four years' service returned to the pastorate. He occupied a pulpit in Washington, D. C., two years, when he was appointed secretary and editor of the Tract Society of his Church. He subsequently served several years in pulpits in New York City and California, Peekskill, Albany, and Syracuse, N. Y. In the latter he was active in founding the Syracuse University of his Church. In 1872 he was elected bishop. He is author of *The Central Idea of Christianity, The True Woman, What must I do to be Saved?* and *The History of the Great Republic.*

Peck (JOHN JAMES), b. at Manlius, N. Y., Jan. 4, 1821; graduated at the U. S. Military Academy, and was appointed brevet second lieutenant of artillery July, 1843; served throughout the war with Mexico, gaining the brevets of captain and major for gallantry at Contreras, Churubusco, and Molino del Rey. Resigned in Mar., 1853, and became cashier of a bank at Syracuse, N. Y. In Aug., 1861, he was appointed brigadier-general of volunteers, and in the Virginia peninsular campaign of 1862 commanded a brigade in the 4th Corps; appointed major-general July, 1862, and subsequently commanded at Suffolk, Va., where he was besieged by Longstreet; in North Carolina, and on the Canada border. Was afterward president of the N. Y. State Life Insurance Co. of Syracuse. D. Apr. 21, 1878.

Peck (JOHN MASON), D. D., b. at Litchfield, Conn., Oct. 31, 1789; became a licensed Baptist preacher in Greene co., N. Y., in 1811; was ordained in 1813; removed in 1817 to St. Louis; was for forty years a successful pioneer preacher of Illinois and Missouri; organized in 1826 the first church of his denomination in St. Louis; was one of the founders of Shurtleff College, Upper Alton, Ill., and of the theological school at Covington, Ky.; received in 1852 the degree of D. D. from Harvard College. Author of *Guides for Emigrants* (1831 and 1836), *Gazetteer of Illinois* (1834), *Life of Boone*, in Sparks's collection, *Father Clark, the Pioneer Preacher* (1855). D. at Rock Spring, Ill., Mar. 15, 1858.

Peck (WILLIAM G.), LL.D., b. at Litchfield, Conn., Oct. 16, 1820; graduated at the U. S. Military Academy in 1844; was promoted to the U. S. corps of topographical engineers, and served on the survey of Portsmouth harbor, and in Western explorations under Fremont till the breaking out of the war with Mexico. He was then assigned to duty with the Army of the West under Gen. Kearny, and served in that capacity till the end of the war, when he was detailed for duty as assistant instructor in mathematics at the Military Academy. After eight years of service at West Point he resigned his commission, and was for two years professor of physics and civil engineering in the University of Michigan. In 1857 he was called to Columbia College, New York, in which institution he has since served as professor of mathematics, mechanics, and astronomy. He was engaged with Prof. Charles Davies in compiling a dictionary and encyclopædia of mathematics; he is the author of a treatise on mechanics, and the American editor of Ganot's popular *Physics*, besides which he has written and published a complete course of mathematical text-books.

Peck (WILLIAM HENRY), b. in Augusta, Ga., Dec. 30, 1830; graduated at Harvard College, Mass., 1853; in 1856 was elected professor of *belles-lettres*, history, and elocution in the University of Louisiana, which position he held for three years, and on resigning was elected in 1860 president of the Masonic Female College at Greenville, Ga.: in 1863 resigned the presidency of the college at Greenville to accept the chair of natural sciences and modern languages in the Le Vert Female College at Talbotton, Ga., which position he held until nearly the close of the war, and, resigning it then, he betook himself to literature as a profession. A tale entitled *Antoinette de Bordelairs* by him was published as early as 1857, and in 1859 appeared the *Brother's Vengeance.* Soon after the war Prof. Peck moved to New York and entered into an engagement as a regular contributor to the *New York Ledger.* He now (Sept., 1875) resides in Atlanta, Ga., but still continues his engagement with Mr. Bonner of the *Ledger.* A. H. STEPHENS.

Pe'cos, county of W. Texas, bounded S. by the Rio Grande and N. E. and E. by the Rio Pecos. Its area exceeds 10,000 square miles. It is very dry, is traversed by mountain-ranges, and is reported to contain valuable silver ores. Where water can be had, the country affords good cattle and sheep ranges. Population small.

Pecos River, of New Mexico and Texas, rises in San Miguel co., N. M., and flows in a general S. S. E. course, falling into the Rio Grande del Norte after a course of 800 miles. It flows through a broken country, and in summer is dry the greater part of its length.

Pecquet' (JEAN), b. at Dieppe about 1620; studied medicine, and especially anatomy, at Montpellier; discovered and demonstrated the course of the lacteal vessels in the human body; wrote *Experimenta Nova Anatomica* (1651), *De Circulatione Sanguinis et Chyli Motu* and *De Thoracis Lacteis* (1651). D. 1674.

Pectase, a substance of the class of ferments found in association with PECTOSE (which see) in the tissues of fruits and vegetables. The special function of pectase is to transform the pectose of unripe fruits, in the process of ripening, to PECTINE (which see). Pectase is producible from the fresh juice of a plant—the carrot, for example—by precipitating with alcohol. This converts it into an insoluble modification, without, however, depriving it of its peculiar fermentive action upon pectosic substances. It has not been obtained in a crystalline form, being doubtless a colloid substance, like diastase, synaptase, and ferments generally. HENRY WURTZ.

Pec'tic Acid, an insoluble gelatinous substance produced by the action of alkaline solutions upon the PECTINE (which see) of ripe fruits and vegetables. Frémy calculates its composition as $C_{16}H_{22}O_{15}$, but this is not regarded as settled. The pectates of the alkalies are soluble, but all other bases form jelly-like insoluble masses, almost impossible to wash pure. Pectic acid, pectosic acid, and pectine are the principal constituents which give the gelatinous character to preserved fruits, fruit and vegetable jellies, etc. HENRY WURTZ.

Pec'tine, or **Plant-Jelly.** This substance exists naturally in ripe fruits and vegetable juices generally, being a product, during the ripening, of the peculiar ferment called PECTASE (which see) on the PECTOSE (which see) of unripe vegetables and fruits. It was obtained by Braconnot, its discoverer, by precipitating ripe-apple juice with alcohol, after boiling to coagulate the albumen, and

filtering. Frémy improved upon this by first precipitating lime with oxalic acid. Pure pectine is white, amorphous, and soluble in water. Even when fruits are unripe, as they contain pectose and pectase, on boiling pectine pectosic and pectic acid are formed, and jellies are producible. The composition of pectine is somewhat uncertain. Frémy computes the formula $C_{16}H_{24}O_{16}$, but others have obtained figures differing a little from his. HENRY WURTZ.

Pectoril'oquy [Lat. *pectus*, the "breast," and *loqui*, to "speak"], in auscultation of the chest, a preternatural distinctness in the sound of the patient's speech, as propagated to the auscultator's ear through the air-passages and pulmonary tissues. Pectoriloquy is either cavernous or amphoric according to the quality or timbre of its sound. It does not always, however, indicate a cavity in the lung, as was once supposed. It may arise from the hardening of a portion of the lung.

Pectose. This is a highly important proximate principle of vegetable bodies, from which proceed all the *gelatinous* constituents of fruits and vegetables, and of preparations thereof. Pectose exists largely in unripe fruits and roots, being, like cellulose, one of the "plastic" constituents, and giving, for instance, the hardness to green fruits. It is, however, a substance not only wholly insoluble, like cellulose, but, unlike the latter, extremely perishable or easily alterable. Therefore we have found no way of isolating and purifying it, so as to determine its composition. It is surmised to be a *carbohydrate*, like cellulose—that is, containing its hydrogen and oxygen in the proportions that form water. It exists more or less in all parts of vegetable bodies, and is always accompanied by a peculiar ferment substance, called PECTASE (see this head), which has the power to transform it, during the ripening of the fruit or maturation of the plant, into the plant-jelly or PECTINE (which see). This substance and its derivatives are of great interest, and demand much further investigation—an investigation surrounded, however, with great difficulties, from the non-crystalline or colloid nature of these compounds. HENRY WURTZ.

Pectosic Acid. This is an intermediate product of the action of the ferment pectase upon PECTOSE (which see), and, like pectine, the principal product is highly gelatinous in its character, forming a frequent constituent of artificial fruit-jellies. Its composition is yet uncertain. H. WURTZ.

Ped'al [Lat. *pedalis*], the distinctive name of that part or division of an organ which is played by a set of keys for the feet. Hence the terms pedal-pipes, pedal-keys, pedal-stops, and the pedal-part in music for the organ. The levers operated by the feet in pianofortes are also known as the loud and soft pedals. Organs, even of the largest class, were originally played by finger-keys or "manuals" alone, and the introduction of the pedal-organ with its separate pipes and key-board is ascribed to Bernhard, a German residing in Vienna in the latter part of the fifteenth century.—The name PEDAL or PEDALE is also given to certain passages in musical compositions in which a long-continued bass or pedal note is accompanied by a train of varied harmonies in the upper parts. (See ORGAN-POINT.)

Ped'lers, also called **Hawkers** and **Chapmen,** are persons who travel from place to place, either with vehicles or on foot, carrying goods and merchandise which they sell at retail. In England they have, from an early day, been subjected to strict statutory regulation, and must be licensed in order to engage in their traffic. The agents of manufacturers and of wholesale dealers, commonly called "commercial travellers," are, however, excepted from the operation of these statutes. Similar legislation generally prevails in the States of this country, and the U. S., as a part of its internal revenue system, requires a license fee from peddlers of tobacco. JOHN NORTON POMEROY.

Pedee', tp. of Montgomery co., N. C. P. 640.

Pedee, tp. of Georgetown co., S. C. P. 2400.

Pedee, tp. of Marion co., S. C. P. 1113.

Pedee River. See GREAT PEDEE RIVER.

Pedicula'ti [from *pediculatus*, "stalked," in allusion to the pediculate pectorals], an order of fishes whose representatives are distinguished by their grotesque forms. The skull is constructed in nearly the same manner as in the typical or teleocephalous fishes; the epiotics united behind the supraoccipital; the intermaxillary and supramaxillary bones well developed and distinct; the first vertebra is united to the cranium by suture; the scapular arch is, as in ordinary fishes, composed of a great external bone (proscapula) and two internal bones (hypercoracoid and hypocoracoid), but coalescent with the proscapula; with these are articulated the actinosts, which are remarkable for their length; between the proscapula and the skull intervenes a post-temporal, which is not bifurcate, but connects by a squamous suture with the skull; the branchial aperture is thrown backward in or near the axilla of the pectoral fin; the ventral fins are more or less jugular; the dorsal fin is divided into a spinous and a soft portion; the latter is normal; the former modified, and in some of the representatives of the order represented by a filament in or near the nasal region. The order thus distinguished is composed of several families—viz. Maltheidæ, or the bat-fishes; Sophiidæ, or the anglers; Ceratiidæ; and Antennariidæ. THEODORE GILL.

Ped'igree [contracted from the French *par degrés*], a statement of the descent of a family or individual, usually arranged in a tabular form. When such a record is expanded into a narrative, it becomes a family history. (See GENEALOGY.) The word pedigree is also sometimes applied, in a secondary sense, to the descent itself. B. R. BETTS.

Ped'iment [Lat. *pes*, "foot"], the gable of a building fashioned after any of the classic orders; the triangular space bounded by the horizontal cornice below, and by the raking cornices at the end of the roof above. It was often employed as a place for setting sculptures. Small pediments are occasionally seen over doors and windows. The face of the pediment is called the tympanum.

Ped'lar, tp. of Amherst co., Va. Pop. 4628.

Pedom'eter. See ODOMETER.

Pe'dro I. (DOM ANTONIO JOSÉ DE ALCÁNTARA), emperor of Brazil, b. at Queluz, Brazil, Oct. 12, 1798; married the archduchess Leopoldina of Austria 1817; was made regent of Brazil 1821; declared himself emperor 1822; was recognized as such by his father, Dom John VI. of Portugal, 1825; reigned as king of Portugal (Pedro IV.) Mar. 10–May 2, 1826, when he resigned in favor of his daughter, Maria da Gloria; married in 1829 Amélie, daughter of Eugène de Beauharnais; abdicated in 1831 and retired to England, but in 1832 succeeded in expelling Dom Miguel, his usurping brother, from Portugal, and restored his daughter, whose regent he became. D. at Lisbon Sept. 24, 1834.

Pedro II. de Alcántara (JOÃO CARLOS LEOPOLD SALVATOR BIBIANO FRANCISCO XAVIER DA PAULO LEUCADIO MIGUEL GABRIEL RAFAEL GONZAGA), emperor of Brazil, b. at Rio Janeiro Dec. 2, 1825; succeeded his father, Dom Pedro I., in 1831; was crowned 1841, and married in 1843 a daughter of the king of Naples. The prosperity of Brazil has been great under his rule, and the emperor has acquired the reputation of being a humane, patriotic, and enlightened ruler, and is a man of cultivated tastes. He has but one child, the crown-princess Isabella, wife of the count d'Eu, son of the duke de NEMOURS (which see).

Pee'blesshire, an inland county of Scotland, on both sides of the Tweed, consists mostly of low, well-wooded mountains. Area, 319 square miles. Pop. 12,330. Rearing of sheep and cattle is the chief occupation; coal is mined, and manufactures of woollens are carried on. The only town in the county is Peebles, on a peninsula at the confluence of the Eddleston with the Tweed, 22 miles from Edinburgh, and the seat of a county administration. It is the birthplace of William Chambers, who in 1859 made a gift to the town of a spacious suite of buildings for educational purposes, designated the Chambers Institution.

Peeks'kill, post-v. of Cortlandt tp., Westchester co., N. Y., situated upon the E. bank of the Hudson River, 43 miles N. of New York City, contains an academy, 4 boarding-schools, 13 churches, 2 banks, 2 newspapers, 6 stove-foundries, 1 agricultural implement factory, a machine-shop and locomotive factory, 1 blast-furnace, 2 distilleries, 2 tanneries, an iron railing factory, a fire-brick establishment, and stores. The village is supplied with water-works, and has frequent connection with New York and other points by the New York Central and Hudson River R. R., and by steamboat in summer. Pop. of v. 6560. FORSHAY BROS., EDS. "HIGHLAND DEMOCRAT."

Peel, county of Ontario, Canada, on the N. W. shore of Lake Ontario. It is traversed by two divisions of the Grand Trunk railway. The soil is fertile. Cap. Brompton. Pop. 16,369.

Peel (Rt. Hon. Sir FREDERICK), K. C. M. G., b. at London Oct. 26, 1823, second son of the second Sir Robert; was educated at Harrow and Trinity College, Cambridge, where he took a first class in the classical tripos; came to the bar in 1849 at the Inner Temple; under-secretary for the colonies 1851–52 and 1853–55; under-secretary for war 1855–57; financial secretary to the treasury 1859–65; became a railway commissioner 1873; attained distinction as a liberal in Parliament.

Peel (Rt. Hon. JONATHAN), D. C. L., son of the first Sir Robert, b. Oct. 12, 1799; studied at Rugby; entered the army, and in 1859 became lieutenant-general on the retired list; was surveyor-general of the ordnance 1841–

46; secretary of state for war 1858–59 and 1866–67, and long a prominent conservative member of Parliament; was sworn of the privy council 1858.

Peel (Rt. Hon. Sir LAURENCE), a cousin of the second Sir Robert, b. 1799; graduated at St. John's, Cambridge, 1821 (A. B.), and 1824 (A. M.), and in the latter year was called to the bar at the Middle Temple; became advocate-general at Calcutta, and in 1842–55 was chief-justice of Bengal; was knighted 1842, sworn of the privy council 1856, and appointed Indian assessor to the same council. Author of a *Life of Sir Robert Peel* (1860).

Peel (Sir ROBERT), BART., b. at Peel's Cross, Lancashire, England, Apr. 25, 1750; became partner with William Yates, his father-in-law, a cotton manufacturer of Bury, Lancashire. Peel's small fortune rapidly increased, and he became probably the largest manufacturer in the world. From 1790 to 1820 he sat in Parliament for Tamworth, and was a strong Tory; was made a baronet in 1800. D. at Drayton Park, Staffordshire, May 3, 1830.

Peel (Sir ROBERT), BART., son of the foregoing, b. near Bury, Lancashire, Feb. 5, 1788; was educated at Harrow and Christ Church, Oxford, where he passed B. A. as double first-class, the first who ever had the distinction. In 1809 he entered Parliament for Cashel; was made under-secretary for the colonies 1811, and was 1812–18 chief secretary for Ireland, where his Tory principles led to the most severe criticisms from the opposition. He established the Irish constabulary. Peel represented Oxford University in Parliament 1818–22; introduced and carried (1819) a bill to return to specie currency; was home secretary 1822–27, 1828–30; introduced and carried important reforms in the administration of criminal law; remodelled the London police; moved the bill for Catholic emancipation (1829), and thus broke with the Tory leaders. Previously, Peel's name, with no special justice, had been associated with the leadership in the opposition to this cause, doubtless because he had held an important post in Ireland as a Tory. The University of Oxford rejected him in the new election; he re-entered Parliament for Westbury, and again represented Tamworth 1832–50; was first lord of the treasury and chancellor of the exchequer 1834–35, and afterwards headed the conservative opposition, having resisted the parliamentary reform of 1831–32 with all his power; was again premier 1841–46, during which time his position drifted slowly from that of a protectionist and strict conservative to that of a free-trader, and he at last supported the repeal of the corn-laws. He afterwards acted generally with the Whigs. D. in London July 2, 1850, in consequence of a fall from his horse. Peel was a man of thorough patriotism and high moral principle. His hereditary conservatism, although strengthened by a dislike of too hasty changes, was ever held subject to feelings of justice and humanity. He refused the Garter and the peerage, and was universally respected for honesty, truthfulness, and ability.

Peel (Right Hon. Sir ROBERT), G. C. B., b. in London May 4, 1822; was educated at Harrow and Christ Church, Oxford; was 1844–46 an *attaché* at Madrid; was secretary of legation 1846, and chargé d'affaires at Berne 1846–50; a lord of the admiralty 1855–57; chief secretary for Ireland 1861–65; has been since 1850 a liberal member of Parliament for Tamworth; was sworn of the privy council 1861; was made G. C. B. 1868; married in 1856 the eighth daughter of the marquess of Tweeddale.

Peele (GEORGE), b. in Devonshire, England, about 1553; graduated at Broadgate's Hall (now Pembroke College), Oxford, 1579; settled at London as a theatrical writer; was an associate of Nash, Marlowe, and Greene, and author of many dramas, of which, however, only six are certainly known to be his. They were republished by Dyce, together with his poems and miscellaneous writings (3 vols., 1828–39). D. about 1598.

Pee Pee, tp. of Pike co., O. Pop. 2320.

Pee'ples, tp. of Beaufort co., S. C. Pop. 1400.

Peepul. See Bo TREE.

Peers [Fr. *pair*, from the Latin *par*, "equal"], in the old feudal law, all the vassals belonging to the same feudal lord; but when, subsequently, the feudal system was broken down and the king became the sole master of the realm, peers became the common title of all the former vassals. In this sense the word is still retained in the English language. In England the peerage comprises the whole nobility, and its members are designated as peers of the king, not of the realm; often, however, the name is restricted to those members of the nobility who have seats in the House of Lords. In France, Louis XVIII. created in 1814 a house of peers. But this peerage comprised only a very limited number of the whole class of the nobility, and its members were styled peers of the realm, not of the king. The attempt to make this peerage hereditary failed, and the whole institution became insignificant.

Pee'rysville, post-v., cap. of McDowell co., West Va., on Big Fork River.

Peet (DUDLEY), M. D., b. at Hartford, Conn., July 9, 1830; graduated at Yale 1852; studied medicine in New York, and practised there; resided 1857–59 at Burlington, Ia., and then became one of the instructors in the New York Institution for the Deaf and Dumb. D. in New York Apr. 18, 1862.

Peet (EDWARD), b. at Hartford, Conn., May 28, 1826; graduated at the University of New York in 1847; studied at the Union Theological Seminary; became in 1849 professor in the New York Institution for the Deaf and Dumb; author of text-books for deaf mutes. D. in New York Jan. 27, 1862.

Peet (HARVEY PRINDLE), LL.D., b. Nov. 19, 1794, at Bethlehem, Conn.; graduated at Yale in 1822; was the associate of Thomas Gallaudet as a teacher in the deaf-mute asylum at Hartford, Conn., 1822–31, and in 1831 became principal of the New York Institution for Deaf Mutes. Author of many published addresses, memoirs, and reports upon his specialty; published a *Course of Instruction for the Deaf and Dumb* (1844–46).

Pegas'idæ [from *Pegasus*, the winged horse of ancient mythology], a family of fishes of somewhat uncertain position and remarkable form. The body is much depressed and broad, covered with osseous angular plates; the snout is produced into a longer or shorter process; according to Günther, the gill-cover is formed by a large plate homologous to the operculum, preoperculum, and suboperculum; interoperculum a long fine bone hidden behind the gill-plate; mouth inferior; upper jaw with the margin formed by the intermaxillaries and their cutaneous prolongations, behind which are the supramaxillaries; teeth absent; branchial aperture narrow and in front of the pectoral fins; branchiostegal rays one, rudimentary; dorsal and anal short and opposite each other; pectorals enlarged and nearly horizontal; ventrals small, with two or three rays. The family has several representatives, one of which (*Pegasus volans*) is found in the seas of China, and is familiar to many by reason of its being preserved in boxes of insects, shells, and other natural curiosities exported by the Chinese. Formerly, the family was considered as being a member of the order Lophobranchiates, but recent systematic authors have removed it from that order, and consider it an ordinary acanthopterygian, related to the Agenidæ. This is, however, quite doubtful, although, having pectinated gills and otherwise disagreeing with the Lophobranchiates, it does not belong to that order as properly restricted. THEODORE GILL.

Peg'asus (Πήγασος), in the Greek legend, a winged horse, the offspring of Medusa by Poseidon. He dwelt among the immortals. His father lent him to Bellerophon when the latter slew the Chimæra; but when Bellerophon attempted to fly to heaven on his back, the rider fell off and was killed. Pegasus made the well Hippocrene by a stroke of his foot. Hence he is considered the horse of the Muses.

Pegli, town of Italy, province of Genoa, lying on the sea-shore 6 miles W. of the city of Genoa. Fine gardens and rich orange orchards surround the town, and the beauty of its position and the charm of the climate attract hither many strangers, who find ample accommodations in the large hotels and bathing establishments provided for them. Pop. in 1875, 5000.

Pe'go, town of Portugal, province of Alicante, is a neat and prosperous place, with 5847 inhabitants.

Pe'gram (JOHN), b. in Virginia in 1832; graduated at the U. S. Military Academy 1854, when he was appointed brevet second lieutenant of dragoons, and was engaged on frontier duty until May, 1861, when he resigned to follow the fortunes of his native State. Appointed colonel, he was defeated at Rich Mountain July 1, and captured with his command July 12, 1861. Subsequently appointed brigadier-general and major-general, he commanded with distinction throughout the war. In command of a division in the army of Virginia he was killed while resisting a Federal advance at Dabney's Mill Feb. 6, 1865.

Pegram (Gen. WILLIAM JOHNSON), b. at Petersburg, Va., in 1841; was a law-student at the University of Virginia at the outbreak of the civil war, when he volunteered as a private in a Confederate regiment of artillery; gained distinction and promotion in that arm of the service at Cedar Run, Chancellorsville, and Gettysburg; was made brigadier-general early in 1865, and was killed in the battle of Petersburg, Apr. 2, 1865.

Pe'gu, province of British Burmah, Farther India, lies on both sides of the lower course of the Irrawadi, be-

tween lat. 15° 14′ and 19° 27′ N., and comprises an area of 36,454 square miles, with 1,533,505 inhabitants. The territory, which is very rich in teak-timber and exceedingly well adapted to rice-culture, was a province of Burmah until in 1853 it was conquered by the English and annexed to their Indian dominions.

Pegu, or **Bagoo,** town of the British dominion in Farther India, formerly the capital of the famous empire of Pegu, stands on the delta of a river of the same name, in lat. 17° 40′ N., lon. 96° 20′ E. It had at one time 150,000 inhabitants, but is now mostly in ruins, while a new city, Zangnomang, rises on the opposite shore of the river. Among its remains is the temple of Shoe-madoo, a pagoda 360 feet high, richly ornamented with spires and bells, and tapering from a basis 1390 feet square.

Pehlavi Language. See Persian Language.

Pei-ho′, a river of China, rises near the Great Wall, flows in a south-eastern direction through the province of Pe-chee-lee, and falls into the Bay of Pe-chee-lee, an inlet of the Yellow Sea. Tien-tsin is situated on its shores, 70 miles from its mouth. Tung-hui, one of its affluents, traverses Peking. It is navigable for more than three-fourths of its course, but at its mouth is a bar of stiff, tenacious clay which makes the entrance very difficult.

Peine Forte et Dure ("hard and severe pain"), called also **Pressing to Death,** was formerly, in England, the punishment of those who refused to plead or stood mute upon their arraignment for felony. The custom was to load the breast of such a person with weights until he was smothered or yielded. The offender lay upon his back. This punishment came into use about 1400, and was last employed in 1741. It was virtually, but not formally, abolished in 1772. A supposed witch was pressed to death at Salem, Mass., during the famous delusion on that subject.

Pe′ipus, a large lake in North-western Russia, 87 miles long, 30 miles broad, communicates with the Gulf of Finland through the Narova. It is deep, easy to navigate, and rich in fish, which are sent to the market of St. Petersburg. Its shores are low, marshy, or sandy, and in many places covered with forests.

Peirce (Benjamin), LL.D., F. R. S., b. at Salem, Mass., Apr. 4, 1809, a son of Benjamin Peirce (1778–1831), librarian of Harvard University. The son was a pupil of Nathaniel Bowditch, and graduated at Harvard in 1829; taught 1829–31 at Round Hill, Northampton, Mass.; became mathematical tutor in Harvard College 1831; professor of mathematics, etc. 1833–42; professor of astronomy, etc. 1842–67, and aided the construction and equipment of the observatory; superintendent of the U. S. Coast Survey 1867–74; has been since 1849 consulting astronomer to the *Ephemeris and Nautical Almanac;* a member of the leading American and foreign scientific societies; author of a series of mathematical textbooks 1835–70, and of many scientific papers. His work in pure and in applied mathematics is noteworthy for its novel, original, and remarkably direct and satisfactory methods.

Peirce (Bradford Kinney), b. at Royalton, Vt., Feb. 3, 1819; graduated at Wesleyan University 1841; became a Methodist preacher 1843; was editor of the *Sunday-school Messenger* and the *Sunday-school Teacher;* was a State senator for Norfolk co. 1855–56; obtained the establishment of the State Industrial School for Girls at Lancaster, of which he became superintendent; was chaplain of the House of Refuge, Randall's Island, N. Y., 1867–72, after which he returned to Boston, and became editor of *Zion's Herald.* Author of a series of Sunday-school question-books, a *Bible Scholar's Manual, The Eminent Dead, Notes on the Acts, The Word of God Opened* (1868), *A Half Century with Juvenile Delinquents* (1869), and *Trials of an Inventor,* being an account of the career of Charles Goodyear, inventor of many of the uses of india-rubber.

Peirce (Charles Sanders), son of Benjamin, b. at Cambridge, Mass., Sept. 10, 1839; graduated at Harvard University 1859; author of *The Logic of Relatives* in the *Memoirs* of the American Academy of Arts and Sciences for 1870; of various papers on logic, published in the *Proceedings* of that academy and in the *Journal of Speculative Philosophy;* and of courses of lectures on logic and the scholastic philosophy, delivered before the Lowell Institute at Boston and at Harvard University about 1869; also of a *Memoir on Observations of the Light of the Fixed Stars,* presented to the American Academy in 1875. He is now (1876) in the service of the U. S. Coast Survey, engaged in pendulum experiments to determine the density of the earth.

Peirce (Cyrus), b. at Waltham, Mass., Aug. 15, 1790; graduated at Harvard College 1810; studied theology; was pastor of a Congregational church at North Reading 1819–27, but preferred the vocation of teacher, in which he was engaged long at Nantucket; was principal of the first normal school in America at Lexington, Mass., 1839–42, and in 1844 became the head of the female normal school at West Newton. D. at West Newton Apr. 5, 1860.

Peirce (Cyrus Newlin), D. D. S., b. at Philadelphia, Pa., Mar. 5, 1829; graduated at the Philadelphia Dental College 1854; commenced the independent practice of the dental profession 1858; was professor of operative dentistry and dental physiology in the Pennsylvania College of Dental Surgery 1858–65; was dean of that institution 1860–65; has been an earnest advocate for a liberal and thorough education for the dental student, and has made several contributions to the literature of his profession.

Peirce (Gen. Ebenezer Weaver), b. at Freetown, Mass., Apr. 5, 1822; received an academical education; was brigadier-general of State militia 1855–61; became colonel of the 29th Massachusetts regiment 1861; lost an arm at the battle of White Oak Swamp, June 30, 1862; commanded a brigade 1863–64, serving in Kentucky, Tennessee, and Virginia; became collector of internal revenue for the first district of Massachusetts 1866, and published a *Genealogy of the Peirce Family* (1870).

Peirce (James Mills), son of Benjamin, b. at Cambridge, Mass., May 1, 1834; graduated at Harvard University 1853; was tutor of mathematics in that institution 1854–58, and became university professor of mathematics 1869. Author of *A Textbook of Analytical Geometry* (Cambridge, 1857), *Elements of Logarithms, Three and Four Place Tables.*

Peirce City, p.-v., Mount Pleasant tp., Lawrence co., Mo., on Atlantic and Pacific R. R., 291 miles E. of St. Louis, has 3 churches, 1 bank, 1 newspaper, 2 large mills, and 3 hotels. P. 432. A. G. Hedges, Ed. "Democrat."

Peiss′ner (Col. Elias), b. at Vilseck, Bavaria, in 1826; graduated at the University of Munich; came to the U. S. in 1849; became professor of modern languages at Union College; published works on the German and Romaic languages and upon political economy; became colonel of the 119th regiment New York Vols., and was killed at the battle of Chancellorsville, May 2, 1863.

Pe′kin, city and tp., cap. of Tazewell co., Ill., on the Illinois River, in the centre of a rich agricultural section, has several important manufactories, an extensive pork-packing establishment, 3 distilleries, 3 newspapers, and stores and mechanical workshops. The city has railroad connection with all the important points of the country. Coal of an excellent quality is mined here. Pop. of city, 5696; of tp., exclusive of city, 166.

D. W. Lusk, Ed. "Republican."

Pekin, post-v. of Cambria and Lewiston tps., Niagara co., N. Y.

Peking, or **Pekin,** the capital of the Chinese empire, situated in lat. 39° 56′ N., lon. 116° 27′ E., in the province of Pe-chee-lee, on the river Tunghui, a tributary of the Pei-ho, about 35 miles from the Great Wall, has no great commercial or industrial importance, but forms, nevertheless, as the residence of the emperor and the seat of the government, the centre of the whole Chinese world. It stands in a fertile and well-cultivated plain covered with summer residences, gardens, and groves, and rising at a short distance into well-wooded hills. To the N. and W. extensive coal-deposits are found, yielding good bituminous and some anthracite coal, which is brought to the city on the backs of camels and mules; but the mines are worked very superficially, no machinery being employed for the removal of water, and coals, like all other articles, are very dear in Peking. Water is procured from numerous wells, and distributed by carts and wheelbarrows; it is of good quality. The climate is healthy, though severe, the thermometer rising in summer to 105°, and falling in winter to 10°. From December to March the waters in the neighborhood are generally covered with ice two feet thick, and violent storms occur; in June and July the atmosphere is horribly polluted by the thick layer of filth and dirt which covers the unpaved and undrained streets. The city consists of two parts—the northern or Tartar city, forming a parallelogram extending 4⅓ miles from E. to W. and 3⅔ miles from S. to N.; and the southern or Chinese city, also in the form of a parallelogram, extending 5 miles from E. to W. and 2¼ miles from S. to N.—the whole covering an area with a circumference of about 25 miles and surrounded with walls, beyond which only a few scattered suburbs are found. These walls with their gates form one of the most conspicuous and most magnificent architectural features of the city, especially that surrounding the Tartar city. It is 36 feet high, with a parapet 6 feet high on both sides. Its breadth varies from 40 to 52 feet, being greatest on the northern side. It is built of earth and stones, faced on both sides

with large bricks, and provided on the inner side with ramps for the ascent of cavalry. It is pierced by nine gates, of which three lead into the Chinese city. Behind the gates are large squares enclosed by other walls, and above the gates rise tall, strong, and elegant square towers, with cannon. At sunset the gates are closed with great ceremony, to be opened again at sunrise; they form the principal police-stations, and tolls are taken here on all goods entering. The Tartar city consists of three divisions, one surrounding the other—namely, the inner or prohibited city, enclosed by a red wall and containing the winter palace of the emperor and his family, to which no foreigner can get access; the celestial city, enclosed by a yellow wall and containing a number of magnificent temples and altars to Chinese divinities, the palaces of the imperial princes and the highest officials, and the imperial gardens, with an artificial mountain crowned with a gorgeous pavilion, an artificial lake bordered with groves and plantations, etc.; and the Tartar city proper, where the imperial stables, the government offices, the literary and educational institutions are located. Here reside the foreign ambassadors and the different missions, and here are a Roman Catholic cathedral, a Greek church, a Protestant chapel, and numerous Mohammedan mosques and Booddhist temples. The Chinese city is a densely-crowded, exceedingly noisy, picturesque, and filthy beehive. Broad, straight streets run from gate to gate, and cross each other at right angles. These streets consist of an elevated carriage-road in the centre, where cabs without springs, carts of all descriptions, camels and mules with towering loads move to and fro; on both sides of the road are footways, unpaved, covered with dust or filled with mud, lined on the one side with brick houses of one or two stories, on the other with stalls, and occupied for more than one-half of its breadth by merchandise gorgeously displayed and still more gorgeously advertised. The lanes which run from the streets are generally very narrow and excessively filthy, and it has repeatedly been remarked by foreign visitors that the whole city, even the public buildings, the temples, and the imperial palaces, bears an aspect of decay. Riots are of frequent occurrence, generally occasioned by the awkward and defective manner in which the city is supplied with provisions. It has been the residence of the emperors since 1410, and is one of the oldest cities of China, but was very imperfectly known to the civilized world until, in Oct., 1860, the French-English army arrived before its walls, occupied two of its gates, and compelled the emperor to conclude the Treaty of Tientsin or have his capital destroyed. The population is estimated at 1,500,000. The first European embassy which visited Peking came from Portugal in 1517. The ambassadors were imprisoned immediately on their arrival, and in 1523 they were put to death. A Dutch embassy of 1667 succeeded in concluding a commercial treaty. With the Russians the intercourse began in 1619. CLEMENS PETERSEN.

Pela'gianism, a system of anthropological doctrine which takes its name from Pelagius, but owes its shape rather to bolder if not abler men. Pelagius is spoken of by several of his contemporaries as a Briton; which is likely enough, in spite of his familiarity with Greek authors. But that his British name was Morgan ("sea-born"), rendered into the Latin *Pelagius*, is without sufficient ancient warrant. He was also called a monk, but perhaps this indicates only ascetic habits. At any rate, he was only a layman. He had been residing for some years in Rome when, in 410, during Alaric's third siege of the city, he escaped with his convert and pupil, Cœlestius, to Northern Africa, and had gone from there to Palestine before the meeting of the Council of Carthage in 411 (some say 412), which condemned Cœlestius. In Palestine two councils (at Jerusalem and at Diospolis, the ancient Lydda, in 415) declared him orthodox. And he is not heard of after 418. In the controversy to which his peculiar views gave rise he may not have acted quite frankly, but otherwise he appears to have been a very good man, of more than common moral strictness and purity, if not a man of any great spiritual depth or intellectual grasp. The impulse to his alleged heresy was a practical one. He had been scandalized by hearing Christians plead human infirmity as an excuse for shortcomings in the religious life. He is said to have been greatly roused by hearing a bishop repeat the well-known prayer of Augustine, *Da quod jubes, et jube quod vis* ("Give what Thou commandest, and command what Thou wilt"). His convert, Cœlestius, who appears to have been more of a Pelagian than Pelagius himself, had been an advocate in Rome, and was, perhaps, an Irishman by birth. He was younger and more impulsive than Pelagius. It was his application for ordination as a presbyter at Carthage (in 411 or 412) which led to the council already referred to. His application was denied, on the ground of these seven heretical opinions: (1) Adam would have died if he had not sinned; (2) Adam's sin injured himself only, not the race; (3) children are born as pure as Adam was before he fell; (4) men neither die because Adam fell, nor rise again in consequence of Christ's resurrection; (5) unbaptized, as well as baptized, infants are saved; (6) the law, as well as the gospel, leads to heaven; (7) even before Christ's advent there were sinless men. The answer of Cœlestius, that these were matters merely of speculation, availed him nothing; he was excluded from the fellowship of the Church. He then went to Ephesus for ordination, and was a presbyter there from 412 to 417, when he returned to Rome, and for a time had the bishop Sozimus (417–418) on his side, but fled from Rome in 418, Sozimus having turned against him; was banished from Constantinople in 429; appears in Rome again in 430; and is not heard of after 431, when he was condemned by the œcumenical Council of Ephesus. Meanwhile, a still younger man, of still greater boldness, Julian, bishop of Eclanum in Italy, comes upon the stage. Deposed in 418, with eighteen other bishops, for sympathy with the opinions of Cœlestius, he literally carried the war into Africa, assailing the Carthaginian anthropology with all his might. Augustine had already entered the lists on the other side. Julian went to Constantinople in 418, spent some years with Theodore of Mopsuestia, was in Constantinople again in 428, sought restoration to the Church in 439, but was refused, and died a schoolmaster in Sicily at some time between 440 and 453. Pelagianism, which was understood to be a denial both of original sin and of supernatural grace, was everywhere condemned. Semi-Pelagianism, 100 years later, shared the same fate. (See Wiggers, *Versuch einer pragmatischen Darstellung des Augustiniasmus und Pelagianismus* (1831–33), translated by Prof. Emerson of Andover (1840); Jacobi, *Die Lehre des Pelagius* (1842); A. Dorner, *Augustinus* (1873); and Shedd, *History of Christian Doctrine* (1863).) R. D. HITCHCOCK.

Pela'gius I., POPE, of Roman birth, archdeacon and legate to Constantinople under Vigilius, his immediate predecessor, and, like him, a mere creature of the Byzantine emperor, Justinian. He was with Vigilius when he died at Syracuse on his way home from Constantinople (where he had been since 547), June 7, 555, and at once assumed the pontificate, as he had previously been authorized to do by Justinian. He was suspected of having hastened the death of Vigilius. He was afterwards consecrated at Rome by two bishops and a presbyter, and d. there Mar. 3, 560.—PELAGIUS II., also of Roman birth, the immediate predecessor of Gregory the Great in the papal chair, and the first independently elected pontiff after the Byzantine conquest of Rome in 536. He was consecrated Nov. 27, 578; d. about the middle of January, and was buried Feb. 6, 590. R. D. HITCHCOCK.

Pe'lago, town of Italy, province of Florence, on the brow of a hill washed by the torrent Vicano. It is about 15 miles E. of Florence, on the road to Vallombrosa, and its chief industries are manufactures of earthenware and of woollen cloths. Pelago was a fief of the bishops of Fiesole in the eleventh century. Pop. in 1874, 10,037.

Pelargon'ic Acid. This compound, which is $C_9H_{18}O_2$, is one of the monatomic fatty acid series, $C_nH_{2n}O_2$, a homologue of formic and acetic acids. On the homologic theory its structural formula is $O_2.9H_2C$. (See HOMOLOGY.) It exists naturally in the volatile oil of rose-geranium, *Pelargonium roseum*, whence its name, and is obtainable artificially by several methods, one being the oxidation of essential oil of *Ruta graveolens*, or rue, by the action of nitric acid, a method discovered by Gerhardt and Cahours. Pelargonic acid is a colorless liquid, oily, and freezing by cold to a fatty mass which melts at 10° C.; odor like that of butyric acid; boils at 260°; slightly soluble in water and very soluble in alcohol. By keeping it becomes yellow. Delffs claims its identity with *œnanthic acid*, discovered by Liebig and Pelouze in wine in the form of *œnanthic ether*, which constitutes a portion of the *bouquet* of all wines (the term *œnanthic* being derived from the Greek word for "vine-blossom," οἰνάνθη). As pelargonic acid is a substance of some practical importance in the preparation of artificial flavoring essences, its mode of preparation will be briefly stated. The method of Gerhardt and Cahours from oil of rue is employed in practice. This essential oil is heated with twice its weight of very dilute nitric acid until it begins to boil. Two layers form in the mixture. The lower layer is separated, freed from free nitric acid by heating in a bath of chloride of zinc, and then filtered. It is now crude pelargonic acid, fit for the preparation of pelargonic or œnanthic ether; but if required pure, it is necessary to combine with potash, decompose with sulphuric acid, rectify the oily acid which separates, combine again with baryta, crystallize, and decompose the crystals of baric pelargonate with sulphuric acid.

Pelargonic Anhydride.—The "anhydride" of pelargonic acid, $C_{18}H_{34}O_3$, was discovered by Cahours, who obtained it by the action of oxychloride of phosphorus on baric pelargonate. It is a colorless oil, lighter than water, freezing at 0° C. and melting at 5°. HENRY WURTZ.

Pelargonic Ether (syn. *Œnanthic Ether*). This substance constitutes largely the aromatic principle or *bouquet* of most wines. It is prepared, in a crude state, from crude PELARGONIC ACID (see this head) by a prolonged digestion of the latter, at a gentle heat, with alcohol. It is recommended to pass dry hydrochloric acid gas through an alcoholic solution of pelargonic acid, when it separates as an oily layer, which is subsequently purified. Pure, it is a colorless oil, of density .861, boiling about 217° C. It has a powerful odor resembling *quinces*—is insoluble in water, though soluble in alcohol even when rather dilute. An alcoholic solution constitutes the commercial artificial *quince-essence.* It is doubtless largely used in the manufacture of factitious wines, as a flavoring constituent, to impart the *fruity* aroma. HENRY WURTZ.

Pelargonium. See GERANIUM.

Pelas'gians, The, are uniformly spoken of by all ancient Greek authors as the oldest inhabitants of Greece, but in details the notices which have come down to us about them are vague and contradictory. Some authors, Homer and Herodotus, describe them as an extensive race, the parent-stock from which sprung the Hellenes, and occupying not only Greece proper, but Asia Minor to the E., Macedonia, Thracia, and Illyria to the N., and Italy to the W. Others, Thucydides and Strabo, consider them only one of the many kindred tribes which inhabited Greece, like the Leleges and Dolopes. As the materials for investigation are exceedingly scanty, modern researches have failed to arrive at any definite and settled view. Of the Pelasgian language nothing has been preserved. Certain names, such as Larissa and Argos, are considered as pertaining to it. A Greek tradition designated the Albanian dialect as directly descended from it. Herodotus speaks of it as barbarous, but whether that means foreign or corrupted is not evident. Of architectural monuments found in Greece, certain constructions of an enormous massiveness and strength are ascribed to them, such as the so-called tomb of Atreus in Mycene. They consist of huge blocks of stone placed one above the other, and held together by their own weight, without any mortar; on account of their size these structures are called cyclopean. Of the history of the Pelasgians not one fact has as yet been ascertained, even that of the transition from the Pelasgian to the Hellenic period. Some modern Egyptologists, however, have described them as a seafaring people in frequent communication with Egypt. Of the various stocks settled in Italy, the Japygians and Etruscans are generally considered as branches of the Pelasgian race, but the hypothesis is at once hazardous and barren.

Pelecan'idæ (*Pelecanus*), a family of birds whose species are familiarly known as pelicans; they are of large size; have a rather long flexible neck, moderate head, a long, nearly straight, and rather broad bill, whose culmen is rounded at the base, and at the end produced into a strong hook; the lower mandible is broader than the upper, and provided with a naked membrane, which extends backward on the throat and is capable of great extension; nostrils linear; wings long and pointed; tarsi short and robust; toes four, connected together by a membrane, the three anterior largest, the fourth interno-posterior and smallest. The family, according to G. R. Gray, includes ten species; of these some one or other species are found in all quarters of the globe, and extend to interior lakes and rivers as well as the sea-coast. They live upon fish, which they take in their pouch to a place of rest, where they ingest and leisurely digest their meal. This habit has been taken advantage of by Chinese fishermen, who place a ring round the throat and send the pelicans to fish for them; the pelican brings to its master the fish in its pouch, and is rewarded by being finally permitted to fish on its own account. Pelicans feed their young with regurgitated and half-digested food. The ancients believed that the mother-bird fed her offspring with drops of blood obtained by piercing her own breast. Hence the pelican is taken as an emblem of maternal piety. THEODORE GILL.

Pel'ecoid [Gr. πέλεκυς, "hatchet," εἶδος, "form"], a geometrical figure of a hatchet shape. It is bounded by a semicircle and two quadrants, all having their concavities turned in the same direction; the quadrants are tangent to each other and to the diameter of the semicircle. W. G. PECK.

Pelew' Islands, a group of twenty islands situated in the North Pacific Ocean, extending between lat. 7° and 8° 30′ N., and between lon. 134° and 136° E. They are high, mountainous, and surrounded by coral reefs, but the soil is fertile, and produces bread-fruits, bananas, sugar-cane, and oranges. Pop. about 10,000, of the Malay race.

Pel'ham, post-v. and tp., Hampshire co., Mass. P. 673.

Pelham, p.-v. and tp., Hillsborough co., N. H. P. 861.

Pelham, p.-v. and tp., Westchester co., N. Y., on Long Island Sound, near New York and New Haven R. R. P. 1790.

Pelham, post-v. and tp., Caswell co., N. C. Pop. 1560.

Pelican. See PELECANIDÆ.

Pe'lion, the ancient name of the modern *Zagora*, a mountain-range on the eastern coast of Thessaly. On the summit of its highest peak stood the temple of Jupiter Actæus, and near this was the cave of Chiron. It was, and is still, celebrated for its magnificent forests of oak, chestnut, elm, and pine, and the deep impression which the ancients received of its lofty peaks found a fit expression in the myth of the giant sons of Aloeus, who in their wars against the gods placed Ossa on the top of Olympus, and Pelion upon Ossa; or, as Virgil relates, piled Ossa on Pelion, and rolled Olympus upon Ossa.

Pélissier' (JEAN JACQUES AMABLE), duke of Malakoff, marshal of France, b. Nov. 6, 1794, at Maromme, near Rouen; was educated at Brussels, afterward at the military schools of La Flêche and St. Cyr; entered the artillery as sub-lieutenant in 1814; served in Spain in 1823, in the Morea in 1828, and in Algeria in 1830. Commanding in 1845 a corps as colonel, he entered the territory of the Ouled Riahs, defeated them, and shut them up in a cave. As they refused to surrender, and even fired at his messengers, he applied burning fagots to the mouth of the cave, and about 600 Arabs were suffocated. This atrocity excited general indignation, and he was saved only by the declaration of Marshal Bugeaud, commander-in-chief in Algeria, that he had simply obeyed a positive order. In 1855 he was made commander-in-chief of the army in the Crimea, and took the Malakoff. He was governor-general of Algeria from 1860 to his death, May 22, 1864.

Pel'la, the ancient capital of the Macedonian empire and the birthplace of Alexander the Great, was a large and magnificent city in the days of Philip and Alexander, but lost its importance under the Romans, and disappeared altogether during the Middle Ages. Some few remains of it are still traceable near the village of *Neokhori* or *Yenikiuy*, along a small brook called Pelle. It is said to have had over 80,000 inhabitants.

Pella, tp. of Ford co., Ill. Pop. 552.

Pella, post-v. of Lake Prairie tp., Marion co., Ia., on the Keokuk and Des Moines R. R., 45 miles from Des Moines, contains the Central University of Iowa, 11 churches, 3 banks, 2 large wagon manufactories, 3 flouring-mills, 1 foundry and machine-shop, 2 newspapers, 3 hotels, 2 grain-elevators, several vineyards, stone-quarries, limekilns, and stores. Principal business, farming and stock-raising. Pop. 1909. J. H. BETZER, ED. "BLADE."

Pella, post-v. and tp., Shawano co., Wis., on a tributary of Wolf River. Pop. 318.

Pella'gra, a supposed endemic skin disease formerly prevalent in the Milanese (Italy), in the Asturias (Spain), and in other regions. Epilepsy, muscular contractions, insanity, and suicidal mania often accompanied it. It was considered probable that a maize diet was the cause, but it is more likely that poverty, hunger, overwork, and filth combined were the causes alike of the scaly eruption and of the other attendant evils.

Pellazzano, town of Southern Italy, province of Salerno, in a good grain-bearing district. P. in 1874, 6123.

Pellegri'no Parmense, town of Italy, province of Parma, in a district rich in olives, chestnuts, grapes, grain, and hemp. An old castle of the twelfth century stands near the town. Pop. in 1874, 5216.

Pellestrina, town of Italy, province of Venice, on one of the lagoon islands or dunes, from which it takes its name. The inhabitants are chiefly engaged in cultivating vegetables, in fishing, and in navigation; the women take part in all these occupations, and are so skilful with the oar that they often contend for and share the prizes in the famous Venetian regattas. The first settlement of Pellestrina was as early as the fifth century. Pop. in 1874, 6253.

Pellew. See EXMOUTH.

Pel'lico (SILVIO), b. at Saluzzo June 24, 1789; studied at Turin, and afterwards spent four years at Lyons, devoting himself to French literature; appointed professor of French in a military college at Milan, but afterwards became private tutor in the family of Porro; in 1819 his tragedy, *Francesca da Rimini*, was represented with the greatest applause, and in the same year, with Manzoni, Berchet, Breme, and others, he established the periodical

Il Conciliatore, which was the champion of the new liberal school of romance; it was suppressed in 1820, and he was arrested; Feb. 21, 1822, he was condemned to death, but the sentence was commuted to close confinement for life, and he was conveyed to the Spielberg. Pellico has painted to the life his sufferings in this prison in his popular and most touching book, *Le mie Prigioni*—a book which excited the strongest public feeling against the despotism of Austria, and brought a powerful moral pressure to bear upon the political policy of that country. He was released from his cruel confinement in 1830, and returned immediately to Turin, where he lived in complete retirement as the private secretary of the marchioness Barolo. Besides his excellent little work, *Dei Doveri degli Uomini*, he continued to write dramas and other poems. D. Jan. 31, 1854.

Pel'litory [from Lat. *parietaria*]. (1) The *Parietaria officinalis* or wall pellitory of the Old World, an urticaceous herb, resembling in its looks the common nettle. It is used as a diuretic in domestic practice. *Parietaria Pennsylvanica* is its North American representative. (2) More commonly this name is given to *Anacyclus pyrethrum*, a composite plant whose root is brought from the Levant. It is much used by dentists to relieve toothache and benumb the nerves of the teeth, and is a valuable and powerful sialagogue and local stimulant in tic douloureux and facial paralysis; is often incorrectly called Spanish pellitory.

Pelomedus'idæ [*Pelomedusus*, from Gr. πηλός, "mud," and μέδειν, to "hold sway over"], a family of tortoises of the sub-order Pleurodela—*i. e.* those forms which retract their neck sideways—distinguished by Prof. Cope (*Proc. Acad. Nat. Sci.*, Philadelphia, for 1868, p. 119) because they possess only two series of phalanges instead of the usual number (three). In external appearance they resemble the Chelydidæ (*Sternothærus*, etc.); the lobes of the sternum are solid and immovable. According to Dr. Gray, there are three species of the group, inhabitants of Africa.
THEODORE GILL.

Pelop'idas, b. at Thebes, a man of great wealth and an intimate friend of Epaminondas; was expelled in 382 B. C. from his native city by an oligarchic party supported by Sparta, but returned in 379 B. C., slew the Spartan leader with his own hand, established a thoroughly democratic government, and broke the Spartan influence not only in Thebes, but in Greece. He distinguished himself in the battle of Leuctra, 371 B. C., and on a diplomatic mission to Susa he was eminently successful in baffling the Spartan and Athenian intrigues at the Persian court, and Thebes was acknowledged as the first city of Greece. Sent in 368 B. C. as ambassador to Alexander of Pheræ, he was seized and imprisoned by the tyrant, but rescued by Epaminondas. In the year 364 B. C. he defeated Alexander at Cynoscephalæ in Thessaly, but was killed while pursuing the enemy.

Pelo'pium [Gr. Πέλοψ, "Pelops," a proper name], a name applied by the great German chemist Heinrich Rose to a supposed new metal found by him, together with NIOBIUM (which see), in American *columbite* and Swedish *tantalite*. Niobium is now understood to be neither more nor less than the columbium of Hatchett, discovered long before, and Rose himself afterwards concluded that his supposed oxide of the peculiar metal pelopium was only an oxide of niobium (columbium); so that it happens that both these names must be dropped from the language of the science. H. WURTZ.

Peloponne'sus (the "island of Pelops"), the ancient name for the southern division of Greece, the peninsula, which now generally is called the Morea. It was connected with Hellas proper by the Isthmus of Corinth, which separated the Saronic Gulf from the Corinthian (Lepanto). It was divided into six districts or states—namely, Achaia, in the N., along the Corinthian Gulf; Argolis, in the E., between the Saronic Gulf and the Gulf of Argolis; Laconia, in the S. E., between the Gulfs of Argolis, Laconia, or Kolokythia, and Messenia or Koron; Messenia, in the S. W., on the Gulf of Messenia; Elis, in the W.; and Arcadia, in the middle. (For further information with respect to its geography and history see the articles on GREECE and its divisions.)

Pe'lops, in Grecian mythology, the son of Tantalus and the father of Atreus and Thyestes; married Hippodamia, a daughter of King Œnomaus of Elis; became king after the death of his father-in-law; renewed the Olympian games, and gave his name to the southern division of Greece by sending a colony thither. Many and very different myths are connected with his name.

Pelouze' (THÉOPHILE JULES), b. at Valognes in the department of La Manche, France, Feb. 26, 1807; studied chemistry under Gay-Lussac; became professor at Lille in 1830, at the École Polytechnique in 1838, at the Collége de France from 1839 to 1851. D. June 1, 1867. Besides a number of minor essays, among which are very valuable ones on the manufacture of sugar, he wrote *Traité de Chimie* (7 vols., 1853–56) and *Abrégé de Chimie* (3 vols., 1858).

Pelu'sium, the Egyptian *Peromi*, the *Sin* of the Scriptures, the Greek name of an ancient town situated on the eastern branch of the Nile delta, and forming the key to Egypt from Asia. It is often mentioned in history, but never obtained any importance.

Pel'ville, post-v. of Hancock co., Ky. Pop. 84.

Pel'vis [Lat. *pelvis*, "a basin"], the name of the lowest of the three great divisions of the trunk, or, more properly, of the bony ring or framework which surrounds this cavity, connecting the column of the spine with the lower extremities, and transferring the weight of the former to the latter. It consists of four bones. The front and sides are formed by the two *ossa innominata*, large irregular bones which have received their name from their not resembling any other body in form; behind, the circle is completed by the *sacrum* and *coccyx*. The pelvis varies somewhat in the male and female skeleton, and also in the skeleton of the different races. (See OSTEOLOGY.)

Pem'berton, post-v. and tp. of Burlington co., N. J., on the N. branch of the Rancocus River, and at the junction of the Burlington County and New Jersey Southern R. R., contains a public library, waterworks, a large feed and flour mill, 3 churches, 1 newspaper, 2 hotels, and stores. Incorporated in 1826. Pop. of v. 797; of tp. 2743.
CHARLES J. PEARCE, ED. "COURIER."

Pemberton, post-v. and tp. of Shelby co., O., on the Indianapolis division of the Cleveland Columbus Cincinnati and Indianapolis R. R. Pop. 157.

Pemberton (JOHN C.), b. in Pennsylvania Aug., 1814; graduated at the U. S. Military Academy, and became second lieutenant of artillery July, 1837; served in Florida against the Seminoles; in the war with Mexico on the staff of Gen. Worth, gaining the brevets of captain and major for Monterey and Molino del Rey; on the northern frontier, etc. until Apr. 29, 1861, when he resigned, being at the time a captain of artillery. Joining the Southern cause, he was appointed a colonel of cavalry, and attached to the staff of Gen. Joseph Johnston; rose to the rank of lieutenant-general, and in 1863 commanded in Mississippi, where he was defeated, May 16, at Champion Hills and Big Black (May 17); falling back on Vicksburg, he defended that place against assault, but being besieged was compelled to surrender the city and garrison July 4, 1863. (See VICKSBURG, SIEGE OF.) He subsequently served as inspector of artillery; farmer in Virginia since the war.

Pem'bina, county of N. E. Dakota, bounded on the N. by Manitoba, and separated on the E. from Minnesota by the Red River of the North, which is navigable. The county contains much fertile soil, which is well adapted to wheat-culture. It is traversed by the Northern Pacific R. R. This county has long been inhabited by descendants of Lord Selkirk's colonists. (See MANITOBA.) Cap. Pembina. Pop. 1213.

Pembina, county of N. W. Minnesota. Area, 7000 square miles. It is bounded W. by Dakota (from which it is separated by the Red River of the North) and on the N. by Canada. A small detached portion lies N. W. of the Lake of the Woods. Pop. 64.

Pembina, post-v. and tp., cap of Pembina co., Dak., on the Red River of the North, 2 miles S. of the boundary of British America.

Pem'broke, town of England, in S. Wales, in the county of the same name, on an inlet of Milford Haven, has large ship-docks and other naval establishments. Pop. 13,741.

Pembroke, a thriving town, capital of Renfrew co., Ont., Canada, on Allumette Lake, a part of Ottawa River, 100 miles above Ottawa. It is a great centre of the lumber business. Water-power is furnished by the falls of Muskrat River. The county buildings are chaste structures built of sandstone. There is 1 weekly newspaper. Pop. 1508.

Pembroke, post-v. of Christian co., Ky., on the St. Louis and South-eastern R. R. Pop. 278.

Pembroke, post-v. and tp., Washington co., Me., on Lubeck Bay. Pop. 2551.

Pembroke, post-v. and tp., Plymouth co., Mass., 5 miles W. of Duxbury. Pop. 1447.

Pembroke, post-v. and tp., Merrimack co., N. H., on the Merrimack River, at the junction of the Concord and Suncook Valley R. Rs. Pop. 2518.

Pembroke, post-v. and tp., Genesee co., N. Y., on Tonawanda Creek, crossed by the New York Central and

the Erie R. Rs., has an academy and 5 churches. The N. part of the town is occupied by a part of the Tonawanda reservation of Seneca Indians, several hundred of whom reside here, having a church and schools. Pop. 2810.

Pembroke, post-v. and tp., Giles co., Va. Pop. 1327.

Pem'brokeshire, county of England, bounded N. and W. by the Irish Sea, and S. by the Bristol Channel, comprises an area of 627 square miles, with 96,278 inhabitants. It is mountainous throughout, and contains coal, slate, lead, and iron. In the southern part the soil is fertile, and barley, oats, and potatoes are raised, and cattle reared. Large quantities of butter and cheese are exported.

Peme, probably the same as *Pempte* (Πέμπτη), the modern *Bembe,* a town of Egypt, in the Heptanomis, 20 miles above Memphis, on the left bank of the Nile. Pliny mentions a place called Pemma, belonging to the nomads settled on the borders of Egypt and Æthiopia, but the text is uncertain.

Pem'iscot, county of S. E. Missouri, bounded E. by the Mississippi River, which separates it from Tennessee, and S. by Arkansas. Area, 470 square miles. It is low, level, and in great part covered by swamps, bayous, and sloughs. Its soil is fertile. Corn is the leading product. Cap. Gayoso. Pop. 2059.

Pemiscot, tp. of Pemiscot co., Mo. Pop. 226.

Pem'mican, a kind of concentrated food, originally made by the North American Indians by drying and powdering the lean meat of the buffalo or deer, mixing it with service-berries, stirring all into boiling fat, and making it into cakes. The name is also given to a very different form of meat-biscuit used by arctic voyagers. The word is Cree.

Pemphi'gus [Gr. πέμφιξ, πέμφιγος, a "breath," a "bubble"], or **Pom'pholyx** [Gr. πομφόλυξ, a "bubble"], a skin disease in which successive crops of watery blisters appear upon the patient, each blister followed by a scab and a dark scar, which lasts for some time. If the disease attacks children, as it commonly does, it may, and not improbably will, leave in a few weeks, but quinia, iron, and other tonics appear to hasten its cure. Some cases are of syphilitic origin, and require mercury, the iodides, etc. But a very large proportion of the chronic cases are of unknown origin, and cannot, so far as is now known, be cured. The itching is usually intense. In such case the treatment is palliative almost entirely, and the patient is finally exhausted by nervous irritation. Ammonia is reported by Bamberger to be present in an abnormally large amount in the fluids of patients suffering from the disease.

Pen [Lat. *penna,* "feather"], an implement for writing. The earliest pen was a sharp iron, steel, or bronze instrument, which cut out letters, characters, or hieroglyphics in the limestones, sandstones, or steatites of Oriental countries; the next was substantially the same implement, used in tracing characters on the plastic clays of Central Asia, which after receiving their inscriptions were dried in the sun or baked in the fire: such were the Assyrian tablets. Not long after in the far East, and perhaps also in Egypt, the use of the camel's-hair pencil was substituted for the steel bodkin, and the characters were painted on the bark of trees and the skins of animals, very much as the Chinese draw them on paper at the present day; in the West, in Persia, Greece, and Syria, wax and leaden tablets came into use, and a stylus of metal, bone, or ivory, with one end terminating in a point and the other flattened to erase what was incorrect, was the pen of the time. The use of parchment and the papyrus necessitated something more flexible, and reed pens took the place of the metallic or ivory stylus. These were of a peculiar species of reed, and underwent a process of preparation before being used. For writing on parchment it was finally discovered that quills made better pens than reeds; the quills of the swan, goose, and, for fine writing, of the crow, were those most used. A somewhat doubtful authority fixes their introduction at A. D. 553. When paper was introduced into Europe for writing some centuries later, the quill pen was still the favorite implement of the ready writer, and continued so down to our own time. Great improvement was made in the preparation of quills for use, and those from Russia and Holland, which had been dutched or clarified by plunging in heated sand, and subsequently dipped in boiling alum-water or diluted nitric acid, were most in demand, and if of large size brought a high price. Pen-making was an art to be acquired by instruction and practice, and every teacher and writer was expected to know how to make a good pen. In the early part of the present century the stationers began to sell in the cities boxes of ready-made pens, and not long afterward pen-nibs, which were fastened in a holder and used for writing. It is recorded that iron pens were used as early as 1685, but their use must have been limited and the pens themselves very poor. Early in the present century the demand for something more durable than quills for writing purposes led to a variety of experiments with horn, tortoise-shell, glass, and finally steel, silver, and gold. The glass pen was a stylus with grooves on all sides of its conical point to hold the ink; the tortoise-shell and horn soon softened under the action of the ink, and were but little better than quills, and even the "diamond" and "ruby" points fastened in them did not make them very effective substitutes for the gray goose-quill. Silver was tried with various degrees of alloy, and from its elasticity and ductility was thought to be a success, but from failure to temper it thoroughly, and its susceptibility to wear at the point, it was eventually abandoned. Steel was tried in Wise's barrel pens as early as 1803, but these were expensive, ill-constructed, and but little used. About 1820 the manufacture of steel pens in Birmingham began in good earnest. Four men whose names have become known in connection with this manufacture all over the world engaged in it nearly at the same time; they were Joseph Gillott, Josiah Mason (now Sir Josiah Mason), ——— Mitchell, and ——— Perry. Mr. Gillott had been a manufacturer of steel toys, and did not enter upon pen-making until 1822, but he introduced many improvements in his pens, and his competitors were not behind him in their zeal to perfect theirs. In 1820 the first gross of pens sold in Birmingham brought at wholesale $36. In 1830 the price was $2; in 1832, $1.50; in 1860, 12 cents, while an article as good as those sold in 1820 was sold for 4 cents a gross. Others followed in the business, but none reaped such colossal fortunes from it as these men. For many years the annual production of Birmingham has ranged from 8,000,000 to 15,000,000 gross of pens. Several efforts have been made in this country to compete with the Birmingham manufacturers. There were in 1870 three manufactories of steel pens in the U. S., one of which achieved a good reputation on the Washington Medallion pen, an excellent pen, modelled after one of Perry's; but the Birmingham pens were sold at such low prices that the business has proved unprofitable.

But if American skill and ingenuity failed to compete successfully with the English on steel pens, it has been quite otherwise in the production of gold pens. In this manufacture, which requires a much higher degree of tact and judgment, as well as mechanical skill, than the other, the American manufacturers have for some years been foremost, and their pens are now sold largely in England, France, and Germany. The first attempt at making gold pens was made in England not far from 1825. Gold, even when alloyed, being too soft to make a durable point, it was necessary to have the points of some harder metal. Bits of diamond or ruby were tried at first, but Mr. John Isaac Hawkins, an American gentleman residing in England, was led by an accident to use the native alloy of iridium and osmium, one of the hardest and most refractory of all metallic alloys. Mordan, the English pencil-maker, also attempted to make gold pens, but without success. Hawkins's rights were purchased by Rev. Mr. Cleveland, an American clergyman then in England, who in 1835 induced Mr. Levi Brown, a watchmaker in Detroit, to engage in the manufacture of gold pens. These were at first made by hand, and were very poor substitutes for the quill. In 1840, Mr. Brown removed to New York and enlarged his business. Among the men in his employ was Mr. John Rendell, whom, by common consent, the pen-manufacturers acknowledge to have done more for the advancement of this industry than any and all other men. He invented a number of machines for the different processes of making the pens and for tempering them, giving them the elasticity of the quill with the permanency of the metal; organized a complete division of labor among the workmen, giving to each one his peculiar branch of the manufacture; and in short revolutionized the entire business. His machines were purchased by other parties who were desirous of entering upon the business, and by their use the pens of Bagley, Barney, Hayden, and others attained a fair reputation. Mr. Rendell associated with himself first Mr. Spencer, and six years later Mr. Dixon, and the pens of Spencer & Rendell, and later Spencer, Rendell & Dixon, soon became known as the best in the market. Two other men, Alexander Morton and Leroy W. Fairchild—the latter at first employed by Mr. Rendell, and the former by Mr. Bagley—about 1850 or 1851 added two important particulars toward perfecting this interesting manufacture. Mr. Fairchild bedded the iridium points in the gold instead of soldering them, thereby avoiding the galvanic and corrosive action of the ink on the two metals, the solder and the gold, as well as giving the points a firmer hold on

the pen, and modified the form and roundness of the pen; and Mr. Morton, by a series of rolls and other processes, increased the elasticity and completely regulated the temper of the pen. Mr. Fairchild eventually became, and still is, the head of the successors to the house of Spencer, Rendell & Dixon, and Mr. Morton, after some years of successful enterprise, died, and left his high reputation to his successors. It is peculiarly true of this manufacture that the highest success can only be obtained by the careful inspection of each finished pen by some thoroughly competent person. Every pen of the first quality manufactured by these houses was thus tested by Mr. Fairchild and Mr. Morton in person, or by carefully-trained experts, before it was put up for sale, and long experience enabled them to detect the slightest defect in its action. The purchaser of a gross of steel pens can throw one or another aside if it displeases him, but the purchaser of a gold pen expects to use it for years, and desires one which will be at all times ready for service. Even with the utmost care in the manufacture not more than eight or nine out of every dozen pass this severe crucial test. The business of making gold pens has been greatly expanded of late years, and several houses export considerable quantities to Europe, but through the lack of skill and careful testing of their goods some of the manufacturers, even with the excellent machinery of Rendell and his associates, turn out very poor pens. In 1870 the census reported 21 manufactories of gold pens and pencils, employing 242 hands, using $268,250 of capital and $181,740 of raw material, paying $133,556 wages, and producing goods valued at $467,380. The number of manufactories is now more than 30; the number of employés more than 500; the amount of capital invested is not far from $1,200,000; the raw material used over $250,000; and the annual product not far from $2,000,000. Several of the gold pen-makers manufacture gold pencils and penholders also, and there are pencil-makers who do not make pens. Gold barrel pens are made to some extent, and there are two or three so-called fountain pens, which by one device or another retain ink enough to write a letter of ordinary length without dipping the pen a second time. In this connection we should notice also the ruling pen, used by the blank-book manufacturers, consisting of two concavo-convex pieces of steel, well pointed, with their points rounded and in apposition, the concave surfaces holding the ink. The pen in ruling is perpendicular to the paper. Of somewhat similar form and application is the pen of the calligraph, a machine invented by Charles Thurber, Esq., and intended for rapid writing, especially for those suffering from writer's cramp or paralysis, and those to whom an upright position at the desk is a necessity. The machine is perfect in its action, exceedingly ingenious, and deserves to be better known. L. P. Brockett.

Penæa'ceæ, a small natural order of monochlamydeous plants, found at the Cape of Good Hope. They are shrubs, have apetalous flowers, four-celled ovaries, and minute or rudimentary cotyledons. One species (*Penæa sarcocolla*) is said to produce the gum-resin called *sarcocol.*

Peñafiel', town of Spain, province of Valladolid, on the Duranton, near its influx into the Douro, has manufactures of worsted and leather. Pop. about 4000.

Pen'alty [Lat. *pœna*, "punishment"], law. In a broad and popular sense this term is often used to describe all punishment inflicted for the commission of crime; but as a word of strictly technical import in the criminal law a penalty denotes the sum of money the payment of which is required by a statute as a forfeiture from the person who violates its prohibitions or commands. While a fine is imposed by the court after conviction in a criminal prosecution, a penalty is sued for in a civil action and recovered by an ordinary judgment obtained therein. In whose name this action should be brought depends upon the requirements of the statute itself or of some general enactment regulating the matter; it may be prosecuted by the people or the state, or by certain designated officials, or sometimes even by a private citizen. Penalty is also a technical term in the law of contract, and signifies, when thus employed, a certain sum of money fixed upon by the parties in one portion of an agreement to be paid in case of a failure to perform the substantial stipulations contained in another part of the same instrument. Thus, in the common money-bond the obligor binds himself in absolute terms to pay to the obligee a certain sum, which is the penalty; but in a subsequent clause, called the condition, it is provided that if he shall pay another and smaller sum with interest at a specified time, the entire obligation shall be void. A penalty thus inserted in a contract is, however, a mere matter of form. Its legal effect was long ago established by equity, and this equitable doctrine has been fully accepted by courts of law. The party who fails to perform the agreement does not thereby forfeit the whole sum mentioned as the penalty, but is liable only for the amount of damages actually sustained by the other, and upon payment of such damages, or the principal and interest of the debt if the instrument is a penal bond, he is discharged from all other further obligation. Under certain circumstances, however, such a clause is not regarded as constituting a penalty, but is treated as a stipulation to pay a definite sum in the nature of liquidated or ascertained damages for a breach of the contract, and is binding according to its terms, so that the exact amount named in the instrument can be recovered from the debtor. John Norton Pomeroy.

Pen'alva, village of Spain, in the province of Huesca, near Fraga, on the Catalonian highway, has about 1000 inhabitants. Here was fought, on Aug. 15, 1780, a bloody battle between the army of Archduke Charles, consisting of Germans and Catalonians, and the army of Philip V., consisting of French troops and Castilians; the latter were defeated.

Pen'ance [from Lat. *pœnitentia*] is one of the seven sacraments of the Roman Catholic Church, and means a penalty imposed by the ecclesiastical authority, but voluntarily accepted by the sinner, by which atonement is made for sins actually committed and the divine punishment averted. The idea of justification in the eyes of God by doing penance was not foreign to the Jews and the pagans, and it showed itself very early in the Christian Church. With the Jews, sacrifices, fasts, rending of the clothes, strewing of ashes on the head, and other penalties were often imposed as means of justification, of averting the wrath of God; but at the same time it was strongly inculcated that the only sacrifice which pleased God perfectly was that of a repentant heart, and the only penance which satisfied him fully was that of the conversion of the sinful soul to obedience under his will. In the New Testament repentance and conversion are the only way to justification, and God's grace its only means; and the penance which very early came into common use in the Christian Church seems to have been simply a disciplinary measure. It was necessary for the Church, if it would not expose itself to fatal misconceptions, to excommunicate all such members as made scandal by signal and notorious crimes, by murder, adultery, idolatry, etc., and not allow them to return into the congregation until they gave public and unmistakable signs of repentance and conversion. But further, this penitential discipline seems not to have gone. In the fourth century its laws became very minutely fixed. The penitent had to go through four different stages: (1) that of the weepers (Gr. *prosklaiontes;* Lat. *flentes*), who were not allowed to enter the church during the time of public worship, but, standing outside, solicited the prayers of the faithful; (2) that of the hearers (Gr. *akroomenoi;* Lat. *audientes*), who were permitted to enter, but who remained among the catechumens, and, like them, left the church when the more solemn part of the service began; (3) that of the prostrators (Gr. *hypopiptontes;* Lat. *prosternentes*), who participated with the congregation in the general prayers, but only kneeling or prostrate; (4) that of the standers (Gr. *systantes;* Lat. *consistentes*), who were only excluded from participation in the sacraments. During the whole time of penance the penitent wore a peculiar dress, and was obliged to renounce all indulgences and luxuries, and practise many ascetic and austere exercises. His final admission into the congregation he received from the bishop who had excluded him, and who had the power of extending or shortening the time of penance. Up to the eighth century this public penance was in common use, but after that time it began to give way for the private penance, and in the eleventh and twelfth centuries it entirely disappeared. Hand in hand with its transition from public to private went its transformation from discipline to sacrament. At present it consists in the Roman Catholic Church of repentance, confession, satisfaction, and absolution. In Protestant churches penance was in use in the first period of Puritanism in Scotland; in Denmark between 1730 and 1746; in several districts of Germany, and also in some parts of Norway, but always as a disciplinary measure only. Clemens Petersen.

Penang', or **Pulo-Penang,** an island in the Strait of Malacca, belongs to the presidency of Bengal, British India, and comprises an area of 107 square miles, with 59,956 inhabitants. The ground is high and mountainous, but the soil is very fertile, and eminently well adapted to the cultivation of pepper, cloves, nutmegs, and other spices, which are annually exported to the value of $75,000. Sugar, coffee, indigo, and cotton are also raised, and tin is abundant; 1195 tons were exported in 1850. Capital, Georgetown, with a good harbor and considerable trade.

Pena'tes [Lat.], the household gods of the ancient Romans, including the private Lares, as well as Jupiter, Juno, Vesta, and other gods. Besides these there were reckoned public Penates, who protected the state and city. A perpetual fire burned upon the hearth to the Penates, and food and salt for them were served at every meal. Libations and prayers were daily offered to them. (See LARES.)

Pencader, hundred of New Castle co., Del., traversed by the Philadelphia Wilmington and Baltimore R. R., and by the Chesapeake and Delaware Canal. Pop. 2542.

Pen'cils [Lat. *penicillum*], instruments for painting, drawing, and writing. The oldest pictures were no doubt produced simply by lumps of colored earth or chalk cut in forms convenient for holding in the hand. But in the fourth century B. C. Greek artists began to use wet colors, which were laid on with fine hair brushes. For such brushes or pencils the hairs of camels, badgers, sables, minks, kolinskis, fitches, goats, and the bristles of hogs are used. They are tied up in bundles terminating in a perfectly smooth cone, well pointed, and either drawn through goose-quills or fastened in metallic holders provided with wooden handles. The manufacture of such a pencil, especially of the finest kinds used by artists, requires great skill and care. The lead pencil was at one time actually manufactured from lead, but subsequently graphite was used almost exclusively. The graphite from the Cumberland mines was especially celebrated, but afterwards large deposits of the finest kind of this mineral were discovered in Siberia and other places. The natural graphite, however, was never found so pure and uniform that a perfectly reliable pencil could be made from it. It was therefore subjected to an artificial process of purification. It was pulverized and all impurities were removed. The pulverized mass was then made solid once more by the aid of hydraulic pressure. At last this was sawed in thin plates, the plates cut in fine sticks, and these encased in wood to protect them from breaking and from soiling the hands.

Pen'cis, tp. of Dallas co., Ala. Pop. 942.

Pen'der (WILLIAM D.), b. in North Carolina in 1834; graduated at the U. S. Military Academy July, 1854, when he was appointed second lieutenant of artillery; transferred to the dragoons in 1855, he was almost constantly engaged in active service on our frontier until Mar., 1861, when he resigned to enter the Confederate service. At once appointed colonel, he was soon raised to brigadier and major-general, and served under A. P. Hill. At Gettysburg, in command of a division, he was killed on the last day of the fight, July 3, 1863.

Pen'dleton, town of England, in Lancashire, 2½ miles N. W. from Manchester, is the seat of a very extensive and steadily increasing manufacturing business, especially in linen and cotton goods. Rich collieries are worked in the vicinity. Pop. 20,900.

Pendleton, county of N. Kentucky, extending on the N. E. to the Ohio River. Area, 300 square miles. It is uneven, well wooded, and has a fertile limestone soil. It is traversed by the Licking River and the Kentucky Central R. R. Live-stock, wool, grain, and tobacco are leading products. Cap. Falmouth. Pop. 14,030.

Pendleton, county of West Virginia, bounded E. and S. W. by Virginia. Area, 500 square miles. It lies E. of the main Alleghany and W. of the Shenandoah range, and is traversed by parallel ridges, with wide, fertile, and well-cultivated valleys, which are watered by the forks of the S. branch of the river Potomac. Live-stock, wool, and grain are leading products. Cap. Franklin. Pop. 6455.

Pendleton, post-v. of Fall Creek tp., Madison co., Ind., on Indiana division of Cleveland Columbus Cincinnati and Indianapolis R. R., has 1 newspaper. Pop. 675.

Pendleton, tp. of St. François co., Mo. Pop. 851.

Pendleton, post-v. of Warren co., Mo., on the St. Louis Kansas City and Northern R. R.

Pendleton, post-v. and tp., Niagara co., N. Y., on Tonawanda Creek and the New York Central R. R. Pop. of v. 214; of tp. 1772.

Pendleton, post-v. of Reilly tp., Putnam co., O. P. 145.

Pendleton, post-v. and tp., cap. of Umatilla co., Or., on the Umatilla River.

Pendleton, post-v. and tp., Anderson co., S. C., on the Blue Ridge R. R. Pop. of v. 985; of tp. 2115.

Pendleton (EDMUND), b. in Caroline co., Va., Sept. 9, 1721; became a lawyer when twenty-one years old; was one of the leaders of the Virginia legislature, and often its Speaker; as a conservative he was the political antagonist of Patrick Henry; was in the first Continental Congress, 1774–75; drew up the resolutions by which Virginia instructed her delegates to propose the Declaration of Independence; though maimed for life by an accident in 1777, he continued to take an important part in public affairs, and afterwards presided over the courts of chancery and of appeals, and over the convention of 1788 by which Virginia endorsed the U. S. Constitution. He was distinguished as a debater. D. Richmond, Va., Oct. 23, 1803.

Pendleton (EDMUND MONROE), M. D., b. at Eatonton, Ga.; graduated in the Medical College of South Carolina 1838; practised medicine in Warrenton and Sparta, Ga., thirty-five years; several of his contributions to science have been copied into the British medical journals. At the organization of the Oglethorpe Medical College in Savannah he was elected professor of surgery, which, however, he declined because of feeble health, as also the chair of chemistry in another institution. He afterward turned his attention to agriculture, and became active in giving an impetus to fertilizers, first developing the fact that phosphoric acid and nitrogen are the two plant-constituents first exhausted from soils by cereals and cotton-culture. In 1872, Dr. Pendleton was called to the chair of scientific agriculture in the University of Georgia at Athens. His textbook on this subject has been adopted by the Agricultural College of Amherst, Mass., and other similar institutions. PAUL F. EVE.

Pendleton (GEORGE H.), b. at Cincinnati, O., July 25, 1825, a son of N. G. Pendleton, an able lawyer, and a grandson of Judge Nathaniel Pendleton of New York; became a lawyer; was in Congress 1857–65; was in 1864 Democratic candidate for Vice-President of the U. S.

Pends d'Oreilles. See KALISPELS.

Pend'ulum [Lat. *pendulus*, "hanging"]. A suspended body oscillating under the action of gravity is called a pendulum. In order to investigate the laws of its motions we abstract from its material qualities, and consider a heavy point suspended by a right line without weight from a fixed point, about which it is free to move. This is called a *simple pendulum*; by an *oscillation* is meant its motion from one extreme of the arc to the other extreme on the opposite side of the vertical. When the arc of vibration is small, the following relation is found to obtain between the length l of the pendulum and the time t of one vibration—viz. $t^2 = \frac{\pi^2}{g} l$, g denoting the force of gravity, or *the squares of the times are proportional to the lengths.* Hence, a pendulum making one oscillation in two seconds must have four times the length of one that oscillates once in one second of time. By g is meant the velocity acquired in one second by a heavy particle falling from rest by the action of the earth's gravity, the space fallen through being $= \frac{1}{2} g$. Hence, we see also, by putting $t = 1$ in the above equation, that $g = \pi^2 l$, or that the velocity acquired in one second is $\pi^2 \times$ the length of a simple seconds pendulum. That length having been found to be, at New York, 39.10 inches, it follows that $g = 32.16$ feet at that place.

It further appears that the time of vibration is independent of the length of the arc, so long as the arc is very small—an important property in the application of the pendulum to the regulation of timekeepers which was first made use of for that purpose by Huyghens. (See CLOCKS.) When a simple pendulum, being at the extremity of its arc of vibration, receives an impulse at right angles to the plane of its vibration, the heavy point will describe a curved path about the vertical, and it is then called a *conical pendulum*. Its path will be circular, with a certain impulse; a greater or less impulse will cause it to describe elliptic arcs. This property is made use of in regulators for steam-engines and other machinery.

When instead of a simple pendulum we have a material or *compound pendulum*—consisting, for instance, of a rod with a disk or ball attached to its lower extremity—the same laws can be applied by conceiving the whole mass of the pendulum united in one point, called the *centre of oscillation*, whose distance from the line of suspension is equal to the length of a simple pendulum vibrating in the same time as the given compound pendulum. That distance is found by dividing the sum of the *moments* of *inertia* of all material particles of the pendulum by the sum of their *statical moments*. When the line of suspension has a considerable length, and bears a very small proportion to the suspended mass, the centre of oscillation is very near the centre of gravity of the latter. Thus, when a disk of several pounds weight is suspended by means of a slender steel rod, the distance from the line of suspension to the centre of the disk will differ but little from 39.1 inches for a seconds pendulum.

For accurate experimental purposes it is necessary to take into account circumstances that modify in some degree the simple relation between the length and time of oscillation above stated. First, when the arc a employed

is not very small, and it becomes necessary to make a proper allowance for it, in order to reduce the time to what it would have been for infinitesimal vibrations. Secondly, in consequence of changes in temperature the length of the pendulum will not remain invariable, and the observed number of vibrations must be reduced to some standard temperature. Thirdly, if the vibrations are made in air, as is usually the case, it becomes desirable to calculate the number which would have been made in vacuum, all other circumstances being the same. The effect of the air, like that of any other fluid upon a body immersed in it, is to diminish the weight of the pendulum by a quantity equal to the weight of the air displaced, or to diminish the apparent force of gravity. Since the density of the air is variable, it becomes necessary to observe the barometer. J. E. HILGARD.

Pendulum Observations. By this term are designated observations to determine the force of gravity at various points on the earth's surface by means of a pendulum. Since the squares of the times of vibration of a pendulum of constant length are inversely proportional to the accelerating force, it is only necessary to ascertain by observation the time of one small vibration of the same pendulum, corrected for the temperature and density of the medium in which it oscillates, in order to obtain the relative values of the force of gravity at the several places of observation. Between that force and the figure of the earth there exists the following relation, known as *Clairaut's theorem*—namely, that $\frac{g}{G} = 1 + (\frac{5}{2}m - e)\sin^2 L$, when G is the force of gravity at the equator, g that at any latitude L, m the ratio of centrifugal force at the equator to gravity, and e the ellipticity, on the supposition that the earth is a spheroid of equilibrium. It is readily seen, then, that if observations be made at places in widely different latitudes, the earth's eccentricity may be deduced from the same. The following table gives an extract of experiments made by Sabine at various places; the column headed "computed oscillations" showing what should have been the number if the law derived from the aggregate of all the observations were strictly fulfilled at each station:

Pendulum Observations.

Stations.	Latitude.	Oscillations. Computed.	Oscillations. Observed.	Differences.
	° ′ ″	s.	s.	s.
Equator	0 0 00	86263.60		
St. Thomas	0 24 41 N.	86263.60	86269.32	+5.72
Maranham	2 31 34 S.	86264.30	86259.77	−4.53
Ascension	7 55 30 S.	86267.86	86273.04	+5.18
Sierra Leone	8 29 28 N.	86268.48	86268.33	−0.15
Trinidad	10 38 55 N.	86271.24	86267.27	−3.97
Bahia	12 59 21 S.	86274.90	86273.16	−1.74
Jamaica	17 56 07 N.	86284.80	86285.12	+0.32
New York	40 42 43 N.	86358.66	86357.73	−0.93
Paris	48 50 14 N.	86390.20	86388.48	−1.72
Shanklin	50 37 24 N.	86397.06	86396.54	−0.52
Greenwich	51 28 40 N.	86400.34	86400.59	+0.25
London	51 31 08 N.	86400.48	86400.00	−0.48
Arbury	52 12 55 N.	86403.12	86403.31	+0.19
Clifton	53 27 43 N.	86407.80	86407.23	−0.57
Altona	53 32 45 N.	86408.10	86408.94	+0.84
Leith	55 58 41 N.	86417.02	86417.89	+0.87
Portsoy	57 40 59 N.	86423.10	86424.60	+1.50
Unst	60 45 28 N.	86433.64	86435.56	+1.92
Drontheim	63 25 54 N.	86442.24	86438.77	−3.47
Hammerfest	70 40 05 N.	86462.42	86461.05	−1.37
Greenland	74 32 19 N.	86471.00	86470.50	−0.50
Spitzbergen	79 49 54 N.	86479.90	86483.01	+3.11

The ellipticity of the earth derived from these and many other experiments of a similar kind is $\frac{1}{289}$, while that derived from geodetic measurements is $\frac{1}{295}$. (See GEODESY.)

A correction for reducing the observation to the level of the sea has been applied in every instance, but from the difficulty of ascertaining the density of the intervening strata such correction cannot be very exact.

The differences in the table indicate very sensible irregularities in the observed times, which doubtless result mainly from the different densities of the matter in the proximate vicinity of the several places of observation. They correspond to similar differences found in the observed amplitudes of measured arcs of the meridian.

This subject has of late received much attention. A marked deflection of the plumb-line having been observed in the vicinity of Moscow, pendulum experiments disclosed a corresponding deficiency of attraction over a well-defined area. Experiments made by Airy in the Harton mine, Durham, England, have shown a diminution of the force of gravity by its $\frac{1}{19200}$th part at the bottom of a shaft 1256 feet in depth. A comparison of the force of gravity between Geneva and Righi-Kulm, by Plantamour has shown that the attraction of the mountain is $\frac{1}{12300}$th part of that of the whole earth, the station on the mountain being 4526 feet higher than that on the lake.

When we desire to ascertain the absolute length of a seconds pendulum, it becomes necessary to measure the distance between its point of suspension and its centre of oscillation. Accurate experiments to this end were first made in 1790 at Paris by Borda, who employed a spherical platinum ball suspended by fine wire 12 feet in length, and found, after applying all due corrections, 3 feet 8.5593 lines (old French measure). The method devised by Huyghens and first employed by Kater is, however, that which affords the simplest means of ascertaining the length of an equivalent simple pendulum. It consists in using a *reversible* pendulum; that is, a rod with opposite knife-edges near either end, and so weighted with two *unequal* weights that the time of vibration is the same whichever of the two knife-edges the pendulum is suspended from. In such case each knife-edge is in the centre of oscillation of the other, and the time of vibration is therefore the same as that of a simple pendulum whose length is equal to the distance between the two. When the times of vibration are not exactly, but very nearly, equal, the requisite reduction can be deduced from the relative distances of the two knife-edges from the centre of gravity. By having the two weights of equal size, one of them being hollow, and placed at equal distances from the nearest knife-edge, the resistances and other variable circumstances affect the vibrations alike in both positions of the pendulum. Such is the form of the reversible pendulum used by Plantamour in Switzerland, which has also been adopted by the European Geodesic Association. The times of oscillation are observed by means of a telescope, and are compared by the electro-chronographic method with a standard clock regulated by astronomical observations. The knife-edges rest on agate planes supported by a firm frame, and about 3000 consecutive oscillations are observed in each of the four positions in which the pendulum can be suspended. The length of a seconds pendulum at Geneva is found to be 0.993333 of a mètre.

The length of a simple pendulum making *in vacuo* one oscillation in one second of mean solar time, at a fixed place, has frequently been proposed as a permanent unit of reference for standards of length, from which they might be reproduced in case of loss, but the wide distribution of a large number of accurate standards renders it unlikely that it will ever be necessary to have recourse to such means. J. E. HILGARD.

Pene'do, town of Brazil, province of Alagoas, on the San Francisco, near its mouth, is well built, and carries on a considerable trade in cotton, coffee, and hides. P. 9000.

Penelope, a gallinaceous bird. See PENELOPIDÆ.

Penel'ope [Gr. Πηνελόπη], in the Greek legend, was the daughter of Icarius, the wife of Odysseus (Ulysses), and the mother of Telemachus. While her husband was absent at Troy she was beset by numerous and eager suitors, whom she put off by declaring that she must first finish weaving the shroud of Laërtes. Accordingly, she wove by day and unwove by night, and thus prolonged the work. Detected in her noble deceit, she was hard pressed by the villains, but was relieved by her husband's timely return.

Penelop'idæ [*Penelope* or *Crassidæ*], a family of gallinaceous birds, including the curassows and guans of South America. The bill is moderate, varying in form according to the genus, with the culmen more or less arched towards the tip; nostrils varying in position according to the subfamily; the wings moderate and round; tail elongated and broad; tarsi robust, with the toes three before, connected together by a basal web, and a long hinder one on the same plane as the front ones. The sternum has its lateral elements (*Metostea*) united by a broad margin with the central part (*Lophosteon*), the single notch being half as long as the sternum itself. The family, by the most recent systematic authors (Sclater and Salvin), has been divided into three sub-families—(1) Cracinæ, with four genera; (2) Penelopinæ, with seven genera; and (3) Oreophasianæ, with one genus. The species are "strictly confined to the forests of the New World, and extend from the Rio Grande of Texas on the N. to the wooded region of Paraguay on the S. They do not occur in the Antilles, with the exception of Trinidad and Tobago, and on the western side of the Andes do not pass southward of the Gulf of Guayaquil." The species found within the limits of the U. S. is *Ortalida vetula*. The *Oreophasis Derbianus* is said to be absolutely restricted to the forests surrounding a single volcano in Guatemala (Volcan de Fuego), at the height of 10,000 feet above the level of the sea. (See also CURASSOW and GUAN.) THEODORE GILL.

Penetan'guishene, a port of entry of Simcoe co., Ont., Canada, on a bay of Lake Huron, 34 miles N. of Barrie. It has a trade in fur, fish, cattle, and produce, and is the seat of the Ontario reformatory prison. It was once a military and naval station. Pop. about 1000.

Pen'field, post-v. of Greene co., Ga. Pop. 447.

Penfield, post-v. and tp., Monroe co., N. Y. P. 2928.

Penfield, post-v. and tp., Lorain co., O. Pop. 749.

Pen'guin, the name of a bird with imperfect wings, derived from "pengwin," a corruption of "penwing" or "pinwing," "meaning a bird that had apparently undergone the operation of pinioning or 'pinwinging,' as it is in at least one part of England still commonly called." The formal name, "pen-wing," it is said, still survives as a reminiscence, in the island of Newfoundland, of the auk or *Alca impennis*, not long ago inhabiting its rocks. The etymologies given by many authors from the Latin *pinguedo* ("fatness") or the Welsh *pengwyn* ("white head") are undoubtedly erroneous. (See A. Newton in *Ann. and Mag. Nat. Hist.* (4), iv. 133, 1869.) In recent times the name has been transferred almost entirely to birds representing a peculiar family (Sphenisciдæ), exclusively inhabiting the ocean and coasts of the southern hemisphere. (See SPHENISCIDÆ.) THEODORE GILL.

Penhallow (SAMUEL), b. in Cornwall, England, July 2, 1665, was a pupil of Charles Morton at Newington Green Academy; accompanied his teacher to Massachusetts 1686; settled at Portsmouth, N. H., where he became treasurer of the province, judge of the superior court, and was chief-justice from 1717 to his death, Dec. 2, 1726. Author of a *History of the Indian Wars of New England from 1703 to 1726*, published 1726, included in the *N. H. Hist. Colls.*, and recently reprinted at Boston.

Penikese Island. See ELIZABETH ISLANDS.

Penin'sula, tp. of Grand Traverse co., Mich. P. 667.

Pen'iston (ANTHONY A.), M. D., b. at Baton Rouge, La., May 24, 1824; graduated at Harvard University in both the literary and law departments, and in the medical department of the University of Louisiana 1853; resided in Paris 1853–55; on his return became one of the founders of a new school of medicine in New Orleans, La., 1856. D. Apr. 2, 1863. PAUL F. EVE.

Peniten'tiaries [Lat. *pœnitens*, "repenting"] were first instituted by the Friends of Pennsylvania in 1786, and are now established on a double plan, that of Pennsylvania and that of New York. According to the first system, the prisoners are kept in separate cells, where they work during stated hours, receive visits from their moral instructors, but are absolutely excluded from any communication with their fellow-prisoners. According to the second system, the prisoners work and eat together, but sleep in separate cells, and are absolutely forbidden to speak to each other. Under the first system punishment is administered by deprivation of food, light, and work for a certain time; under the second, by whipping.

Penn, tp. of Shelby co., Ill. Pop. 428.

Penn, tp. of Stark co., Ill. Pop. 1121.

Penn, tp. of Jay co., Ind. Pop. 1441.

Penn, tp. of Parke co., Ind. Pop. 1335.

Penn, tp. of St. Joseph co., Ind. Pop. 4982.

Penn, tp. of Guthrie co., Ia. Pop. 676.

Penn, tp. of Jefferson co., Ia. Pop. 1616.

Penn, tp. of Johnson co., Ia. Pop. 676.

Penn, tp. of Madison co., Ia. Pop. 651.

Penn, post-v. and tp., Cass co., Mich., on the Michigan Central and Chicago and Lake Huron R. Rs. Pop. 1421.

Penn, tp. of McLeod co., Minn. Pop. 420.

Penn, tp. of Sullivan co., Mo. Pop. 1744.

Penn, tp. of Highland co., O. Pop. 1471.

Penn, tp. of Morgan co., O. Pop. 1242.

Penn, tp. of Allegheny co., Pa. Pop. 2685.

Penn, tp. of Berks co., Pa. Pop. 1515.

Penn, tp. of Butler co., Pa. Pop. 837.

Penn, tp. of Centre co., Pa. Pop. 1158.

Penn, tp. of Chester co., Pa. Pop. 692.

Penn, tp. of Clearfield co., Pa. Pop. 639.

Penn, tp. of Cumberland co., Pa. Pop. 1888.

Penn, tp. of Huntingdon co., Pa. Pop. 1143.

Penn, post-v. and tp., Lancaster co., Pa., on the Reading and Columbia R. R. Pop. 1972.

Penn, tp. of Lycoming co., Pa. Pop. 701.

Penn, tp. of Perry co., Pa. Pop. 1529.

Penn, tp. of Snyder co., Pa. Pop. 1415.

Penn, post-v. and tp., Westmoreland co., Pa., on Pittsburg division of Pennsylvania R. R., includes the scene of Boquette's battle with the French and Indians. P. 820; of tp. 2423.

Penn, tp. of Williamsburg co., S. C. Pop. 676.

Penn (GRANVILLE), son of Thomas and grandson of William Penn, b. at Philadelphia, Pa., Dec. 9, 1761; was for many years assistant chief clerk of the British war-office, and succeeded to the family estates on the death of his brother, John Penn, in 1834. D. at Stoke Park, Buckinghamshire, Sept. 28, 1844. Author of numerous works, chiefly archæological or theological, among which the most important were *Memorials of Sir William Penn* (1833, 2 vols.) and a translation of the New Testament under the title *The Book of the New Covenant* (1836–38), which displayed considerable learning.

Penn (JOHN), a grandson of William Penn, b. in England 1728; proprietary governor of Pennsylvania 1763–71, and again 1773–75; a man of austere and ungenial disposition; neutral during the Revolution, although leaning towards royalism. D. in Bucks co., Va., Feb., 1795.

Penn (JOHN), b. in Caroline co., Va., May 17, 1741; read law with his relative, Edmund Pendleton; became an eloquent and successful barrister; removed in 1774 to Greenville co., N. C.; was in Congress 1775–76, 1778–80; signed the Declaration of Independence; served with ability in various important public positions. D. Sept., 1788.

Penn (JOHN), LL.D., brother of Granville and grandson of William Penn, b. in England in 1759; educated at Clare Hall, Cambridge, and succeeded his father, Thomas Penn, as hereditary governor of Pennsylvania 1775. D. in 1834. Author of several poetical, dramatic, and critical productions, which, however, never attained popularity.

Penn (RICHARD), brother of Gov. John Penn, was b. in England in 1734; was proprietary governor of Pennsylvania 1771–73; was liberal, scholarly, and highly popular; carried in 1775 a petition from Congress to the king, and it is said that he entered the House of Commons; when examined by the House of Lords regarding the colonies, his liberal views drew forth a strong rebuke from the ministry. D. in England May 27, 1811.

Penn (THOMAS), son of William, b. in England Mar. 8, 1702; resided many years in Pennsylvania; returned to England 1741; became proprietor and governor of Pennsylvania on the death of his brother John, 1746; was the principal founder of Pennsylvania College, and a liberal benefactor of many public institutions at Philadelphia. D. in London, Eng., Mar. 21, 1775.

Penn (WILLIAM), a celebrated member of the Society of Friends and the founder and first legislator of the State of Pennsylvania, was b. at London Oct. 14, 1644. He was a son of Admiral Sir W. Penn, and received a very careful education. He studied at Christ Church, Oxford, but having met here with Thomas Loe, he was converted to Quakerism, and shortly after expelled from the university. The father sent him on travels in Holland and France, and on his return in 1666 he was set to manage the estates of the family in the county of Cork, Ireland. He fulfilled this task with great success, but in Cork he met for the second time with Thomas Loe. He was imprisoned for attending a Quaker meting, and although he was very soon liberated he had to leave Ireland. On his return to London he began to preach and work in different ways for the society to which he belonged, and after the publication of *The Sandy Foundation Shaken* (in 1668) he was thrown into the Tower. Here he wrote *No Cross, no Crown*, and *Innocency with her Open Face*, but by the interference of the duke of York he soon obtained his freedom again. The good relations between father and son were several times disturbed on account of the religious views of the latter, but after every rupture a reconcilement soon followed; and when the old admiral died (in 1670) he left his estates and all his property to his son. Penn continued, however, to preach and work for what he considered to be the highest truth, and in 1671 he was once more thrown into prison. As he would not take an oath at his trial, he was sent to Newgate for six months, and while here he wrote the celebrated defence for toleration, *The Great Cause of Liberty of Conscience*. Having been liberated, he made a tour to Holland and Germany, and on his return in 1672 he married Gulielma Maria Springett. From his father he had inherited a claim on the government for £16,000. In settlement of this claim the government granted him large territories in North America, the present State of Pennsylvania, with right to found a colony or society with such laws and institutions as expressed his views and principles. In 1682 he went over to America. A great number of settlers, not only Quakers, but members of all denominations, Englishmen, Swedes, and Germans, gathered together; a charter of liberties was issued, and a democratic government instituted; the city of Philadelphia was planned, and the colony soon came into a most flourishing condition. Towards the close of the reign of Charles II., Penn returned to England, in-

tent on bettering the social position of the Quakers in that country, in which plan he also partly succeeded. During the reign of James II. his connection with the court became very intimate—so much so that he was suspected of being implicated in certain disgraceful measures of the king. After the overthrow of James he was twice accused of entertaining treasonous communications with the exiled king, and an order of council (Mar. 14, 1692) deprived him of his title to the Pennsylvania government. After a most searching trial he was fully acquitted in 1693, and another order of council restored his title to him in 1694. After the death in 1693 of his first wife, he married (in 1695) Hannah Callowhill, and went in 1699, for the second time, to America, where he stayed till 1701. His return to England was chiefly caused by the deranged state of his affairs there. The mismanagement and villainy of his agent had brought him to the verge of bankruptcy. He was even thrown into the Fleet for some time in 1708. These vexations affected his health; in 1712 he was struck by apoplexy, and although he recovered, his mental faculties were greatly impaired after that time. D. July 30, 1718, at Ruscombe in Berkshire. His contemporaries, even such as were not his friends, testify to the correctness and justice of his character, and recent attempts at reviving old suspicions have been successfully refuted. C. Petersen.

Pennacooks. See Massachusetts Indians.

Pen'nant (Thomas), LL.D., b. at Downing, Flintshire, England, June 14, 1726; educated at Queen's and Oriel colleges, Oxford; devoted himself to zoology and archæology, and produced a large number of folio and quarto volumes containing his travels in various parts of the British Islands, which possess few graces of style and little scientific accuracy, but have preserved from oblivion some valuable facts. D. at Downing Dec. 16, 1798. Among the more important of his works are *British Zoology* (4 vols., 1761–77), *History of Quadrupeds* (2 vols., 1771), *Three Tours in Scotland* (3 vols., 1771–76), *Arctic Zoology* (3 vols., 1784–87), *Antiquarian and Historical Account of London* (1790), and his amusing autobiography, entitled *The Literary Life of the Late Thomas Pennant, Esq., written by himself*, published during his lifetime in 1793.

Penne, town of Italy, province of Teramo, in the Abruzzi. It is situated on two hills below which flow the torrents Tavo and Sino from Monte Corno. Penne is of very ancient origin, and the medicinal springs for which it is now well known are praised by Vitruvius. Pop. in 1874, 9848.

Penn'field, tp. of Calhoun co., Mich. Pop. 1132.

Penn Forest, tp. of Carbon co., Pa. Pop. 504.

Penn Haven, post-v. of Lausanne tp., Pa., on the Lehigh River.

Pen'nington, tp. of Bradley co., Ark. Pop. 1806.

Pennington, post-v. of Hopewell tp., Mercer co., N. J. Pop. 1200.

Pennington, tp. of Trinity co., Tex. Pop. 193.

Pennington (William), son of Gov. W. S. Pennington, was b. at Newark, N. J., May 4, 1796; graduated at Princeton 1813; was clerk of his father's district court 1815–26; became chancellor of New Jersey; governor 1837–43; declined the governorship of Minnesota Territory and other Federal offices; was a member of Congress 1859–61, and was chosen Speaker of the House after a long contest. D. at Newark, N. J., Feb. 16, 1862.

Pennington (William S.), b. in 1757; was major of the 2d New Jersey artillery in the Revolutionary army; became a lawyer in 1802; associate justice of the State supreme court in 1804; was for a time chancellor of the State; governor 1813–15; U. S. district judge 1815–26. D. at Newark, N. J., Sept. 17, 1826. Author of a volume of law-reports 1825.

Penningtonville, post-v. of Sadsbury tp., Chester co., Pa.

Penns'bury, tp. of Chester co., Pa. Pop. 767.

Penn's Grove, post-v. of Upper Penn's Neck tp., Salem co., N. J., on Delaware River, about 12 miles N. of Salem.

Penn's Station, post-v. of Westmoreland co., Pa.

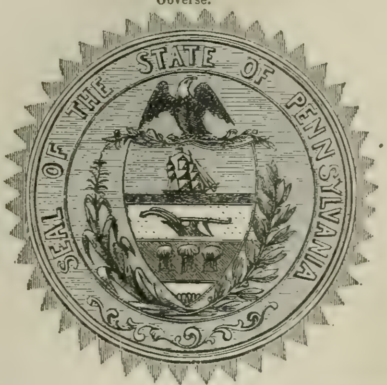
Penns'ville, tp. of Morgan co., O. Pop. 189.

Pennsylva'nia, one of the Middle States of the Atlantic slope, and one of the original thirteen of the first Confederacy, lying between the parallels of 39° 43′ and 42° 15′ N. lat. (the parallel of 42° being its northern limit to the western boundary of New York, where it takes in a small tract of the Lake Erie coast), and between the meridians of 74° 43′ 36″ and 80° 31′ 36″ W. lon. from Greenwich. It is bounded on the N. by Lake Erie and the State of New York, on the E. by Chautauqua co., N. Y., and by Delaware River, which separates it from Delaware co., N. Y., and from the State of New Jersey; on the S. by Delaware, Maryland, and West Virginia; on the W. by West Virginia, Ohio, and Lake Erie. Its greatest length from E. to W. is 302.34 miles, and its greatest breadth from N. to S. 175.6 miles. Its mean length is 280.39 miles; its mean breadth, 158.05 miles. Its area, including the water-surface of the portions of Lake Erie and Delaware Bay which pertain to it, is 46,000 sq. m.; its land-area is 45,086 sq. m., or 28,808,443 acres.

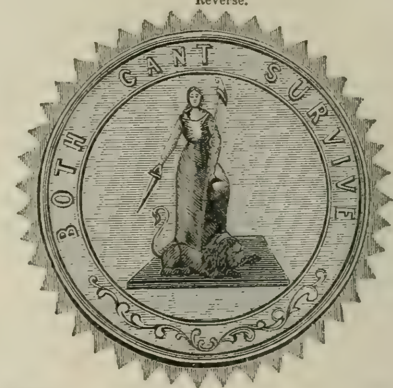
Face of the Country, Mountains, Rivers, Lakes, etc.—The surface of Pennsylvania is greatly diversified, but falls naturally into three divisions of unequal size—viz. (1) The S. E. section or district extending from Delaware River to the Blue or Kittatinny Mountains; near the river a narrow plain of level land, not over 75 or 100 feet above the sea, but a few miles inland a rolling or undulating tract with gently-rounded hills, for the most part with broad and beautiful valleys and ridges of hills of no great elevation, that portion of what is known as the Great Valley of the eastern chain of the Appalachian system being here (in Cumberland Valley) without a barrier toward the sea. There are occasionally here as in New Jersey, in this continuation of the red sandstone, isolated elevations of trap-rock, such as the Haycock in Berks co. and the Round Top in York. This region, while containing much mineral wealth, is admirably adapted for the growth of cereals. (2) The mountain-district adjoining this, which crosses the State in a belt varying in width from 75 to 160 miles, and trending from N. E. to S. W. All the mountain-chains which go to make up the Appalachian system are here in their full breadth, though not attaining a great altitude. The greater part of these chains do not rise above 2000 feet, though some of the summits of the Alleghanies proper attain a height of 2500 feet, and one or two of them nearly 3000. The mountains of the Appalachian system in the State, aside from their general division into two great ranges, the Blue or Kittatinny and the Alleghany range, are subdivided into a host of minor chains, ridges, or isolated mountains, and intersected by numerous valleys, often of considerable length, and broad and fertile, occasionally canoe-shaped, and of wonderful beauty, and sometimes narrow and deep, with the frowning and precipitous eastern face of the Alleghany range overhanging them. The most noted of these local mountain ranges and spurs are Sharp and Broad Mountain, enclosing the Pottsville and Mine Hill basin of the anthracite region; the Lime Mountain and Mahanoy and Little mountains, enclosing the Shamokin and Mahanoy basin; the Beaver Meadow Mountain basin, which extends to Bucks Mountain on the N., and has numerous short spurs or ranges intersecting it; and the chains which surround the exquisitely beautiful Wyoming Valley — Wyoming and Moosic mountains on the S. E. and Knob Mountain, Shawney Range, Capon's Range, and Lackawanna Range on the N. W. These mountain-groups, basins, and valleys all lie E. of the Susquehanna Valley proper, and the E. branch of the Susquehanna traverses nearly the whole length of Wyoming Valley. Between the Wyoming mountains and the Kittatinnies extends the "Poco" or "Pocono Wilderness"—a wild and desolate region, occupying a considerable portion of Pike and Monroe cos., and including swampy thickets of laurel and other shrubs, the lair of the panther, bear, and other wild animals, known to sportsmen as "The Shades of Death"—and extensive plateaus of beech-woods about 2000 feet above the sea. W. of the Susquehanna Valley are the Blue Mountains proper, then the Tuscarora mountains, the Shade and Black Log mountains, Sideling Hill Mountain, Broad Top, Jack's Mountain, Stone Mountain, and the Seven Mountains, Tussey's Mountain, and the isolated summits of Huntingdon, Warrior's Ridge, and Terrace Mountain. Some of the valleys, particularly Stone Valley, Juniata Valley, Great Aughwich Valley (a continuation of the preceding), and Kishacoquillas Valley, present landscapes of rare and extraordinary beauty; between Tussey's Mountain and the precipitous eastern front of the Alleghany range proper, are Bald Eagle Ridge and the magnificent Bald Eagle Valley, which opens at its lower portion into Bedford Valley on the E. For a part of the distance (110 miles) Nittany Valley runs parallel with it on the eastern side. The Bald Eagle Valley is 160 miles in length, but for a part of its length it is narrow. (3) The western table-land, which occupies about one-half the area of the State, is a broad rolling plateau, with occasional ranges of hills, but sloping northward and westward toward New York, Lake Erie, and Ohio River. It extends from the summits of the Alleghanies westward to the N. W. and W. boundaries of the State. The N. W. portion has several isolated summits, such as Meboopany Mountain, Towanda Mountain, Blossburg Mountain, and Crooked Creek Mountain. It is the

region of pine and hemlock lands, and furnishes vast amounts of lumber to Eastern markets. The S. W. part is intersected by Negro Mountain, Chestnut Ridge, and Laurel Ridge. Ligonier Valley, lying between the last two ridges and intersected at one point by Youghiogheny River, which forces its way through both ranges, has some admirable landscapes. *Rivers.*—Regarded simply with reference to the drainage of the State, there are six distinct water-basins, which, with their tributaries, drain the entire State—viz. the Delaware and its affluents, which drain about $\frac{1}{7}$th of the State; the Susquehanna and its tributaries, about $\frac{4}{9}$ths; the Genesee, about $\frac{1}{320}$th; the Potomac, nearly $\frac{1}{28}$th; Lake Erie, about $\frac{1}{120}$th; and the Ohio, with its large and numerous affluents, about $\frac{1}{3}$d. The Ohio is formed by the union of two large rivers, the Alleghany and Monongahela, at Pittsburg. Both have numerous tributaries; the principal affluents of the Alleghany are Conewango, Oil, and French creeks, Tionesta Creek, Clarion River, Red Bank, Mahoning, and Crooked creeks, and Conemaugh River. The Monongahela receives the Youghiogheny and several smaller streams, while Chartier's Creek and Shenango River discharge directly into the Ohio. The Susquehanna is formed by the union of the E. and W. branches at Sunbury, and from thence flows S. and S. E. to Chesapeake Bay. The E. branch receives in Pennsylvania, Meshoppen, Tunkhannock, and Lackawanna creeks; the W. branch, Sinnemahoning, Pine, Lycoming, Loyalsock, and Muncy creeks, and on the S. bank Clearfield, Moshannon, Bald Eagle, White Deer, and Buffalo creeks. The Susquehanna itself receives Juniata River and Penn's, Sherman's, Conedogwinit, Breeches, Conewago, and Codorus creeks, and on the E. bank Shamokin, Mahanoy, Wiconisco, Powell's, Clark, Stony, Swatara, and Conestoga creeks. The principal tributaries of Delaware River in this State are Lackawaxen Creek, Lehigh River, Schuylkill River, and Brandywine River. Aside from Lake Erie, there are no lakes of importance. There are several islands in the Delaware, and two or three in Lake Erie, belonging to Pennsylvania.

Obverse.



Reverse.



Seal of Pennsylvania.

Geology.—Our space does not allow us to go into minute details in regard to the very interesting geological formations of Pennsylvania, and as an elaborate geological survey of the State is in progress, there is the less necessity for this; but the general features of its geology must be understood in order to comprehend the economic value of its varied and abundant mineral deposits. Bucks co., and a portion of Lehigh and Montgomery, forming the Alluvial plain N. of Philadelphia and 10 or 15 miles W. of the Delaware, is an Alluvial or Quaternary deposit of considerable thickness. The S. E. corner of the State, including Philadelphia, Delaware, Chester, Lancaster, and most of York cos., is Azoic. N. and W. of this the Alluvial belt, of no great width, extends to and across the Maryland line, with occasional isolated masses of trap-rock, already referred to. W. and N. W. of this a somewhat broader belt of Silurian rocks, forming the Kittatinny Mountains, and extending from the Hudson River region in New York, passes S. W. to Maryland and Virginia. This tract is rich in iron ores. The Devonian overlaps this along the W. slope of the Kittatinnies, and in the Devonian are found the three distinct anthracite coal-fields, the most important and valuable deposit of anthracite, though not the only one, on this continent. The area of these coal-fields is about 472 sq. m. The northern part of the State, nearly one-fourth of its area, extending to Lake Erie, is wholly Devonian, except occasional scattering outcrops of bituminous coal. W. of the Susquehanna and S. of its W. branch the Devonian and Silurian systems alternate to the summit of the Alleghanies proper, where the Conglomerate, which underlies the coal-measures, appears with a westerly dip; and thence to and beyond the W. boundary of the State, and from about 41° 30′ N. lat. S. into West Virginia, the whole region belongs to the coal-measures. The coal varies in quality and character, being all of it bituminous, but some cannel, and other deposits block or smelting coals. The N. W. portion of the State—the oil-region—is partly Devonian and partly Carboniferous.

Minerals and Mineralogy.—Gold, silver, copper, tin, and sulphur in a native state have been discovered in Pennsylvania, but none of them in such quantities as to make their working profitable. Prof. Genth estimates that the clay which underlies Philadelphia co. contains over $1,000,000,000 worth of gold, but adds that no one could realize more than from 30 to 60 cents per day in extracting it, as a cubic foot does not contain more than 3 cents' worth. Silver in some localities would pay better, but not well enough to make it profitable to work the mines. Iron does not exist in a native state, but the iron ores of the State embrace every known ore, and many not found elsewhere. The iron furnaces of Pennsylvania have hitherto made about one-half of the pig iron manufactured in the U. S., though having only two-fifths of the whole number of stacks. The iron interest has for the past two or three years been suffering from great depression all over the U. S., and Pennsylvania has suffered more than her share from the fact that some of the other iron-regions could produce iron at somewhat less cost than her furnaces. The most valuable of the minerals of Pennsylvania economically is her coal. Of anthracite coal nearly 25,000,000 tons are annually sent to market or used in the vicinity of the mines. The amount of bituminous coal is constantly increasing. Pennsylvania furnishes nearly one-third of the entire amount used, or about 6,000,000 tons. Petroleum is another mineral product of Pennsylvania of great value and importance. The product for the year 1874 was 11,589,115 barrels of 40 gallons each, of which 1,652,601 barrels were exported. The other mineral products of economic value are building-stone, including granite, brownstone (sandstone), trap or porphyry, and marble, slate, the production of which is rapidly increasing, zinc, nickel, and copper. Attempts have been made to produce salt, but the brines are more valuable for the chlorine, bromine, and iodine, and the compounds of these elements, which they contain, than for the salt. There are numerous mineral springs, some of them of great medicinal value. Several of them have been reputed to contain considerable quantities of chloride of lithium, but Prof. Genth finds but a slight, almost inappreciable trace in any of them. Of the minerals possessing only scientific value the number is very great, embracing almost every mineral of note in our largest catalogues.

Soil, Vegetation, and Botany.—The State has yet a large amount of forests; about 6,257,000 acres, or almost one-fourth of the area of the State, was included among the woodlands in farms, aside from the wild forests of the Pocono Wilderness, which have never been reclaimed. The demands on this for lumber, for hemlock bark for tanning, and for the use of the railroads, are, however, materially and rapidly diminishing this large reserve. The forest trees of the State include several species of pine, hemlock, spruce, fir, cedar, and cypress, as well as some other coniferous trees; 6 or 7 species of oak and 4 of hickory; the black walnut and butternut; 3 or 4 species of maple; the chestnut, chinquapin, beech, buckeye, linden, tulip tree, dogwood, hornbeam, birch, ash, willow, elm, aspen, sycamore, American poplar, mulberry, persimmon, gum, sassa-

fras, locust, wild cherry, papaw, catalpa, magnolia, crab-apple, etc. The flora is varied. The soil of the valleys and plains is generally fertile, and some of it very rich, yielding large crops for a succession of years.

Zoology.—From the extent of the forests in the central portion of the State the number of wild animals is very large—bears, panthers, wild-cats, lynxes, wolves, otters, the red and the gray fox, the raccoon, marten, mink, weasel, skunk, opossum, muskrat, porcupine, woodchuck or ground hog, and occasionally the beaver; the flying, red, striped, and gray squirrel; the hare or rabbit; and among the larger game the Virginian deer, and rarely the elk. Birds are numerous—of prey, the bald and the golden eagle, the turkey-buzzard, fish and other varieties of hawk, owls, the whippoorwill, the nighthawk, the swallow, etc.; these and the reptiles are the same as those found in New York and New Jersey.

Climate.—Extending over so large an area and of such varied surface and elevation, there are considerable differences in the climate of different portions of the State. The mean annual temperature, which is 52° in the S. E. counties, decreases to 48° in the central counties and 44° in the northern and north-western. The amount of rainfall is usually greatest in the S. E., and decreases N. and W. The following table gives the temperature and rainfall in ten representative points in the State:

METEOROLOGICAL DATA.	Erie, lat. 42° 07′, lon. 80° 10′; elevation, 671.5 ft.	Pittsburg, lat. 40° 32′, lon. 80° 02′; elevation, 791 ft.	Newcastle, lat. 41° 1′ 40″, lon. 80° 21′.	Cannonsburg, lat. 40° 17′, lon. 80° 12.	Franklin, lat. 41° 23′, lon. 79° 50′.	Tioga, lat. 41° 48′ 30″, lon. 78° 10′.	Mount Joy, lat. 40° 11′, lon. 77° 22′.	Lewisburg, lat. 40° 57′ 30″, lon. 77° 58′.	Harrisburg, lat. 40° 15′, lon. 77° 56.	Philadelphia, lat. 39° 57′, lon. 75° 10′; elevation, 71.12 ft.
Temperature:	°	°	°	°	°	°	°	°	°	°
Annual mean temp...	49.2	52.6	49.3	50.1	47.1	44.4	52.3	48.4	53.3	52.5
Highest temp. of year	96	99.5	89	93	92	106	103	98	96	97
Lowest " " ...	8	10	4	6	0	—20	1	2	13	10.5
Range annual temp...	88	89	85	87	92	126	102	96	83	86.5
Mean temp. spring...	42.7	40.3	46.7	47.7	43.6	41.7	50.6	46.7	49.1	47.5
Highest " " ...	81	......	81	84	86	80	86	85	87	87.5
Lowest " " ...	11	......	2	6	7	—20	5	6	13	19
Range " " ...	70	......	79	78	79	100	81	79	76	68.5
Mean temp. summer.	71.2	73	70.9	70.2	67.5	64.4	72.9	69.7	74.7	72.9
Highest " " ...	96	99.5	89	93	92	106	103	98	96	97
Lowest " " ...	50	50	39	44	39	30	42	40	45	51
Range " " ...	46	49.5	50	49	53	76	61	58	51	46
Mean temp. autumn.	51.5	53.6	47	47.6	46.4	46.5	51.5	47.5	53.1	53.7
Highest " " ...	87	97	81	88	86	84	87	85	85	90
Lowest " " ...	20	18	15	16	10	10	1	21	30	20.5
Range " " ...	67	79	66	72	76	74	86	64	55	69.5
Mean temp. winter...	31.6	35.7	32.7	34.8	30.9	25.1	34.0	29.8	35.1	36.1
Highest " " ...	70	69	60	68	64	54	64	48	59	75
Lowest " " ...	8	10	4	6	0	—12	10	2	18	10.5
Range " " ...	62	59	56	62	64	66	54	46	41	64.5
Rainfall:	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Mean annual rainfall	45.65	44.26	43.91	37.96	50.86	40.54	30.33	38.63	44.51	49.32
Rainfall of spring....	4.55	12.51	10.17	10.43	11.10	11.41	5.65	10.14	10.48	14.67
" summer..	12.78	11.50	10.67	8.48	11.34	7.38	7.48	10.83	10.93	9.92
" autumn..	13.88	10.49	8.29	10.04	16.68	14.85	11.80	10.69	8.40	16.31
" winter...	14.44	9.76	14.78	9.01	11.74	6.90	5.40	6.97	14.70	8.42

Agricultural Productions.—In 1870 there were reported 17,994,200 acres of land in farms, about 63.44 per cent. of the entire land-area of the State; of these, 11,515,965 acres were improved and 6,478,235 acres unimproved, including woodlands. The value of the farms was \$1,043,481,582, and of farming implements and machinery, \$35,658,196. The value of all farm productions for the year was \$183,946,027, and of animals slaughtered or sold for slaughter, \$28,412,903. The value of home manufactures was \$1,503,754; of forest products, \$2,670,370; of market-garden products, \$1,810,016 (evidently an under-statement); of orchard products, \$4,208,094. The wheat-crop of the year 1869–70 was 19,672,967 bushels (nearly all of it winter wheat); the rye-crop, 3,577,641 bushels, a larger amount than is grown in any other State; Indian corn, 34,702,006; oats, 36,478,585; barley, 529,562; buckwheat, 2,532,173; flax, 815,906 pounds; hemp, 571 tons; wool, 6,561,722 pounds; hay, 2,848,219 tons; hops, 90,688 pounds; tobacco, 3,467,539 pounds; maple-sugar, 1,545,917 pounds; sorghum-sugar, 9 hogsheads; sorghum-molasses, 213,373 gallons; maple-molasses, 39,385 gallons; Irish potatoes, 12,889,367 bushels; sweet potatoes, 131,572; peas and beans, 39,574; beeswax, 27,033 pounds; honey, 796,989 pounds; domestic wine, 97,165 gallons; cloverseed, 200,679 bushels; flaxseed, 15,624; grass-seed, 50,642; butter, 60,834,644 pounds; cheese, 1,145,209 pounds; milk sold, 14,411,729 gallons. Value of all live-stock, \$115,647,075; number of horses, 611,488; of mules and asses, 18,009; of neat cattle, 1,505,897, of which 706,437 were milch cows; of sheep, 1,794,301; of swine, 867,548. The report of the agricultural department gives the value of all live-stock in the State in Jan., 1875, as \$121,803,698. There were estimated to be 573,700 horses, 25,600 mules, 828,800 milch cows, 722,600 oxen and other cattle, 1,674,000 sheep, and 930,900 swine. The principal crops of 1874, according to the same authority, were—wheat, 16,636,000 bushels; rye, 3,250,000; Indian corn, 35,821,000; oats, 25,607,000; barley, 437,000; buckwheat, 2,062,000; Irish potatoes, 9,223,000; tobacco, 10,500,000 pounds; hay, 2,421,900 tons. The value of these crops was stated at \$117,730,915.

Manufacturing Industry.—Pennsylvania ranks second only to New York in the annual product of her manufactures, while, if we could place any dependence upon the estimates of capital employed in manufacturing given in the census, it would seem that the State was first in the amount of its capital invested; but these estimates are acknowledged to be grossly erroneous. The general statistics of manufactures are—37,200 establishments, employing 319,487 hands (256,543 men, 43,712 women, and 19,232 children); the capital invested was stated at \$406,821,845 (it was quite probable that it was at least four times that sum); the amount of wages paid was \$127,976,594; the amount of raw material used, \$421,197,673; and the amount of annual product, \$711,894,344. The Pennsylvania statisticians give the annual product in 1875 as \$1,067,841,351, but go into no details, except the apportionment of the increased amount to the several counties. Of the various industries which employ its people, iron and manufactures of iron occupy the first place—907 establishments, producing annually \$129,174,007; flouring-mill products, 1251 mills, were \$31,124,017; leather tanned, curried, dressed, and in morocco, 1495 establishments, amounted to \$28,899,466; machinery of all kinds, 477 machine-shops, produced \$29,258,153. Of woollen goods, there were produced in 403 mills \$27,361,897; cotton goods, 143 establishments, goods to the value of \$17,565,028; boots and shoes and findings, 359 shops, produced goods to the amount of \$11,322,406; glass and glassware, 52 establishments, \$8,301,325 (the glass-factories of Pittsburg alone produce about \$11,600,000, and the 25 or 30 others more than \$6,000,000 more); molasses and sugar, refined in 15 establishments, produced \$26,731,016; printing cotton and woollen goods, \$6,113,584, in 7 establishments; printing and publishing, 307 offices, \$13,482,449; bleaching and dyeing, 79 establishments, \$7,285,114; brick, 458 kilns, \$6,071,209; clothing, ready made, 1538 establishments, \$23,363,156; coal oil rectified, 89 establishments, \$15,251,223; drugs and chemicals, 82 establishments, \$8,451,991; furniture, 948 cabinet-shops, \$8,082,530; carpets, 396 establishments, \$10,218,621; cars, freight and passenger, 49 car-shops, \$9,288,041; carriages and wagons, 1449 establishments, \$6,682,302; bread and other bakery products, 809 bakeries, \$5,597,291; agricultural implements, 286 establishments, \$3,652,295; bookbinding, 91 binderies, \$3,588,623; cooperage, 474 shops, \$3,209,470; hosiery, 76 factories, \$5,306,738; steel and steel springs, 26 establishments, \$7,754,801; tobacco and cigars, 1000 establishments, \$6,130,873; tin, copper, and sheet-iron ware, 974 establishments, \$5,311,810; worsted goods, 31 establishments, \$7,883,038; liquors, malt and distilled, 354 distilleries and breweries, \$11,674,628; lumber, planed and sawed, and sash, doors, and blinds, 1953 saw and planing mills, \$18,080,705; marble and stone work, monuments, etc., 308 establishments, \$4,843,302; packed meats, 22 packing-houses, \$6,662,902; paints and oil floor-cloth, 40 establishments, \$5,187,774; paper, 83 establishments,

$6,511,446; patent medicines and compounds, 61 establishments, $6,344,796; soaps, candles, perfumery, and fancy soaps, 115 establishments, $3,917,826; silk goods and silk and twist, 10 establishments, $1,662,900 (in 1874–75 the production of the 23 establishments was $1,876,744); oils, vegetable and animal, 27 establishments, $2,108,623; shipbuilding, repairing, and materials, 106 shipyards, $3,083,244; umbrellas, canes, and umbrella furniture, 31 factories, $2,479,643; lime, 403 kilns, $2,058,675; brass founding and finishing, 63 establishments, $2,030,055; confectionery, 268 establishments, $2,491,332; hats and caps, 81 factories, $2,813,766; saddlery and harness, 903 establishments, $3,051,771. Sixteen other branches of manufacturing industry produced in 1108 establishments goods to the value of between $1,000,000 and $2,000,000 each.

Mining.—The mining interests of Pennsylvania are large; in 1870 they lacked but $182,214 of equalling the entire product of the other States and Territories. The returns of the census of 1870 show 3086 mining and quarrying companies, of which 598 were engaged in coal-mining; they were reported to have a cash capital invested of $84,660,276, to give employment to 81,215 hands, to pay $38,815,276 in wages, and to produce $76,208,745 of coal, ores, petroleum, and quarry products. A little more than two-thirds of this amount ($52,357,814) was coal, and three-fourths of the remainder was petroleum, while iron, copper, nickel, zinc, marble, slate, and other stone made up the amount. At the close of 1875 the entire mining product of the State exceeded $100,000,000 per annum.

Railroads and Canals.—The auditor-general's report on railroads, canals, and telegraphs for 1875 gives the returns to the beginning of 1875. From this report we learn that there were in the State at that time 146 railways operated by steam, the main lines of which had a length in miles of 7886.56, of which 6829.87 were in operation, and of this 4392.91 miles were in Pennsylvania, in addition to 1547.64 miles of branch roads and 2733.14 of sidings. There were 1806.28 miles of double-track road. In 1873–74 there were 5228.61 miles completed and operated in Pennsylvania, including branches. The amount of capital stock of these roads paid in was $482,931,393.50; amount of funded debt, Jan. 1, 1875, $437,157,118.44; amount of floating debt, $34,923,155.75; total funded and floating debt, $471,633,998.02; cost of roads and equipment, $744,701,826.99. Number of passengers carried on cars during the year, 42,297,158; gross amount of tonnage for year, 78,992,785; number of miles run by all trains for the year, 99,443,714. The gross expenses of these roads for the year were $82,940,105.49, of which $44,241,700.18 was for operating the roads. The gross receipts were $137,446,245.16. There were in the State 40 passenger railways operated by horse-power. The total length of these roads was 311.51 miles, and the cars were drawn by 6430 horses. Total cost of roads and equipment, $9,695,843.57; the amount of capital stock subscribed was $14,965,672.50, of which only $7,028,901.80 had been paid in; and there was $2,676,121.48 of funded and floating debt. The number of passengers carried on these cars was 91,036,500. The total expenses were $4,149,553.68; the total receipts, $5,828,690.27. *Canals.*—There are 9 canals in the State, having a total length of 875 miles; the cost of the canals and fixtures was $36,816,728.14; the amount of capital actually paid in is $46,107,629, and of funded and floating debt, $46,239,173.12. The amount of tonnage carried on them in the year 1874 was 7,925,883 tons. The annual expenses are $1,179,890.75, and the receipts, $2,289,824.55.

Finances.—The public debt on Dec. 1, 1875, amounted to $23,233,137.74, and there was in the sinking fund $9,466,572.85 toward reducing it, leaving net indebtedness of $13,766,564.89. The debt is being rapidly reduced, and probably by 1890 will be extinguished. Receipts into the treasury for the year ending Dec. 1, 1875, including balance, $7,534,650.67, and disbursements $6,541,443.40, leaving a balance in the treasury of $993,207.27.

Commerce.—As Pennsylvania nowhere touches the ocean, and only at one point one of the great lakes, its foreign commerce is not, of course, so large as that of States having numerous harbors and seaports. Still, a large foreign business is conducted through the port of Philadelphia, which is well situated for that purpose (according to the government reports, Philadelphia ranks as the fourth port in the amount of her imports and sixth in the amount of her exports, while her merchants also import largely through New York in bond), and a smaller but considerable trade through the port of Erie. Pittsburg is also a port of entry, but its imports and exports are indirect, and, though the latter are large, the city is mostly noted for its domestic trade, carried on upon Ohio River and the numerous railways which centre there. The following table gives the commercial statistics of the three ports for the years ending Dec. 31, 1874, and June 30, 1875:

Customs Districts.	Imports for the year ending Dec. 31, 1874.	Domestic exports for year ending Dec. 31, 1874.	Foreign exports for year ending Dec. 31, 1874.	Imports for year ending June 30, 1875.	Domestic exports for year ending June 30, 1875.	Foreign exports for year ending June 30, 1875.	Entrances for year ending June 30, 1875, including coastwise trade.			Clearances for year ending June 30, 1875, including coastwise trade, etc.			Registered, enrolled, and licensed tonnage in 1875.		Indirect trade for year ending Dec. 31, 1874, imports.
							Vessels.	Tonnage.	Crews.	Vessels.	Tonnage.	Crews.	Vessels.	Tonnage.	
	$	$	$	$	$	$									$
Erie	229,675	47,723	......	361,593	58,690	......	829	459,473	10,211	820	456,911	9,881	74	20,516	
Philadelphia	25,306,525	29,878,911	22,432	24,236,387	28,588,019	23,635	2,355	1,155,479	31,216	2,566	1,347,296	36,543	3,039	403,874	874,045
Pittsburg	....	....	......	....	....	......	.....	....	......	.....	....	......	457	98,720	
Totals	25,536,200	29,926,634	22,432	24,597,980	28,646,709	23,635	3,184	1,615,052	41,427	3,386	1,804,207	46,424	3,570	527,110	874,045

The internal commerce of the State vastly exceeds its foreign. Over its railways, canals, and navigable rivers the products of its numerous manufactories, mines, and farmlands, as well as great quantities of foreign goods and the products of other States, are constantly passing, and the aggregate amount is counted by probably thousands of millions. The coal, iron, and oil shipped annually make up over $150,000,000, while grain, flour, and meal, brick, machinery, locomotives, cars and car-wheels, woollen and cotton goods, imported and American silks, provisions, produce, butter and cheese, groceries generally, etc., make a total which considerably exceeds $2,000,000,000.

Population.

Census year.	Total population.	Males.	Females.	White.	Colored.*	Native.	Foreign.	Density of population.	Ratio of increase of population.	Illiteracy.	Persons of school age, 5–20.	Persons of military age, 18–45, males.	Persons of voting age, 21 and upward, males.	Citizens.	No. of dwellings in the State.	No. of persons to a dwelling.	No. of families.	No. of persons to a family.
1790	434,373	222,810	211,563	424,099	10,274	....	....	9.45	.....	......	158,329	85,789	103,260					
1800	602,365	309,507	292,857	586,095	16,270	....	....	13.09	38.67	......	219,540	118,968	143,362					
1810	810,091	413,575	396,518	786,804	23,287	....	....	17.60	34.49	......	295,278	159,993	192,801					
1820	1,049,458	532,432	517,047	1,017,094	30,413	....	....	22.81	29.55	......	382,527	207,268	249,771					
1830	1,348,233	684,378	664,455	1,309,900	38,333	....	....	29.31	28.47	......	491,431	266,276	320,879					
1840	1,724,033	867,556	856,477	1,676,115	47,918	....	....	37.49	27.87	......	628,410	340,496	410,319					
1850	2,311,786	1,168,103	1,143,683	2,258,160	53,626	2,006,207	305,579	50.26	34.09	76,272	842,766	456,593	550,181	459,781	386,216	5.99	408,497	5.66
1860	2,906,215	1,454,419	1,451,796	2,849,259	56,949†	2,475,710	430,505	63.18	25.71	81,515	1,033,527	559,689	691,296	590,443	515,319	5.64	524,558	5.54
1870	3,521,951	1,758,499	1,763,452	3,456,609	65,294‡	2,976,642	545,309	76.56	21.19	222,356	1,222,697	679,506	886,883	776,345	635,680	5.54	675,408	5.21

Banks.—There were in the State 205 national banks in 1875, having a capital paid in of $53,910,240, bonds on deposit to the amount of $47,645,850, and an outstanding circulation of $42,092,711. There were at the same time 121 State banks and savings institutions (61 savings banks and 60 State banks and trust companies), whose capital stock actually paid in was $11,022,906.22, their deposits $22,801,449.41, reporting an aggregate surplus of $1,388,199.84, and earnings for the year of $752,489.67. Their entire liabilities, summed up, including surplus and earnings, were $40,391,877.99, and their resources to the same amount.

Fire and Life Insurance Companies.—There were 63 joint-stock fire and fire marine insurance companies in the State on Jan. 1, 1875, having $28,590,355.25 of admitted assets, a paid-up capital of $10,312,384.74, a net surplus of $4,778,681.78, and all other liabilities, including re-insurance fund, amounting to $13,632,771.52, making the total liabilities, including capital and surplus,

* Of the colored population enumerated in this column, 3737 were slaves in 1790, 1706 in 1800, 795 in 1810, 211 in 1820, 403 in 1830, and 64 in 1840.

† Including 7 Indians.

‡ Including 14 Chinese and 34 Indians.

$28,723,838.04. The total cash income of the year had been $13,446,849.32, and the total cash expenditures, $10,659,388.03. There were also 111 mutual fire insurance companies; their showing indicated assets available to the amount of about $5,146,000, and immediate liabilities of about $1,789,000, and a total surplus since their organization of about $3,797,600. The income from the year's business was stated at $2,293,827.19, and the disbursements at $1,879,648.24, giving about $414,000 net profit for the year. There were 9 life insurance companies in the State, 7 of them in Philadelphia, having total assets of $15,085,387.09, and liabilities (including a re-insurance reserve, and excepting capital) of $11,800,719.78, showing a surplus, as regarded policy-holders, of $3,600,351.65; the amount of capital stock was $1,879,262.03. (Two of the companies were mutual.) The income of the year was $3,694,910.08, and the expenditures, $2,679,756.57. The number of policies issued during the year was 5503, and the amount insured by them, $13,859,750; the number of policies in force Jan. 1, 1875, was 34,032, insuring $87,027,532.

Education.—I. *Public Schools.* There were 2089 school districts and 17,092 public schools in the State on June 1, 1875; of these 5625 were graded schools; the number of teachers was 19,880; the number of pupils, 890,073; the average attendance, 551,848; average length of school term, in months, 6.85; average salaries of male teachers, per month, $41.07; of female teachers, $34.09. The cost of tuition for the year was $4,746,875.52; cost of buildings, fuel, contingencies, debt and interest, $4,507,780.61; making the total expenditure for school purposes $9,363,927.07, of which $1,000,000 was appropriated by the State and the remainder raised by counties and districts. The estimated value of school property was $24,260,789. Of this school property, $5,352,161 belongs to Philadelphia, and $1,815,811.36 was expended in that city for school purposes in 1875, besides $30,000.50 for evening schools. Teachers' institutes were held in each county—88 in all—continuing an average of 5 days in each; they were attended by 13,863 teachers, and nearly 29,000 other persons interested in education were present; 474 instructors and lecturers gave instruction, and $13,145.53 was expended for them.

II. *Secondary Instruction.*—There are about 350 academies and seminaries in the State, many of them of high grade, and a considerable number of excellent preparatory schools. The Moravian schools at Nazareth, Litiz, and Bethlehem, as well as many others, have a good reputation. There are also several female colleges or collegiate schools, which impart a high grade of secondary instruction.

Superior (Collegiate), Scientific, and Professional Education.—The following table gives the principal statistics of the colleges, scientific and professional schools of the State, so far as they are obtainable. Most of the statistics are for 1875; in a few instances those of 1874.

Colleges, Universities, Scientific and Professional Schools.	Location.	Date of organization.	Under whose control.	Professors and instructors.	Students. Male.	Students. Female.	Students. In preparatory course.	Students. In collegiate or advanced course.	Value of buildings, grounds, apparatus, etc.	Amount of productive endowment.	Income from endowment or State funds.	Total income from all sources.	Volumes in library.
I. *Colleges and Universities.*									$	$	$	$	
Allegheny College	Meadville	1815	Meth. Episcopal	7	160	...	59	101	145,700	150,000	10,000	18,500	12,000
Dickinson College	Carlisle	1783	Meth. Episcopal	6	88	...	...	88	150,400	200,000	11,500	13,269	27,503
Franklin and Marshall College	Lancaster	1853	Reformed (Ger.)	7	128	...	57	71	90,000	117,500	5,000	7,120	12,000
Haverford College	Haverford, Delaware co.	1832	Orth. Friends	6	49	...	...	49	152,800	91,200	7,508	18,814	10,500
Lafayette College	Easton	1826	Presbyterian	27	323	...	...	323	666,702	400,000	24,000	31,462	19,400
La Salle College	Philadelphia	1863	Roman Catholic	9	176	...	110	66	155,000	...	...	...	1,500
Lebanon Valley College	Annville, Lebanon co.	1867	United Brethren	7	90	34	52	72	62,000	7,000	...	4,000	1,100
Lehigh University	South Bethlehem	1866	Prot. Episcopal.	7	103	...	...	103	500,000	400,000	24,000	24,000	2,000
Lincoln University	Lincoln Univ., Lower Oxford, Chester co.	1853	Presb. (colored).	9	185	...	81	104	125,000	105,000	6,885	...	3,500
Mercersburg College	Mercersburg	1865	Reformed (Ger.)	10	101	...	59	42	60,000	14,000	700	4,900	4,000
Monongahela College	Jefferson, Greene co.	1867	...	6	93	...	81	12	...	20,000	1,200	2,580	140
Muhlenberg College	Allentown	1867	Evang. Luth.	7	111	...	69	42	125,000	45,500	3,380	8,700	3,600
Palatinate College	Myerstown	1868	Reformed (Ger.)	9	208	...	192	16	30,000	...	...	5,000	900
Pennsylvania College	Gettysburg	1832	Lutheran	11	158	...	74	84	103,400	156,000	6,150	12,150	19,550
Pennsylvania State College	State Col., Bellefonte, Centre co.	1859	State	12	141	...	85	56	...	...	...	30,000	
Pennsylvania Military Academy	Chester	1862	Non-sectarian	12	121	...	17	104	100,000	...	...	...	1,200
St. Francis's College	Loretto	1849	Roman Catholic	10	85	...	85	...	120,000	6,000	400	14,400	3,000
St. Vincent's College	Near Latrobe	1846	Roman Catholic	24	469	...	315	154	...	...	...	...	13,000
Swarthmore College	Swarthmore, Delaware co.	1869	Friends, Hicks.	19	160	101	161	100	470,000	35,000	80,000	82,000	2,500
Thiel College	Greenville	1870	Evang. Luth.	8	63	...	32	31	30,000	22,200	2,152	4,015	2,600
University of Lewisburg	Lewisburg	1847	Baptist	6	99	...	34	65	222,000	130,000	8,500	14,500	5,400
University of Pennsylvania	Philadelphia	1753	Non-sectarian	22	215	...	63	152	1,500,000	1,450,000	30,810	50,819	10,000
Ursinus College	Freeland	1870	Reformed (Ger.)	11	111	...	75	36	30,000	...	...	3,500	6,500
Villanova College	Villanova P. O.	1842	Roman Catholic	18	160	...	60	100	250,000	50,000	3,000	33,000	8,000
Washington and Jefferson College	Washington	1802	Presbyterian	8	177	...	37	140	140,000	210,000	11,500	14,000	7,000
Waynesburg College	Waynesburg	1850	Cumb. Presb.	10	151	146	215	82	20,000	30,000	2,000	4,000	1,800
Western University of Pennsylvania	Pittsburg	1819	Non-sectarian	16	296	...	213	83	202,000	345,833	17,520	33,578	5,280
Westminster College	New Wilmington	1852	United Presb.	7	165	...	48	117	25,100	79,000	6,000	...	3,000
II. *Schools of Science.*													
Franklin Institute	Philadelphia	1824	Trustees	Inst	ruc	tion	by	lec	tures and	evening cl	asses.	...	15,000
Polytechnic College	Philadelphia	....	Trustees										
Pardee Scientific dept. of Lafayette Col.	Easton	1866	Lafayette Col.	Rep	orte	d w	ith	the	college.				
Pennsylvania State College	Bellefonte, Centre co.	1859	State	10	142	...	86	56	397,589	500,000	...	30,000	1,500
Scientific department of Villanova Col.	Bryn Mawr P. O.	1842	Villanova Col.	9	76	...	20	56	7,000	...	...	...	2,500
Scientific dept. of Univ. of Pennsylvania	Philadelphia	1871	Univ. of Penn.	16	113	...	...	113	500,000	500,000			
Wagner Free Institute of Science	Philadelphia	1855	Trustees	6	...	...	...	...	300,000	...	...	...	16,000
III. *Schools of Theology.*													
Crozer Theological Seminary	Upland, Chester co.	1868	Baptist	5	46	...	...	46	150,000	227,000	...	...	7,000
Moravian Theological Seminary	Bethlehem	1807	Moravian	3	17	...	...	17	7,387	58,000	2,271	...	5,026
Meadville Theological School	Meadville	1847	Unitarian	7	12	...	...	12	27,000	110,000	7,000	...	12,000
Missionary Institute	Selinsgrove	1855	Lutheran	2	12	...	...	12	20,000	16,000	1,000	...	2,000
Theological Sem. St. Charles Borromeo.	Lower Merion	1832	Roman Catholic	8	139	...	...	139	...	...	...	...	10,000
Philadelphia Divinity School	Philadelphia	1862	Prot. Episcopal.	5	37	...	...	37	...	...	...	...	6,000
Theological dept. of Ursinus College	Freeland	1869	Reformed (Ger.)	3	10	...	...	10					
Theological Seminary	Gettysburg	1826	Evang. Luth.	6	40	...	...	40	50,000	90,000	5,500	...	11,000
Theological Seminary of Reformed Ch.	Lancaster	1825	Reformed (Ger.)	3	34	...	...	34	...	60,000	3,600	...	7,000
Theological Seminary of Evang. Church	Philadelphia	1864	Evang. Luth.	5	54	...	...	54	52,000	116,356	7,581	...	2,000
St. Michael's Theological Seminary	Pittsburg	1845	Roman Catholic	15	30	...	...	30	60,000	...	...	...	5,000
Theological Seminary of U. P. Church	Allegheny City	1825	U. P. Church	4	43	...	...	43	50,000	43,790	3,180	...	4,000
Theological department of Villanova Col.	Villanova P. O.	1842	Roman Catholic	3	19	...	...	19	...	...	...	...	3,000
Theological department of Lincoln Univ.	Lower Oxford	1871	Presbyterian										
Western Theological Sem. of Presb. Ch.	Allegheny City	1827	Presbyterian	6	2	...	...	2					
IV. *Schools of Law.*													
Law department of Lincoln University.	West Chester	1870	Lincoln Univ.	6	...	...	...	...	...	...	...	...	190
Law department Univ. of Pennsylvania.	Philadelphia	1850	Univ. of Penn.	5	54	...	...	54	...	...	...	...	250
V. *Schools of Medicine.*													
Jefferson Medical College	Philadelphia	1824	Trustees	7	320	...	...	320	100,000	...	...	45,000	
Medical department of Lincoln Univ.	Oxford	1870	Lincoln Univ.	8	6	...	...	6				60,000	3,000
Medical dept. Univ. of Pennsylvania	Philadelphia	1765	Univ. of Penn.	22	486	...	...	486	...	...	...	7,900	
Woman's Medical College	Philadelphia	1850	Trustees	14	...	62	...	62	50,000	69,750	4,750		
Hahnemann Medical College	Philadelphia	1869	Trustees	23	126	...	...	126	60,000	...	...	10,123	2,000
Pennsylvania College of Dental Surgery	Philadelphia	1856	...	3	59	...	...	59	...	...	...	6,755	
Philadelphia Dental College	Philadelphia	1863	Trustees	14	101	...	...	101					
College of Pharmacy	Philadelphia	1821	Trustees	71	269	...	...	269	76,000	16,000	1,550	11,850	2,750

III. *State Normal Schools.*—Twelve of these have been ordered by the State, and ten of them are now in operation, though the State superintendent gives statistics of only nine, which we reproduce on next page.

Special Education.—There are in the State 2 institutions for deaf mutes—viz. the Institution for the Deaf and Dumb at Philadelphia, founded in 1821, a corporate institution, but receiving State beneficiaries and State support for them. It had in Jan., 1875, 14 instructors and 271 pupils (146 males and 125 females), of whom 192 were State beneficiaries. Its buildings, grounds, and apparatus are valued at $325,000; the State appropriation is about $50,000, and the income from other sources about $13,600 more. The expenditure for the year 1874 was $63,628. The number of volumes in its library was about 5000. The Pittsburg Day School for the Deaf and Dumb, with which is connected a home for deaf mutes, was founded in 1869; it has 2 instructors and 43 pupils (19 males and 24 females);

there are 10 acres of land connected with it, and the buildings, grounds, and apparatus are valued at $45,000. It has a State appropriation of $2000 a year; its expenditures are $4500 a year. The Pennsylvania Institution for the Instruction of the Blind, founded in 1832, is perhaps the best institution of its class in the U. S. It had in Jan., 1875, 200 pupils, 121 males and 79 females (the capacity of the institution is but 204); 130 were State beneficiaries. The value of buildings, grounds, and apparatus is stated at $201,000; the amount of endowments yielding income is $106,640. The State and municipal appropriation is about $54,660; the sale of merchandise amounted to $20,811.85;

Title.	Location.	Date of organization.	No. of teachers.	Students in normal school.		No. graduated in elementary course.	No. graduated in scientific course.	No. graduated in classical course.	No. of graduates 1874-75.	Pupils in model school.		Value of buildings, grounds, apparatus, etc.	Debts.	Tuition per year in normal school.	Tuition per year in model school.	Income from State.	Total Income.	Annual expenditures.	Volumes in library.
				Males.	Females.					Boys.	Girls.	$	$	$	$	$	$	$	
2d Dist. Nor. School..	Millersville, Lancaster co.........	1859	26	458	281	37	1	..	38	46	18	204,449.09	77,093.75	55	55	19,510	135,162.84	73,659.30	3,500
12th " "	Edinboro', Erie co..	1861	10	334	359	15	..	..	15	82	87	[illegible]7,400.00	61,000.00	36	18	5,000	33,261.23	30,916.87	2,530
5th " "	Mansfield, Tioga co.	1862	7	125	80	31	..	..	31	9	9	88,250.00	102,097.43	36	15	5,000	18,726.00	34,333.08	906
3d " "	Kutztown, Berks co.	1866	12	388	22	19	..	..	19	83	23	76,760.45	65,700.60	41	18	7,644	38,913.02	36,459.01	1,700
6th " "	Bloomsburg, Columbia co............	1869	15	144	113	17	1	..	18	41	39	143,919.00	95,137.85	..	21	5,000	27,959.89	26,174.28	581
1st " "	West Chester, Chester co............	1871	14	121	135	18	..	..	18	27	10	126,500.00	96,735.26	65	21	.....	35,394.57	26,426.15	2,000
7th " "	Shippensburg, Cumberland co........	1873	12	221	108	25	..	..	25	29	23	166,500.00	170,175.00	63	21	5,000	39,209.21	47,258.24	800
10th " "	Sagamore, Washington co............	1874	8	119	136	2	..	..	...	41	48	77,302.00	52,631.00	40	20	5,000	14,127.27	17,122.31	350
9th " "	Indiana, Indiana co.	1875	10	79	66	...	..	..	...	43	37	191,800.00	157,000.00	58	12.60	.....	4,240.00	4,849.50	
Totals............	....	...	114	1989	1300	164	2	..	166	401	294	1,102,880.54	907,570.89	..	....	52,154	346,293.53	297,198.66	12,367

receipts from other sources, $32,098.17, making entire receipts $93,576.80; and the expenditures of the year were $86,888.03. There is a home for the blind connected with this institution, which had 18 inmates—7 males, 11 females. There are also an industrial home for blind women and a Pennsylvania working home for blind men, both, we believe, in Philadelphia; the former receives $2000 from the State. The Training School for Feeble-minded Children at Media, founded in 1853, is a well-conducted institution. It had in Jan., 1875, 65 instructors and employés, and 231 children (128 males and 103 females). Its expenditures in 1874 were $63,593.99, of which a little over $7000 was for new buildings; its receipts were about $65,550; of these, $22,460.20 was from the State of Pennsylvania for State pupils, and a little more than $3500 from the city of Philadelphia; nearly $9000 from other States; $24,507.31 from private pupils; and the remainder from donations and special funds.

Reformatories and Industrial Schools.—There are two houses of refuge—one for white, the other for colored children—in Philadelphia; the Pennsylvania Reform School at Pittsburg; and the Sheltering Arms, a private reformatory for homeless and morally-endangered girls, at Wilkinsburg, near Pittsburg. These institutions were founded in 1826, 1850, 1854, and 1873. The income of the two houses of refuge from all sources in 1874–75 was $122,254.93, and the expenditures $109,063.36. The population of the white house of refuge was 738—595 boys and 143 girls; of the colored house, 200—138 boys, 62 girls. The buildings, real estate (11 acres), and furniture, etc. of the Philadelphia houses of refuge are valued at $926,000. The Reform School at Pittsburg has 10 acres of land, and its buildings and personal property are valued at $350,000. It had 431 inmates in 1874–75—286 white and 30 colored boys, 101 white and 14 colored girls. There are about 30 other industrial schools, farm schools, and homes for orphaned and morally-endangered children, all private, though some of them receiving county or municipal aid. They are mostly under the control of religious denominations.

Churches.

Denomination.	Number of church organizations, 1870.	Number of church edifices, 1870.	Sittings, 1870.	Church property, 1870.	Church organizations, 1875.	Church edifices, 1875.	Ministers, etc., 1875.	Church members or communicants, 1875.	Adherent population, 1875.	Church property, 1875.
All denominations......................	5984	5668	2,332,288	$52,758,384	7824	7583	2783	738,595	2,407,600	$64,311,365
Baptists, regular..........................	395	371	178,210	3,157,500	548	511	435	57,874	285,000	4,673,400
Baptists, Seventh-day, Mennonite, Church of God, Tunkers, etc.....	235	218	110,100	537,800	388	297	286	38,000	180,000	1,083,500
Christians, and Disciples...............	97	69	27,500	584,100	117	93	87	10,183	51,000	1,186,000
Congregationalists........................	40	36	14,450	318,200	77	70	54	5,672	27,500	529,500
Protestant Episcopalians...............	238	234	94,182	6,703,067	264	259	316	31,850	159,000	7,216,500
Evangelical Association...............	256	233	80,545	712,800	289	273	208	32,180	160,000	989,400
Friends..	114	118	43,725	1,764,700	120	122	......	12,460	60,000	2,073,000
Jews..	15	14	7,750	681,000	17	16	18	2,500	12,000	758,000
Lutherans.......................................	904	841	339,128	6,474,022	1007	916	520	123,406	560,000	7,231,000
Methodists.....................................	1286	1271	446,463	7,510,675	1612	1573	1869	141,981	650,000	9,928,515
Minor sects*..................................	7	7	2,500	63,200	7	7	6	560	2,500	65,000
Moravians.......................................	15	16	9,000	401,000	16	16	19	4,800	25,000	478,000
New Jerusalem (Swedenborgian)..	11	7	1,950	78,000	12	9	9	1,016	5,500	88,000
Presbyterians (regular)................	739	723	304,828	9,626,950	1183	1106	1078	152,602	660,000	10,986,750
Presbyterians (United, Reformed, Cumberland, etc.)......................	289	285	119,022	2,487,500	321	311	276	29,400	120,000	3,103,500
Reformed (late Dutch).................	10	10	5,300	298,000	11	11	13	2,150	10,000	357,000
Reformed (late German)..............	712	657	270,835	3,746,320	926	801	427	74,080	290,000	4,617,500
Roman Catholics..........................	362	319	197,115	6,675,050	513	424	528	....	450,000	7,825,000
Second Adventists........................	3	3	725	11,500	3	3	3	240	1,000	13,000
Unitarians......................................	4	4	2,050	68,800	5	5	5	1,000	5,000	83,500
United Brethren in Christ............	201	183	60,860	489,300	327	294	186	14,389	70,000	581,000
Universalists.................................	21	18	6,725	288,500	28	26	22	2,247	10,600	348,500
Union churches............................	26	27	7,450	51,900	29	29	17	2,315	11,000	65,800
Local missions..............................	4	4	1,875	28,500	4	4	3	500	2,500	30,000

Charitable Institutions not Educational.—There are four State hospitals for the insane, having accommodations for 2050 patients—viz. Harrisburg, Dixmont near Pittsburg, Danville, and Warren, the last now nearly completed. Besides these there are the Philadelphia Hospital for the Insane; Philadelphia Almshouse Hospital, which has an average of 1100 patients; the Pennsylvania Hospital for the Insane, one of the best institutions of its class in this country, at Haverford, near Philadelphia, having accommodations for 500 patients; and the Friends' Asylum, at Frankford, which has accommodations for about 100. The whole number treated in these hospitals in a given year is about 3854, and there are usually about 80 or 90 more males than females. The expenditure for the erection and maintenance of these hospitals is very large—the support and treatment of the indigent insane being a very heavy tax on the resources of almost any State. The annual expenditure does not vary greatly from $650,000 per annum, and the outlay for buildings exceeds $3,500,000. There are also over 1300 indigent insane maintained in almshouses and jails. The cities of Philadelphia and Pittsburg are well provided with ordinary hospitals for the sick, and there are a considerable number in the smaller cities; 4 or 5, especially in the mining districts, have received State aid. There are many charitable institutions of the asylum class, homes for aged and

*Including Bible Christians, 1 church, 1 church edifice, 300 sittings, church property, $30,000; Schwenkfelders, churches 6, church edifices 6, sittings 2200, church property $33,200.

indigent persons, lying-in asylums, eye, ear, orthopedic, and pulmonary hospitals, inebriate asylums, etc., but these are privately endowed or supported.

Penal Institutions.—Pennsylvania has two State penitentiaries—one at Philadelphia, the other at Allegheny. The Eastern penitentiary, and, to a certain extent, the Western, have been conducted on the plan of solitary confinement or complete isolation, being the only prisons on this plan in the U. S. The prisons are not self-supporting. The Western penitentiary in 1874 had 633 convicts, maintained at a cost of $88,038.76, of which only about $16,500 was from their earnings; the Eastern penitentiary had 854 convicts, maintained at a cost of $111,305.27, of which $26,795.03—less $3175.77 overwork—was the product of convicts' labor. In the county jails there remained Sept. 30, 1874, 2083 persons—1974 males, 109 females—besides 1706 awaiting trial, detained on account of fines, costs, etc. The cost of maintenance of prisoners in these jails for the year was $838,687.47.

Newspapers and Periodicals.—In 1870 there were 540 newspapers and periodicals published, having a circulation of 3,419,765, and issuing annually 241,170,540 copies. Of these, 55 were dailies, having an aggregate circulation of 466,070; 3 tri-weeklies, 10,000 circulation; 2 semi-weeklies, 17,700; weeklies, 385, with 1,214,395 circulation; 11 semi-monthlies, 825,100 circulation; 73 monthlies, 846,750 circulation; 3 bi-monthlies, with 8550 circulation; 8 quarterlies, 31,200 circulation. In 1875 the number had increased to 707, of which 78 were dailies, 2 tri-weeklies, 2 semi-weeklies, 511 weeklies, 19 semi-monthlies, 88 monthlies, 2 bi-monthlies, and 5 quarterlies.

Constitution, Courts, Representatives in Congress, etc.—The provisions of the new constitution, adopted Dec., 1873, require that every male citizen of the age of 21 years who has been a citizen of the U. S. one month and has resided in the State one year and in his election district two months prior to the election, and, being 22 years of age or upward, has paid a State or county tax within two years, shall be entitled to the rights of an elector. The executive power of the State is vested in the governor, who, with the lieutenant-governor, is elected by the people for the term of four years. The secretary of the commonwealth and attorney-general are nominated by the governor and confirmed by the senate during pleasure. The superintendent of public instruction is appointed in the same way for four years. The secretary of internal affairs is elected for four years, the auditor-general for three years, and the State treasurer for two years. The legislative power is vested in a general assembly, consisting of a senate and house of representatives, the former consisting of 50 members, elected for four years, and the latter of an indefinite number, apportioned among the counties according to the population, for two years. The number in 1876 was 201. The judicial power is vested in a supreme court, composed of 7 judges elected for a term of twenty-one years; in courts of common pleas, which have one judge for every district of 40,000 inhabitants, these judges being elected for ten years; in courts of oyer and terminer, general jail delivery, quarter sessions, and orphans' courts, all of which are to be presided over by the judge of the court of common pleas in the same district. Under the apportionment of 1872, Pennsylvania is entitled to 27 Representatives in Congress.

Counties.—The whole number of counties is 66, as follows:

COUNTIES.	Pop., 1870.	Males, 1870.	Females, 1870.	Pop., 1860.	Assessed valuation of property, 1874.	True valuation of property, 1874.
					$	$
Adams	30,315	14,879	15,436	28,006	11,368,043	22,736,086
Allegheny	262,204	132,811	129,393	178,831	282,711,269	282,711,269
Armstrong	43,382	22,157	21,225	35,797	10,102,875	40,411,500
Beaver	36,148	18,025	18,123	29,140	4,949,496	24,747,480
Bedford	29,635	14,925	14,710	26,736	4,444,221	22,221,105
Berks	106,701	53,448	53,253	93,818	21,394,010	106,970,050
Blair	38,051	18,878	19,173	27,829	7,924,435	23,773,305
Bradford	53,204	26,926	26,278	48,734	7,801,688	35,107,596
Bucks	64,336	32,235	32,101	63,578	21,398,656	74,895,296
Butler	36,510	18,351	18,159	35,594	7,988,537	27,959,870
Cambria	36,569	18,601	17,968	29,155	4,943,636	24,718,180
Cameron	4,273	2,408	1,865	......	1,006,169	3,018,507
Carbon	28,144	14,711	13,433	21,033	4,359,920	17,439,680
Centre	34,418	17,313	17,105	27,000	11,823,392	23,646,784
Chester	77,805	38,594	39,211	74,578	58,164,751	87,247,126
Clarion	26,537	13,559	12,978	24,988	3,645,033	14,580,132
Clearfield	25,741	13,492	12,291	18,759	8,420,051	12,630,076
Clinton	23,211	12,109	11,102	17,723	5,423,003	13,557,507
Columbia	28,766	14,325	14,441	25,065	5,709,501	17,128,503
Crawford	63,832	32,780	31,082	48,755	23,102,218	40,428,881
Cumberland	43,912	21,336	22,576	40,098	12,974,171	45,409,598
Dauphin	60,740	30,155	30,585	46,756	16,074,079	56,259,276
Delaware	39,403	19,507	19,896	30,597	37,702,458	50,269,944
Elk	8,488	4,793	3,695	5,915	2,372,239	7,116,717
Erie	65,973	33,435	32,538	49,432	40,784,579	61,176,868
Fayette	43,284	21,395	21,889	39,909	14,592,443	36,481,107
Forest	4,010	2,219	1,791	898	1,608,255	2,412,382
Franklin	45,365	22,313	23,052	42,126	14,184,556	35,461,390
Fulton	9,360	4,693	4,667	9,131	1,117,763	3,353,289
Greene	25,887	12,935	12,952	24,343	7,223,393	14,446,786
Huntingdon	31,251	15,499	15,752	28,100	5,305,582	26,727,910
Indiana	36,138	17,729	18,409	33,687	8,399,709	25,199,127
Jefferson	21,656	11,030	10,626	18,270	2,440,588	12,202,940
Juniata	17,390	8,697	8,693	16,986	2,490,696	9,962,784
Lancaster	121,340	59,172	62,168	116,314	103,028,120	128,785,150
Lawrence	27,298	13,440	13,858	22,999	8,721,494	17,442,988
Lebanon	34,096	16,806	17,290	31,831	12,107,691	36,323,073
Lehigh	56,796	29,047	27,749	43,753	39,744,999	49,681,136
Luzerne	160,915	84,785	76,130	90,244	26,894,111	147,917,610
Lycoming	47,626	24,227	23,399	37,399	6,791,885	40,751,310
McKean	8,825	4,598	4,227	8,859	1,411,225	5,644,900
Mercer	49,977	25,413	24,564	36,856	23,397,398	40,945,446
Mifflin	17,508	8,677	8,831	16,340	3,380,000	13,520,000
Monroe	18,362	9,401	8,961	16,758	1,499,522	8,997,132
Montgomery	81,612	40,583	41,029	70,500	38,134,631	66,735,604
Montour	15,344	7,760	7,584	13,053	2,663,706	13,318,530
Northampton	61,432	30,911	30,521	47,904	48,239,330	48,239,330
Northumberland	41,444	20,971	20,473	28,922	7,244,507	28,978,028
Perry	25,447	12,778	12,669	22,793	7,118,217	14,236,434
Philadelphia	674,022	320,379	353,643	565,529	586,164,332	1,025,785,831
Pike	8,436	4,299	4,137	7,155	898,190	5,389,140
Potter	11,265	5,734	5,531	11,470	1,335,652	6,678,260
Schuylkill	116,428	59,555	56,873	89,510	32,393,414	97,180,242
Snyder	15,606	7,773	7,833	15,035	3,642,714	10,928,142
Somerset	28,226	14,411	13,815	26,778	4,293,746	17,174,984
Sullivan	6,191	3,262	2,929	5,637	789,355	3,157,420
Susquehanna	37,523	19,172	18,351	36,267	3,471,258	20,827,548
Tioga	35,097	18,034	17,063	31,044	7,097,110	17,742,775
Union	15,565	7,651	7,914	14,145	4,439,095	13,317,285
Venango	47,925	25,625	22,300	25,043	16,359,262	32,718,524
Warren	23,897	12,813	11,084	19,190	10,421,662	10,421,662
Washington	48,483	23,766	24,717	46,805	15,395,655	46,186,965
Wayne	33,188	16,924	16,264	32,239	1,793,702	14,349,616
Westmoreland	58,719	29,254	29,465	53,736	29,323,010	51,148,767
Wyoming	14,585	7,419	7,166	12,540	4,178,550	10,446,375
York	76,134	37,626	38,508	68,200	44,557,799	77,976,148
Totals	3,521,951	1,758,499	1,763,452	2,906,215	1,760,765,415	3,425,325,415

Principal Cities and Towns.—Harrisburg, the capital, had 23,104 inhabitants in 1870; Philadelphia, the commercial metropolis, had 674,022 at the same time, and claimed about 900,000 in 1875; Pittsburg, 86,076 in 1870, and Allegheny, 53,180, were the only other cities of over 50,000 inhabitants; Scranton and Reading were each between 30,000 and 40,000; Lancaster and Erie, between 20,000 and 30,000; Williamsport, Allentown, Pottsville, York, Easton, Norristown, Altoona, and Wilkesbarre, between 10,000 and 20,000; Chester, Titusville, East Birmingham, Birmingham, and Danville, between 8000 and 10,000; while 20 other towns ranged from 5000 to 8000.

History.—Delaware Bay was discovered by Hendrick Hudson in 1609, and Delaware River ascended in 1616 by Cornelis Hendricksen. Settlements were made on the E. side of the Delaware as early as 1623, but none in Pennsylvania (except two or three trading-houses in 1626–27) before 1643, though a colony of Swedes under Peter Minuit was planted at Zwanendael in Delaware in 1638. The first settlement within the bounds of Pennsylvania was at Tinicum Island by Swedish colonists, under John Printz's administration; the same year (1643) a mill was built on Cobb's Creek, and in 1646 a church at Tinicum. Uplandt (now Chester) was founded in 1648. In 1655 the Dutch from New Amsterdam, led by Stuyvesant in person, marched upon these Swedish settlements, captured their forts, and took formal possession of the country, over which they appointed a vice-director. In 1660 a Dutch settlement was planted at the Minisinks, the settlers being colonists from New Amsterdam. When the English captured New Amsterdam in 1664 the colony on the Delaware followed its fortunes, and remained under the government of New York (except for a part of 1673–74, when the Dutch recaptured it) until Mar. 4, 1681, when Charles II. granted to William Penn the "tract of land in America lying N. of Maryland, on the E. bounded with Delaware River, on the W. limited as Maryland, and northward to extend as far as plantable," in consideration of the claims of his father, Admiral Penn. This tract King Charles named Pennsylvania. The original charter is still in existence at Harrisburg. The principal condition of this grant was the payment of two beaver-skins annually, and this was paid regularly for 99 years. William Markham, a cousin of Penn, was deputed to proceed to America and take command of the province. Finding that Lord Baltimore claimed the land along Delaware Bay and River to the mouth of the Schuylkill, Penn solicited and obtained from the duke of York a release of the territories or counties on both river and bay extending over 150 miles of shore-line. Penn landed at New Castle (now in Delaware) Oct. 27, 1682. Thence he went to Uplandt on the 29th, and in November visited the infant city of Philadelphia, and probably during that month made his famous treaty of amity with the Indians under the great elm in Shackamaxon. During 1683 he was employed in organizing his new government and providing places for the large number of immigrants (mostly Friends) who began to flock thither. A controversy having arisen between him and Lord Balti-

more concerning the boundaries between Pennsylvania and Maryland, he returned to England in 1684 for its settlement, leaving the executive government in the hands of a provincial council of which Thomas Lloyd was president. At this time the province and "territories" (the latter term designating what is now Delaware) consisted of six counties—Philadelphia, Chester, and Bucks W. of the Delaware, and New Castle, Kent, and Sussex farther S. The population was a little above 7000, of whom 2500 were in Philadelphia. In 1686 the government was vested in five commissioners, any three of whom might act, but their want of unanimity made a deputy governor necessary, and Capt. John Blackwell was commissioned in 1688. A printing-press was established in Philadelphia in 1685 by William Bradford, who printed his first book in that year, and the first Bible in 1687–88, and in 1689 defended the liberty of the press on his trial for libel. From 1692 to 1694, Penn was deprived of all authority over the province, but his rights were restored in Aug., 1694, and William Markham appointed lieutenant-governor. In 1698 the Shawanese Indians were permitted by the authorities to migrate from North Carolina and occupy the lands along the Susquehanna. In 1698, Penn again visited his province, remaining till 1701, and gave the colonists a new constitution and Philadelphia a charter. He also agreed to the eventual separation of the "territories" from the province; this separation took place in 1703. From this time to 1720 emigration to Pennsylvania, stimulated by the liberality of the proprietary government, constantly increased. The Palatinates, persecuted at home, came by thousands, and selected lands beyond the English settlements; many Huguenots also came, and the North of Ireland Protestants in large bodies took up lands still farther W., and proved themselves excellent and enterprising citizens. Penn died in 1718 at the age of seventy-four, and his heirs succeeded him as proprietors. An attempt was made in 1726 to impose a duty of 40 shillings per head on aliens in order to limit immigration, but it was defeated by a union of the Friends and Germans. Independence Hall, the old State-house, was built 1729–34. In 1735, Hannah and Springett Penn having died, John, Thomas, and Richard Penn became proprietaries. The declaration of war between France and Great Britain in Mar., 1744, led to apprehensions of trouble with the Indians, whom the French, in order to establish their line of forts from Canada to the Mississippi, were stimulating to hostility against the English colonists. Great efforts were made to retain the friendship of the Indians, but all in vain. The Shawanese were the first to break faith with the colonists. The French, having secured them as allies, constantly increased their aggressions, establishing forts at Presque Isle (Erie) and at two other points on and near Lake Erie in 1753, and in 1754 seizing the position at the forks of the Ohio (Pittsburg) and erecting Fort Du Quesne there. The repeated battles in that vicinity, in which Washington participated, the defeat of Braddock, and the ravages of the Indians which followed in 1755 and 1756, belong properly to the history of the U. S. A line of forts was erected along Susquehanna River and the Blue Mountains, and for three years the settlers acted mostly on the defensive. The French evacuated and burned Fort Du Quesne in 1758, and the same year a treaty with the Indians secured peace till 1763. Then came Pontiac's war, and throughout nearly the whole year there were terror and bloodshed along the frontier, but the Indians were severely punished in December. An insurrection occurred the same year against the provincial government. The proprietaries, John and Richard Penn, assumed the government in person from 1763 to 1776. The boundary between Pennsylvania and Maryland was run in 1767–68 by Charles Mason and Jeremiah Dixon. In 1768, by a treaty with the Six Nations, a large tract of land, called the New Purchase, embracing most of the counties of N. and N. W. Pennsylvania, was conveyed to the proprietaries, and at once induced an enlarged immigration. Pennsylvania took an active part in the movement for independence; her merchants signed the non-importation agreements and destroyed the taxed tea in 1774. The first Continental Congress was held in Philadelphia in Sept., 1774, and Pennsylvania was well represented. A provincial convention was held on Jan. 23, 1775, and after the battle of Lexington a committee of safety appointed. Within ten days after receiving intelligence of the battle of Bunker's Hill the first Pennsylvania rifle regiment was on its way to Boston. The Declaration of Independence was made public at Independence Hall, Philadelphia, July 4, 1776, and on the 8th it was read to the thousands assembled in front of that building. On July 15, 1776, a convention was called to prepare a constitution for the State of Pennsylvania, and on Sept. 28 it was ratified by the people. The battle of Brandywine occurred Sept. 11, 1777, the massacre at Paoli on the 20th, and the battle of Germantown Oct. 4, 1777. The British troops occupied Philadelphia from Sept. 26, 1777, to June 18, 1778; the State and national authorities returned soon after the latter date. The massacre of the Wyoming settlers by British soldiers, Tories, and Indians occurred in July, 1778, and was summarily avenged by the McIntosh and the Sullivan expeditions. In 1778 the charter was annulled, and the Penns were allowed £130,000 for their unsettled lands in the State. Pennsylvania furnished more than her full quota of troops for the Revolutionary war. Slavery was abolished in 1780. The State constitution was revised in 1790. The "whisky insurrection" in the western counties occurred in 1794; it occasioned great excitement, but was put down without bloodshed. Another but less considerable insurrection was attempted four years later, but was promptly suppressed. In 1799 the State capital was removed to Lancaster, and in 1812 to Harrisburg. A tram railroad was built in 1806 in Ridley township, Chester co. In the war of 1812, Pennsylvania quickly raised her quota of troops. The State claims a share in the glory of the naval battle of Lake Erie, Perry's fleet being built and fitted out at Erie. After this war the State was largely engaged in colossal enterprises of internal improvement—canals and railroads—which for some years embarrassed her finances. Her common-school system was established in 1834; a revised constitution was adopted in 1838. In 1859 the petroleum discoveries were made, creating an excitement only less intense than that following the announcement of the discovery of gold in California in 1848–49. After the lapse of fifteen years Pennsylvania still remains the centre of the coal-oil interest, the north-western corner of the State, on and near Oil Creek, furnishing more than three-fourths of all the petroleum of commerce. In the late civil war Pennsylvania was prompt, generous, and always ready; she sent 362,284 men into the field, besides over 25,000 militia in 1862, and fed hundreds of thousands from other States at her refreshment saloons in Philadelphia. The State was three times invaded by the Confederates—first on Oct. 10, 1862, when Chambersburg was captured and military stores burned; second, by Gen. Lee, when the battle of Gettysburg was fought on her territory, and several towns put under contribution by the enemy; third, in July, 1864, when Chambersburg was burned. In 1873 her constitution was revised for the third time, and the revision ratified by over 100,000 majority.

Governors.

I. Colonial.

1. *Under the Swedes.*

Peter Minuit....................1633
Peter Hollander....................1641
John Printz....................1643
John Pappegoya....................1653
Johan C. Rysingh....................1654

2. *Under the Dutch.*

Deryck Schmidt, *pro tem*...1655
John Paul Jacquet....................1655
Colony divided into city and company....................1657–62
Jacob Alricks (city)....................1657
Alex. D'Hinoyossa (city)...1659
Goeran Van Dyke (com'y)..1657
Wm. Beekman (company)..1658
Colony united....................1662
Wm. Beekman....................1662
Alex. D'Hinoyossa....................1663
Captured by the English...1664

3. *Under the English.*

Col. Richard Nichols (gov.) 1664
Robert Carr (deputy gov.)..1664
Col. Francis Lovelace....................1667
Anthony Colve (gov.) Dutch 1673
Peter Alricks (deputy gov.).1673

4. *Under the English.*

Sir Edmund Andross....................1674

5. *The Proprietary Government.*

Wm. Markham (dep. gov.) 1681
William Penn (proprietor) 1682
The Council (Thos. Lloyd, president)....................1684
Commiss'ners ap. by Penn..1688
John Blackwell (dep. gov.) 1688
The Council (Thos. Lloyd, president)....................1690
Thos. Lloyd (d. g. of prov.)..1691
William Markham (deputy governor lower counties) 1691
Benj. Fletcher, governor of New York (governor).....1693
Wm. Markham (lieut.-gov.) 1693
Wm. Markham (dep. gov.) 1695
William Penn (proprietor) 1699
Andrew Hamilton (d. g.)...1701
Council (E. Shippen, pres.).1703
John Evans (deputy gov.)..1704
Charles Gookin (dep. gov.) 1709
Sir Wm. Keith (dep. gov.)..1717
Patrick Gordon (dep. gov.) 1726
Council (J. Logan, pres.)....1736
George Thomas (dep. gov.) 1738
Council (A. Palmer, pres.)...1747
James Hamilton (dep. gov.) 1748
Rob. Hunter Morris (d. g.).1754
William Denny (dep. gov.) 1756
Jas. Hamilton (dep. gov.)...1759
John Penn (lieut.-gov.)......1763
Council (J. Hamilton, pres.) 1771
Richard Penn (lieut.-gov.) 1771
John Penn (lieut.-gov.)......1776

6. *In the Revolution.*

Com. of Safety (B. Franklin ch'n), Sept., 1776–Mar., 1777

7. *Pres'ts of Supreme Ex. Council.*

Thos. Wharton, Jr...Mar. 5, 1777
Joseph Reed.........Dec. 22, 1778
William Moore......Nov. 15, 1781
John Dickinson....Nov. 7, 1782
Benj. Franklin......Oct. 17, 1785
Thomas Mifflin.....Nov. 5, 1788

II. State.

1. *Under the Constitution of 1790.*

Thomas Mifflin....................1790
Thomas McKean....................1799
Simon Snyder....................1808
William Findlay....................1817
Joseph Heister....................1820
John Andrew Shulze..........1823
George Wolf....................1829
Joseph Ritner....................1835

2. *Under the Constitution of 1838.*

David R. Porter....................1839
Francis R. Shunk....................1845
Wm. F. Johnston (acting)..1848
William Bigler....................1852
James Pollock....................1855
William F. Packer............1858
Andrew G. Curtin.............1861
John W. Geary....................1867
John F. Hartranft.............1873

3. *Under the Constitution of 1873.*

John F. Hartranft.............1876

Electoral and Popular Vote for President and Vice-President.

Elect. year.	Candidates for whom the electoral vote of the State was cast.	Elect. vote.
1788	George Washington P......	10
	John Adams V.-P..........	8
	John Hancock V.-P........	2
1792	George Washington P......	15
	John Adams V.-P..........	14
	George Clinton V.-P........	1
1796	John Adams P.............	1
	Thomas Jefferson P.........	14
	Thomas Pinckney V.-P.....	2
	Aaron Burr V.-P....	13
1800	Thomas Jefferson P.........	8
	Aaron Burr P..............	8
	John Adams V.-P..........	7
	C. C. Pinckney V.-P........	7
1804	Thomas Jefferson P...... George Clinton V.-P.....	20
1808	James Madison P......... George Clinton V.-P.....	20
1812	James Madison P......... Elbridge Gerry V.-P......	25
1816	James Monroe P.......... D. D. Tompkins V.-P.....	25
1820	James Monroe P.......... D. D. Tompkins V.-P.....	24

Elect. year.	Candidates for whom the electoral and a majority of the popular vote of the State were cast.	Elect. vote.	Pop. vote.	Opposition or minority candidates.	Pop. vote.	Other candidates.	Pop. vote.
1824	Andrew Jackson P....... John C. Calhoun V.-P...	28	36,100	John Quincy Adams P... Nathan Sanford V.-P....	5,440	William H. Crawford P. Martin Van Buren V.-P. Henry Clay P.......... Nathan Sanford V.-P...	4,206 1,609
1828	Andrew Jackson P....... John C. Calhoun V.-P...	28	101,652	John Quincy Adams P... Richard Rush V.-P......	50,848		
1832	Andrew Jackson P....... William Wilkins V.-P....	30	90,983	Henry Clay P............ John Sergeant V.-P......	56,716		
1836	Martin Van Buren P.... Richard M. Johnson V.-P.	30	91,475	William H. Harrison P.. Francis Granger V.-P...	87,111		
1840	Wm. H. Harrison P...... John Tyler V.-P..........	30	144,021	Martin Van Buren P..... Richard M. Johnson V.-P.	143,676	James G. Birney P...... Thomas Earle V.-P	343
1844	James K. Polk P......... George M. Dallas V.-P...	26	167,535	Henry Clay P........... T. Frelinghuysen V.-P...	161,203	James G. Birney P...... Thomas Morris V.-P.......	3,138
1848	Zachary Taylor P....... Millard Fillmore V.-P...	26	185,360	Lewis Cass P............ William O. Butler V.-P..	171,176	Martin Van Buren P..... C. Francis Adams V.-P..	11,263
1852	Franklin Pierce P........ William R. King V.-P...	27	198,568	Winfield Scott P......... William A Graham V.-P.	179,174	John P. Hale P.......... George W. Julian V.-P..	8,525
1856	James Buchanan P...... J. C. Breckenridge V.-P..	27	230,710	John C. Fremont P...... William L. Dayton V.-P.	147,510	Millard Fillmore P....... A. J. Donelson V.-P.....	82,175
1860	Abraham Lincoln P..... Hannibal Hamlin V.-P..	27	268,030	Stephen A. Douglas P.. H. V. Johnson V.-P.... J. C. Breckenridge P... Joseph Lane V.-P......	16,765 178,871	John Bell P.............. Edward Everett V.-P....	12,776
1864	Abraham Lincoln P...... Andrew Johnson V.-P...	26	296,391	George B. McClellan P... George H. Pendleton V.-P.	276,316		
1868	Ulysses S. Grant P...... Schuyler Colfax V.-P....	26	342,280	Horatio Seymour P...... Francis P. Blair, Jr., V.-P.	313,382		
1872	Ulysses S. Grant P...... Henry Wilson V.-P......	29	349,589	Horace Greeley P......... B. Gratz Brown V.-P....	212,041	Charles O'Conor P.......	No report.

(For a valuable collection of documents relative to the present condition of Pennsylvania, its geology, etc., as well as for the brief but comprehensive abstract of its history given above, the writer is indebted to William H. Egle, M. D., author of the latest and best *History of Pennsylvania*, and of the sketch of Harrisburg in this CYCLOPÆDIA.) L. P. BROCKETT.

Pennsylva'nia, tp. of Mason co., Ill. Pop. 932.

Pennsylvania College, Gettysburg, Pa., was founded in 1832, and is under the auspices of the Lutheran Church. In 1834 the State of Pennsylvania appropriated $18,000 to the institution, and, for a number of years, annually $1000. By an act of the legislature in 1850 one-third of the value of the funds of Franklin College of Lancaster, Pa., was transferred to Pennsylvania College, to establish in it a professorship known as the "Franklin professorship." A preparatory department has been from the first connected with the institution, designed to afford a suitable training for admission into college. The control is in the hands of a board of thirty-six trustees, which perpetuates itself by elections on the occurrence of vacancies. The instruction is given in the college proper entirely by the professors in the different departments, who constitute the faculty and administer the government and discipline under the board of trustees. The first president was Rev. C. Philip Krauth, D. D., from 1834 to 1850, followed by Rev. H. L. Baugher, D. D., at whose death, in 1868, Rev. M. Valentine, D. D., succeeded. Within the last few years additional advantages have been provided by the founding of professorships of the German language and literature, of the English language and literature, and of the natural sciences. The institution possesses chemical and philosophical apparatus, a laboratory for practical chemistry, and a cabinet of mineralogy. The libraries of the college and literary societies contain over 18,000 volumes. The chair of the English language, etc., has been endowed by the gift of $20,000 by John E. Graeff, Esq., of Philadelphia; and the professorship of the natural sciences by the same amount by the brothers A. F. and G. P. Ockershausen of New York. M. VALENTINE.

Pennsylvania Dutch (more correctly *German*) is not a corrupt dialect of German formed in America, nor is it akin to such broken English as Leland attributes to European Germans in his *Breitmann Ballads*, but it is a legitimate South-German dialect, due to the fusion of forms existing on the upper Rhine in Rhenish Bavaria, Baden, Darmstadt, Würtemberg, German Swisserland, and Alsace, and taking up an English element, as English itself took up native words like *hickory*, or French forms like *prairie*, *bayou*, and *ville*. The characteristics of the dialect may be learned from the excellent poems in it by the late H. Harbaugh, D. D. (1870), and in Haldemann's *Pennsylvania Dutch* (1872), both published by the Reformed Church Publication Board, Philadelphia. Careless speakers of English unconsciously corrupt their language with Germanic idioms, as in the use of "dumb" for *dull* or *stupid*, and "red beet" for *beet*, translating *die rothe rübe*, because in German a "white" beet (*weisse rübe*) is a turnip. S. S. HALDEMAN.

Pennsylvania, University of, originated as a charity school 1745; founded as an academy 1749; incorporated as a college 1755; and erected into a university 1779. The medical department was founded in 1765, and the law department 1789. In 1872 the institution was located at the junction of Thirty-sixth street, Darby road, and Locust street, in two squares of about sixteen acres, in West Philadelphia, Pa., and having separate and commodious buildings for the medical hall, for the university hospital, and for the departments of arts, science, and law. The department of arts, with 13 teachers, embraces the collegiate branches, and the department of science, with 18 teachers, those of architecture, chemistry, drawing, engineering, geology, metallurgy and assaying, mineralogy, and mining, each department having a course of four years. Connected with the department of science are a mineralogical cabinet and a collection of American fossils, containing 10,000 specimens. The law department has a course of two years and 5 professors. The medical department, with a faculty of 24 professors, has a two years' course, and is provided with a valuable museum and cabinets. Adjoining the medical hall is a well-arranged hospital, having accommodations for nearly 200 patients, affording an invaluable means of clinical instruction. The various libraries connected with the university number 18,000 volumes. In 1875 the whole number of professors was 41, other teachers 15, and students 800.

Penn'ville, post-v. of Penn tp., Jay co., Ind.

Pen'ny [Ger. *Pfennig*], an English coin, first mentioned in the laws of Ina, king of Wessex, about 695 A. D. It was at first of silver, and at one time weighed 22½ grains troy, being the twelfth part of a shilling, and designated by the letter *d*, the initial of the Lat. *denarius*, but its value and weight slowly declined. The first copper pence were introduced in 1797. At present the English penny is of bronze.

Penny (VIRGINIA), b. at Louisville, Ky., in 1826; was educated at the female seminary at Steubenville, O.; devoted herself to the industrial side of the woman's question, in behalf of which she has written in periodicals, and has published *The Employments of Women, a Cyclopædia of Woman's Work* (1862), *Five Hundred Employments adapted to Women* (1868), *Think and Act, a Series of Articles pertaining to Men and Women, Work and Wages* (1869).

Penn Yan [so called because originally settled by *Penn*sylvanians and *Yan*kees], p.-v., Milo tp., cap. of Yates co., N. Y., on Northern Central R. R., at the foot of Keuka Lake, near Seneca Lake, which is navigated by two steamers; has 5 churches, 2 banks, 3 newspapers, an academy, a fine water-power, extensive trade, and manufactures. P. 3488.

Penny'backer (ISAAC S.), b. in Shenandoah co., Va., in 1806; studied law, and entered upon the practice of his profession; was a representative in Congress 1837–39; afterward a judge of the district court of Western Virginia; and was in 1845 elected as a Senator in Congress for Virginia for the ensuing term of six years, but died before the completion of the term. D. in Washington Jan. 12, 1847.

Pen'nypacker (GALUSHA), b. in Pennsylvania. Entering the service as private on the outbreak of the civil war, he was in August appointed captain in the 97th Pennsylvania volunteers, and in October major, attaining the colonelcy of that regiment in Aug., 1864; served in the department of the South to Apr., 1864; engaged in operations in Florida and against Charleston. With the 10th corps, Army of the James, he participated in the attack

on Drury's Bluff, May, 1864 (thrice wounded), and engaged in operations on the N. side of James River and in front of Petersburg to Sept., 1864; commanded a brigade in the assault and capture of Port Harrison (wounded) and action of Darbytown Road. In the final and successful attack upon Fort Fisher he led his brigade with great bravery, receiving severe wounds which confined him to the hospital till Apr., 1866, when he resigned, being meanwhile (Feb., 1865) appointed brigadier-general. In July, 1866, he was appointed colonel of the 34th Infantry, U. S. A.; transferred to the 16th regiment in 1869; brevet brigadier-general for Fort Fisher, and major-general for gallant services during the war.

Pennyroy'al, a popular name for *Mentha pulegium*, a fragrant labiate herb of the Old World, growing wild or cultivated in gardens, and used in Europe in domestic medicine as a stimulant and carminative. In the U. S. the name is given to *Hedeoma pulegioides* (low pennyroyal) and *Mentha Canadensis* (high pennyroyal), both having very nearly the odor of the English pennyroyal. They are valuable in domestic practice as deobstruents, carminatives, and diaphoretics.

Pennyweight. See WEIGHTS AND MEASURES.

Pe'no, tp. of Pike co., Mo. Pop. 2160.

Penob'scot, county of Central Maine. Area, 3350 square miles. Its N. portion is covered with dense forests, and is hilly and in parts mountainous. The S. part is well settled, and contains much good soil. Live-stock, grain, potatoes, and wool are leading products. The manufactures are important, and include lumber, carriages, cooperage, harnesses, leather, brick, shipping, boots, shoes, metallic wares, clothing, etc. The noble Penobscot River traverses the county, and affords great water-power as well as important navigation and fisheries. The county is intersected by the Maine Central, the Bangor and Piscataquis, and the European and North American R. Rs. Cap. Bangor. Pop. 75,150.

Penobscot, p.-v. and tp., Hancock co., Me. P. 1418.

Penobscot Bay penetrates the coast of Maine for 30 miles, having Waldo and Knox cos. on the W. and Hancock co. on the E. Its deep waters abound in islands and good harbors; principal tributary, Penobscot River.

Penobscot River, the longest and largest river of Maine, and the most important navigable stream in the New England States, rises in Somerset co., near the Canada line, flows E. into Chesuncook Lake, thence S. E. to its union with the Mattawamkeag, having 12 miles above united in the town of Medway with the Seboois or E. branch of the Penobscot. Afterwards its course is S. by W. to Penobscot Bay. It is navigable for large ships to Bangor, 60 miles, where the tide rises 17 feet. Above this point small steamers run for many miles. Its upper waters afford valuable motive-power, and great numbers of logs are floated from the forests of Northern Maine to Bangor, and then sawed for lumber. Its length is 300 miles. The valley of the Penobscot has an area of 8200 square miles. The mean outflow of water is given as 146,250 cubic feet per minute. Its enormous motive-power is only in small part utilized. It is the most important salmon-stream in the U. S., its product excelling in value and quality of fish, though not in quantity, that of the Columbia River.

Penobscots, a tribe of Indians in Maine, residing upon an island of the river of the same name, at Oldtown, 8 miles N. of Bangor. They belong to the Abenaquis branch of the Algonkin family, being nearly related to the Passamaquoddies (of whom about 500 remain on Passamaquoddy Bay), and to the Micmacs and Malaseets (or Malecites) of New Brunswick. By early French writers they were called Etechemins. They were allies of the colonists during the war of the Revolution, and were rewarded by the grant of a large tract of land on both sides of Penobscot River, most of which they have sold piecemeal. They are Roman Catholics, have a church, several schools, and some devotional works in their language which were prepared by Rev. Eugene Vetromile, S. J., and possess a fund of more than $50,000, administered by the State authorities. They have established an elective government, and number about 500.

Penobs'quis, p.-v. of Kings co., N. B., on European and North American Railway, 51 miles from St. John, has extensive saltworks and some paper-mills. P. about 400.

Pen'rith, town of England, county of Cumberland, is beautifully situated and well built, and has some manufactures of cotton, linen, and woollen goods. Pop. 7189.

Pensaco'la, city, cap. of Escambia co., Fla., on Pensacola Bay, 10 miles from the Gulf of Mexico and 64 miles E. of Mobile, southern terminus of Pensacola and Louisville R. R., has an excellent harbor, with 21 feet of water on the bar, and was a place of considerable importance during the Spanish and English government of Florida. It has a navy-yard and forts, and was the scene of important military and naval operations during the war of the rebellion. The ruins of the old Spanish fortresses San Miguel and San Bernardo are a short distance to the rear of the city. Pensacola has 5 churches, 2 newspapers, several schools, a custom-house, and a considerable trade in lumber. The climate is usually healthy, but subject to occasional visitations of yellow fever. P. 3347.

Pensacola, tp. of Yancey co., N. C. Pop. 319.

Pensacola Bay, an inlet of the Gulf of Mexico, at the W. extremity of Florida, extending inland N. E. about 35 miles, affording a deep, capacious, and commodious harbor. It is divided into Escambia Bay on the W. and the Bay of Santa Maria de Galvez on the E., and receives Escambia, Black Water, and Yellow Water rivers. The entrance is 1 mile wide between Santa Rosa Island, on the E. defended by Fort Pickens, and the entrance point of the mainland on the W., on which stands Fort McRee. Less than 2 miles N. of the latter stands the old Spanish fort of San Carlos de Barrancas, and in its immediate vicinity a naval hospital, extensive barracks, and a lighthouse, while a short distance N. E. is the navy-yard, which was surrendered to the Florida militia Jan. 12, 1861, but recovered by the Federal forces, after sharp engagements, early in 1862.

Pensau'kee, post-v. and tp., Oconto co., Wis. P. 777.

Pen'sions [Lat. *pensio*, "payment"], allowances of money, generally in fixed amounts and annual payments, made by the government to certain individuals or to their families and representatives, in consideration of some public services performed or supposed to have been performed by them. In Great Britain pensions are conferred upon the judges of the higher courts and upon many other civil officers who have performed their duties for a specified number of years and then resigned their active functions. They are also frequently granted to distinguished and meritorious authors, artists, scientific men, inventors, and the like, or to their widows or families, for the purpose of rewarding personal merit and of encouraging literature, art, and science. The policy of the U. S. government has confined the bestowment of pensions to the officers and privates who have served in the army or navy during the wars in which the country has been engaged, or who have been wounded or otherwise disabled while in active service, and to their widows, children, and other dependent relatives. In distributing its bounty among these military classes, Congress has exercised a liberality unsurpassed, and indeed unequalled, by any other modern nation. The provisions of the existing laws which determine the various classes of the national beneficiaries and the amounts of their respective pensions, and which are too numerous and complicated to be quoted, are contained in the *U. S. Rev. Stat.* (§§ 4692–4791). JOHN NORTON POMEROY.

Pentac'rinus [Gr. πέντε, "five," and κρίνον, "lily"], an interesting genus of ENCRINITES (which see) remarkable as containing, besides many fossil species, the *P. caput medusæ*, long considered to be the only species of living encrinite, but several others are now known.

Pen'tateuch [from πέντε, "five," and τεῦχος, "book"], the collective name of the first five books of the Old Testament—Genesis, Exodus, Leviticus, Numbers, and Deuteronomy. It originated from the Greek translators and Fathers; the Jews themselves called this division of their sacred book *Torah*, "the Law." (See BIBLE.)

Pentathion'ic Acid, one of the sulphur-acids, formed, like common sulphuric acid, by combination of sulphur, oxygen, and water. It is $H_2O.S_5O_5$. It was discovered by Wackenroder, and prepared by the interaction of sulphohydric acid and sulphurous monohydrate, $5(H_2O.SO_2) + 5H_2S = H_2O.S_5O_5 + 9H_2O + S_5$. In liquid form it is inodorous; with care may be concentrated, but when more highly heated decomposes into S, SO_2, H_2S and $H_2O.SO_3$. Its salts are almost all soluble, that of baryta even in alcohol, and crystallizing therefrom in square prisms.

H. WURTZ.

Pen'tecost [Gr. πεντηκοστή, "fiftieth"], one of the three principal festivals of the Jews, celebrated on the fiftieth day after the Passover. It was originally called the "Feast of Weeks," took place at the beginning of harvest-time, was characterized by the offering, as "first fruits," of two loaves of leavened bread made from new grain, and was a period of liberality to the poor. In modern times the Jewish festival of the Pentecost lasts two days, and the anniversary of the giving of the Law on Sinai has been combined with the earlier festival. In the Christian churches the word Pentecost has a different meaning, derived from the occurrences related in Acts ii.—viz. the de-

scent of the Holy Spirit upon the infant Church ten days after the Ascension, the gift of tongues, and the conversion of 3000 persons. In the English Church, Pentecost is known as Whitsunday or Whitsuntide, from the white garments formerly worn by candidates for baptism.

Penthièvre′, de (Pierre Philippe Jean Marie d'Orléans), Duke, son of the Prince de Joinville, b. Nov. 4, 1845. He went through, with the aid of a tutor, the course of study of the College of Edinburgh before reaching the age of fifteen. His predilections pointed strongly to the naval service, and in Sept., 1861, the prince, with permission of the American government, placed him in the U. S. Naval School, then at Newport, where he had the rank of naval cadet. He received the commission of midshipman in 1863, ensign the same year, and lieutenant in 1864, during which time he made a cruise in the Gulf of Mexico. Political reasons constrained his reluctant resignation from the service of the U. S. He then entered the Portuguese service, in which he remained two years. Since the return of his family to France he has found his chosen sphere of duty as a naval officer in the service of his native country.

Pent′land Frith, a channel connecting the Atlantic with the German Ocean, and separating the Orkney Islands from Scotland, is 17 miles long, from 6 to 8 miles broad, and annually passed through by about 4000 vessels, though it is very difficult to navigate.

Pent′water, p.-v. and tp., Oceana co., Mich., at the terminus of the Chicago and Michigan Lake Shore R. R., on Lake Michigan, has 2 churches, 1 bank, 1 newspaper, saw and shingle mills, 1 foundry, and 4 hotels. Its deep harbor affords excellent dockage. Pop. of v. 1294; of tp. 1414. Amos Dresser, Jr., Ed. "News."

Penum′bra. See Eclipse.

Pen′za, government of European Russia, lies around the rivers Moksha and Soora, and comprises an area of 14,768 square miles, with 1,197,393 inhabitants. The ground is mostly level and somewhat elevated, and the soil very fertile. Corn, flax, hemp, tobacco, hops, and beetroots are raised; splendid forests of oak trees cover nearly one-third of the country. Besides agriculture, the principal branch of industry, manufactures of linen stuffs, spirits, glass, and beetroot-sugar are carried on.

Penza, town of European Russia, capital of the government of the same name, is finely built on the banks of the Soora, and contains a large park and many beautiful promenades and gardens. It has many educational and benevolent institutions, some manufactures, and an active trade in corn and timber. P. about 28,000.

Penzance′, town of England, county of Cornwall, on Mount's Bay, is well built and beautifully situated. It has some manufactures of woollens and cloth, and an active trade in flax, hemp, timber, corn, iron, and coal. The mild climate and the beauty of the surroundings attract a great number of visitors. Pop. 10,406.

Peo′ria, county of Central Illinois. Area, 580 square miles. It is bounded on the S. E. by Illinois River and Lake Peoria. It is undulating, fertile, and contains valuable deposits of coal. Live-stock and grain are leading products. The county is traversed by various railroads. Cap. Peoria. Pop. 47,570.

Peoria, city and tp., cap. of Peoria co., Ill., situated on the Illinois River at the foot of Peoria Lake, an expansion of the river ½ to 1 mile wide and 20 miles long, 160 miles S. W. from Chicago. It lies along the W. bank of the river and lake about 4 miles, and covers an elevated plateau extending back three-fourths of a mile to a bluff rising 120 feet above the lake. Upon the bluff are many fine residences, and from it may be had many fine views of the river-valley and adjacent country. The city has an extensive commerce by regular packets with Chicago and St. Louis 173 miles distant. Eleven railways terminate in the city or pass through it. The total receipts of freight by river and railroad for 1876 were 1,285,978,000 pounds; shipments, 960,195,070 pounds. There were received 7,662,695 bushels of corn—an amount exceeded by only one city in the North-west. Elevator capacity, 1,260,000 bushels. An abundance of coal found in the bluffs near by favors manufactures. The yield of high-wines for 1876 was 9,430,498 gallons. There are four large packing-houses, numerous establishments engaged in manufactures of wood and iron, especially farm-implements, several large distilleries, flour-mills, etc., and extensive stockyards. The city has a flourishing board of trade, 3 national and 4 private banks. The internal revenue from this city on whisky alone for 1876 was $8,341,995.80—an amount exceeded by no other city in the U. S. It has an efficient system of free schools, including a good high school, a county normal school, numerous private schools, a business college, 2 circulating libraries of 12,300 volumes, and 10 daily and weekly newspapers. There are 32 churches with 36 Sunday-schools. Among the principal buildings are the new courthouse, costing $250,000, the chamber of commerce, two opera-houses, and many fine churches. There are several lines of horse railways and pleasant parks. The streets are generally well lighted. There is a good fire department, and an extensive system of waterworks gives an ample supply of water and protection from fire. Four artesian wells yield an abundance of white sulphur water. The city was settled in 1779; its growth was slow for many years; latterly it has grown rapidly. Pop. in 1870, 22,849: in 1877, estimated at 35,000. Pop. of tp. 794. S. H. White.

Peoria, a v. of Butler tp., Miami co., Ind. Pop. 119.

Peoria, post-v. and tp., Franklin co., Kan. P. 1160.

Peoria, post-v. of Hill co., Tex. Pop. 234.

Peoria Indians, a tribe of aborigines once inhabiting Illinois. In revenge for the murder of Pontiac in 1769 the northern tribes fell upon and almost exterminated them and the neighboring Illinois tribes. In 1832 their remnant was removed to Kansas, and in 1867 to the Indian Territory, where they are prosperous, though very few in number. They are confederated with the Weas, Kaskaskias, and others.

Peoria Lake See Peoria.

Peotone, post-v. and tp., Will co., Ill. Pop. 1213.

Pep′in, county of W. Wisconsin, bounded S. W. by the Mississippi River (Lake Pepin), and E. partly by Chippewa River. Area, 250 square miles. It is somewhat uneven, and has a fertile soil well adapted to grain-culture. Cap. Durand. Pop. 4659.

Pepin, v. of Glasgow tp., Wabashaw co., Minn. P. 336.

Pepin, post-v. and tp., Pepin co., Wis., on Chippewa River and Lake Pepin. Pop. 956.

Pepin, Lake, an expansion of the Mississippi River, 27 miles long and from 2 to 3 miles wide, having Pierce and Pepin cos., Wis., on the N. E., and Goodhue and Wabashaw cos., Minn., on the S. W. It is surrounded with rocky ramparts of picturesque and inspiring appearance. The lake is not very deep, and affords a good supply of fish.

Pepin le Bref, b. in 714, son of Charles Martel and father of Charlemagne; became in 741 major-domus of Neustria and Burgundy under Childeric III., a *fainéant*, and in 747 succeeded his brother Carloman as major-domus of Austrasia and the Rhine country, including Thuringia and Suabia. In 749 he defeated the Bavarians, and in 752 was crowned king of the Franks by St. Boniface by authority of Pope Zachary; conquered Septimania from the Saracens 752–760; was again crowned by Pope Stephen III. 754; broke the power of the Lombards in Italy 754–756, and gave the exarchate of Ravenna and the Pentapolis to the Holy See, the origin of the temporal power of the popes; overcame the Saxons 757; took Narbonne from the Saracens 759; waged a stubborn war with Guaifar, duke of Aquitania, 760–768, and in the latter year procured the assassination of his valorous enemy. D. Sept., 768. His title, *Le Bref* (the "short"), was given on account of his small stature.

Pepin of Héristal, founder of the Carlovingian line of Frankish kings, a grandson of Pepin von Landen, mayor of the palace in Austrasia; became duke of the Austrasian Franks 680, and in 687, by the battle of Testry, conquered Burgundy and Neustria, and afterwards subdued the Frisians and ravaged Suabia. D. Dec. 16, 714 A. D. He never assumed the royal title, but exercised sovereign power in the name of four successive Merovingian *fainéant* kings. Charles Martel was his natural son.

Pe′poli (Carlo), Count, b. in 1801 at Bologna, where he was educated, and where he still lives. He was a member of the provisory government of 1831, and on its fall emigrated first to Switzerland, then to France, and finally to England, where he lectured on the fine arts in Italy, and wrote the libretto for *I Puritani*. In 1839 he was appointed professor of Italian literature in the London University, a post which he held till his return to Italy in 1848, when he entered into the service of the pontifical army. He was vice-president of the Roman republic, and on its overthrow by the French again retired to England, where he devoted himself to literature till 1859, when he once more returned to his native country, and was soon after appointed senator of the kingdom of Italy.

Pep′per [Lat. *piper*] is a climbing shrub, with a smooth, woody stem from twelve to twenty feet long, with leathery, ovate leaves, and, opposite to each leaf, a solitary spike with hermaphrodite flowers, and fruits of the size of a pea and bright red when ripe. The common or black pepper is a native of the East Indies, but now extensively cultivated in most tropical countries. It was known to the Romans, and highly appreciated during the Middle Ages, when a

pound of pepper was considered a royal present. It is now one of the most common spices.

Pep'per (William), M. D., b. at Philadelphia, Pa., Aug. 21, 1843; graduated at the University of Pennsylvania 1861; became professor of clinical medicine in the University of Pennsylvania; physician to the Pennsylvania Hospital and to the Children's Hospital, fellow of the College of Physicians, president of the Pathological Society, and director of the biological department of the American Academy of Natural Sciences.

Pep'perell, post-v. and tp., Middlesex co., Mass., on the Nashua River and the Worcester and Nashua R. R., has 4 paper, 5 grist, and 3 saw mills, 4 churches, and a fine town-hall. Pop. 1842.

Pepperell (Sir William), Bart., b. at Kittery Point, Me., June 27, 1696, of Welsh descent, was the son of a fisherman; became a merchant and a distinguished Indian fighter; was a member of the Massachusetts council 1727–59; became chief-justice of the common pleas court 1730; captured Louisburg 1745; was made a baronet 1746; a colonel of the British army 1749; major-general 1755; lieutenant-general 1759; was acting governor of Massachusetts 1756–58. D. at Kittery, Me., July 6, 1759.—W. P. Sparhawk, his grandson, took his name, title, and his great estates in 1774, but lost everything in consequence of his Tory principles in 1778. D. in London Dec. 17, 1816.

Pepperidge. See Black Gum.

Pep'permint, the *Mentha piperita*, a well-known labiate herb, a native of the Old World, but completely naturalized in the New. This plant and its essential oil are extensively used in confectionery, and in medicine as a carminative and to conceal the flavor of nauseous drugs. Peppermint is extensively cultivated in St. Joseph co., Mich., and in Wayne co., N. Y. Lyons, N. Y., is the great seat of the distillation of oil of peppermint in the U. S. Great quantities are produced here, and the business is in good seasons a very lucrative one.

Pep'perville, tp. of Butler co., Neb. Pop. 197.

Pep'sine [Gr. πέψις, "digestion"], an active principle of the gastric juice, precipitated by alcohol or lead-acetate. It has never yet been perfectly isolated, but is known to be one of the albuminoids or nitrogenous organic substances. Substances called pepsine, and usually containing more or less of the active principle, are often prescribed in dyspepsia for the relief of the irritated stomach; and no doubt in well-selected cases the prescription is a useful one.

Pe'pusch (Johann Christoph), b. at Berlin in 1667; was a musician at the court of Brandenburg when in 1698 he went to London. Here he founded in 1710 the Academy of Ancient Music, arranged the music to the *Beggar's Opera*, wrote a *Treatise on Harmony* in 1731, and d. July 20, 1752.

Pepys (Samuel), F. R. S., b. Feb. 23, 1633, the son of a London tailor; was educated at Magdalen College, Cambridge; became a Roundhead, but turned royalist under Monk, and was made secretary to the generals of the fleet; was appointed clerk of the acts of the navy 1660, and had other important offices in connection with the admiralty, for he had good talents for business. He was (1673–79) secretary for the affairs of the navy; was imprisoned 1679–80 for alleged complicity in the popish plot; was afterwards the secretary to the admiralty until 1689; president of the Royal Society 1684–86, and was in 1690 imprisoned for a time as a Jacobite. D. at London May 26, 1703. Pepys's *Diary*, kept in shorthand (1660–69), has been often imperfectly reprinted since 1825, when Lord Braybrooke's very imperfect edition appeared. Bohn's ed. (4 vols.) is very generally accessible, but that of Mynors Bright (1875) is the fullest and most satisfactory. This work is instructive and entertaining, giving us a valuable insight into the every-day life of the times of the later Stuarts. His *Memoirs of the Royal Navy* (1690), *Portugal History* (1677), and other writings are of some value. He was an industrious collector of ballads, a dabbler in the various sciences and the fine arts, and founder of the Pepysian Library at Cambridge.

Pequan'nock, tp. of Morris co., N. J. Pop. 1534.

Pequea', post-v. and tp., Lancaster co., Pa., on the Conestoga River. Pop. 1276.

Pe'quods, or **Pequots,** a tribe of Algonkin Indians of Eastern Connecticut, nearly related to the Mohegans, whom the early colonists nearly exterminated in the "Pequot war" of 1637. (See Mason, John.) The remnants were scattered among the neighboring tribes, but a few were afterwards gathered into bands in the towns of Ledyard and North Stonington, where about 50 still remain. The others went to Oneida co., N. Y., with the Brotherton Indians, and are now at Green Bay, Wis.

Pe'ra [Gr. πέραν, "beyond"], a suburb of Constantinople, beyond (N. of) the Golden Horn, over against the old Stamboul, and connected with it by a floating bridge. It crowns a bold promontory, and is the diplomatic and Frankish quarter of the Turkish metropolis. The name appears in the *Chronographia* (lib. xvi.) of Malalas, a Byzantine historian of the sixth century.

R. D. Hitchcock.

Peræ'a [Gr. Περαία, from πέραν, "beyond"], the name of several districts lying beyond a river, strait, or sea, but used especially of that part of Trans-Jordanic Palestine which extended from Pella on the N. to Machærus on the S., and from Philadelphia on the E. to the Jordan on the W. These were its boundaries as given by Josephus in his *De Bello Judaico*, iii. 3, 3. It is there described as generally wild and rugged, though well watered by streams and fountains, and in some parts of it very fertile. The name has also been applied to the whole of Palestine beyond the Jordan. (See Reland, *Palæstina Illustrata*, p. 197.) R. D. Hitchcock.

Peramel'idæ [*Perameles*, from Gr. πήρα, "pouch;" Lat. *meles*, "badger"], a family of marsupials of the order Syndactyla and section Entomophaga, distinguished by the elongated snout and slender legs. Teeth of three kinds and in large number are developed—viz. M. $\frac{4}{4}$, P. M. $\frac{3}{3}$, C. $\frac{1}{1}$, I. $\frac{4-5}{3-4} \times 2$; the true molars have transverse crowns; the third premolars only have deciduous predecessors; premolars compressed; canines and incisors small; the stomach is simple; a moderately long intestinal cæcum is developed; the legs are slender and the toes in incomplete number (*i. e.* less than five), and provided with well-developed claws; as to the rest, they differ much in the development of their feet. (1) In the typical species (Peramelinæ) the anterior feet have the three middle toes well developed, while the external are rudimentary; (2) in an aberrant type (Chæropodinæ) the digits are reduced to a minimum, and the anterior feet have only two well-developed toes, and these offer in combination some resemblance to those of a hog (a circumstance which has obtained the name for the genus—viz. *Chæropus*—*i. e.* χοῖρος, "hog," and πούς, "foot"); they are sustained by very long metatarsals, and correspond with the largest digits of the feet of Paramelinæ, but their claws are shorter than those of that group; a small-clawed tubercle developed at the external base of the metacarpal represents the third digit. All the species are of inconsiderable size, and are confined to Australia, Tasmania, and New Guiana. They appear in those countries to replace in the economy of nature the insectivorous mammals of other regions. (For illustration see Bandicoot.) Theodore Gill.

Per Cap'ita [Lat.], in law, a technical term originally of the Roman law, transferred to the English and American, and used in the statement of those rules which regulate the succession to the property of a deceased owner. Whenever the heirs and next of kin of the deceased, in whatever degree of relationship they may be, inherit his lands or succeed to his personalty as individuals in equal shares, they are said to take *per capita*—that is, by the heads. Thus, if the intestate had originally three sons, two of whom are living, and the other has died leaving four children, and the whole estate is divided into six equal parts, one for each child and grandchild, the succession thereto would be *per capita*. Also, if all the three sons have died, the first leaving two children, the second three, and the third four, and the property is distributed share and share alike among these nine grandchildren, the same phrase would designate the mode of division. A like rule applies in the case of collateral kindred. If the relatives of the intestate entitled to his estate are certain surviving brothers and sisters and the children of other deceased brothers and sisters, and they all participate equally in the property, real or personal, they would take *per capita*. In what instances the descent of lands to heirs and the distribution of personalty among the next of kin follows the mode thus described is determined by statute, and there is a great variety in the statutory rules established by the several States. Succession *per capita* is opposed to that *per stirpes*. (See Per Stirpes.)

John Norton Pomeroy.

Percé [so called from the Pierced Rocks in the sea near by], post-v., cap. of Gaspé co., Quebec, Canada, on the Gulf of St. Lawrence, 500 miles below Quebec. It has a court-house, a jail, and a thriving cod fishery. P. about 300.

Percep'tion [Lat. *per*, "through," and *capio*, "to take"], the act of obtaining knowledge of external objects through or by means of the organs of sense, or of internal states and conditions by means of consciousness or intuition. It also signifies the result of such act. Application has been made of this term to signify cognition or thinking in general, including all the theoretical powers

—sensation, representation, inference, and intuition. In this sense perception and volition would include all the powers of the mind. It is limited by many writers to external perception by means of the senses, and the higher activities of reason and reflection are regarded as modified sensation. The presence of inference or judgment in each act of sense-perception has been pointed out by Reid, Kant, Fichte, and Hegel. Erasmus Darwin made volition an essential element of higher perception—the association of ideas. In so far as attention underlies perception, the modifying influence of the will is obvious.

The doctrine of the intervention of images arising from effluxes from sense-objects has played a great rôle in the history of philosophy. Empedocles (500 B. C.) first advanced this theory, explaining sense-perception through effluxes and pores, interpenetration and mixture of elements arising through the same; effluxes of fire and water to and from the eyes constituting sight; of air into the ears, producing sound; smell and taste being similarly caused. Cognition of the elements of things was held to be by means of corresponding elements in ourselves. Anaxagoras (500 B. C.) took notice of the principle of contrast in perception, and held that like is not known by like, but by unlike, thus repudiating the principle of identity as set up by Empedocles, and explaining perception through difference. The atomists, Leucippus and Democritus (460 B. C.), taught the doctrine of effluxes modified to suit their doctrine of atoms. Atoms impinge on our senses and produce images. These thinkers also distinguished between obscure perception (*σκοτίη*)—*i. e.* through the organs of sense—and clear perception (*γνησίη*), through investigation. The doctrine of effluxes appears again with Epicurus (341–270 B. C.). Sense-perceptions are mental images coming from the surfaces of things by efflux. Plato (427–347) pointed out the existence of inference in all sense-perception, and showed it to be necessary to reconcile the contradictory predicates which inhere in sense-objects by reason of their relativity. He found a higher form of perception in the cognition of ideas, which constitute the true in and for itself; sense-perception deals with the changing and variable. Aristotle (384–322 B. C.) held that sense-perception (*αἴσθησις*) is the result of qualities which exist potentially in the objects perceived, and actually in the perceiving subject. The seeing of colors, for example, depends on the activity of the medium of vision (air or water). In the active reason (*νοῦς ποιητικός*), which is the highest potence of the soul, will and perception are one; it is creative and cognitive in one. The Peripatetic Strato (288 B. C.) made this higher perception to be only a modification of the lower, and in this direction the Stoics tended, their prevalent doctrine being that sense-perception is the origin and criterion of all perception. St. Augustine, Thomas Aquinas, and Meister Eckhart held the doctrine of effluxes and images which were taken up into the soul through the senses. But, with Aristotle, they distinguished from this the higher perception through the active reason, which gives us knowledge of divine truth. Descartes (1596–1650) laid great stress on the distinction between clear and obscure perceptions, making the former cognizant of eternal truths existing only in the mind, and the latter cognizant of external things and their affections. He separated soul from body so sharply that he was forced to explain their connection (in volition and sense-perception) by divine interference. Geulincx tried to explain the same by the doctrine of occasionalism, holding that through God's power our psychical activity is transmuted into corporeal, and the latter into the former. Malebranche unfolded this into the mystical doctrine that we perceive all things by participation in God's perception. Spinoza, however, abandoned the Cartesian dualism altogether for the doctrine of the unity of substance, which makes perception explicable. Leibnitz denied the theory of effluxes as a more mechanical explanation, and set forth the more spiritual one of monads as perceiving-substances which reflect or represent within themselves, each, the entire universe. Obscure or insensible perceptions are those which are unaccompanied with consciousness or memory. The myriad of perceptions to which we do not direct our attention are of this order. The whole universe is latent, as it were, in each monad, existing in this form of insensible perception, which needs only to be aroused to consciousness to become actual knowledge. Thus, even the lowest state of the monad—that simply of heavy matter—contains in its weight an obscure representation of the universe of matter, for the weight of each body depends upon the mass of all other bodies in space. Thus, the entire history of each being and of all beings is contained in a dormant state in each being; and it is the activity of the soul which brings them to consciousness in the various grades of perception. The aggregate of these obscure or insensible perceptions makes up the instinct of animals and the disposition, impulses, and emotions of man. Herbart (1776–1841) and Beneke (1798–1854) have pursued this thought of Leibnitz, and have made many valuable discoveries in psychology. The mutual arrest of opposing ideas in consciousness, and the power which one idea has of intensifying or obscuring and rendering latent another, as well as of combining, when latent, with other latent ideas and reappearing in consciousness in a new guise,—the investigation of these phases of perception forms one of the most interesting chapters in modern psychology. Kant (1732–1804) made time and space the *a priori* forms of sense-perception, and denied the objective validity of higher perception, limiting it to subjective forms. Reid (1710–96) taught that mind is active in sense-perception, every act being an act of judgment or inference. Common sense or higher perception cognizes necessary truths of inherence, causation, and design—truths which Kant had pronounced merely subjective. Sir William Hamilton agrees on the one hand with Reid in repudiating the intervention of images and material effluxes, but holds with Kant that we do not cognize things in themselves, thus rejecting Reid's common-sense theory. (See PSYCHOLOGY.)

WILLIAM T. HARRIS.

Perceso'ces [Gr. *πέρκη*, "perch," and Lat. *esox*, "pike"], a sub-order of teleocephalous fishes, peculiar for the combination of features respectively characteristic of acanthopterygian and malacopterygian fishes. Generally, there are two dorsal fins, the first of which is sustained by spinous rays, but sometimes (Ophiocephalidæ) a long single dorsal, and the ventrals are abdominal, although provided, typically at least, with an external spiny ray; the lateral line is either obsolete or nearly concurrent with the back; the branchial arches are well developed, all the bones, except the fourth superior pharyngeal, being developed, and the third is much enlarged; the inferior pharyngeals are separate; the air-bladder is closed, and has no connection with the œsophagus. The sub-order was first recognized by Prof. Cope, who included therein the Atherinidæ, Mugelidæ, and Ophiocephalidæ. On the one hand the sub-order is related to the *Haplomi* (Esocids, Cyprinodonts, etc.), and on the other to the typical acanthopterygian fishes (perches, etc.). THEODORE GILL.

Per'ceval (SPENCER), b. in London, England, Nov. 1, 1762, was the second son of John, earl of Egmont; educated at Harrow and Cambridge; studied law at Lincoln's Inn; was called to the bar 1786; entered Parliament for Northampton 1796; became intimate with Pitt, through whose influence he was made solicitor-general in the Addington ministry 1801; was promoted to attorney-general 1802; conducted the prosecution in the celebrated Peltier case; was an active partisan of war with France and an opponent of Catholic emancipation; resigned office on the death of Pitt; became chancellor of the exchequer in the Portland cabinet Apr., 1807; succeeded the duke of Portland as premier Oct., 1809, and was assassinated by John Bellingham in the lobby of the House of Commons May 11, 1812.

Perch [Lat. *perca*], a name primitively applied to the species of *Perca* or yellow perches (*Perca fluviatilis* of Europe and related American forms), but also extended to many other, often quite distantly related, types; *e. g. Stizostedium Americanum*, etc. (pike-perch), *Morone Americana* (white perch of the Atlantic border), *Haploidonotus grunniens* (white perch and buffalo-perch of Ohio, etc.), *Sebastes norvegicus* (red perch of Eastport), etc. (See PERCIDÆ.)

Perche, tp. of Boone co., Mo. Pop. 3119.

Perchlo'rates, compounds of perchloric anhydride (see PERCHLORIC ACID) with bases. Perchloric acid reacts powerfully with bases, forming well-defined and perfectly neutral salts. Most of these are very deliquescent, as those of *soda*, *baryta*, *strontia*, *lime*, and *magnesia*. Serullas succeeded, however, in crystallizing these from alcoholic solutions. *Potassic perchlorate* is the most important one as the source of perchloric acid. It is preparable by two methods: (*a*) Chlorate of potash is fused and allowed to evolve oxygen until it becomes pasty, and until a drop removed on a platinum wire does not color muriatic acid deep yellow, indicating absence of chlorate. The residual mass by solution and crystallization will yield crystals of perchlorate and a solution of chloride. (*b*) Potassic chlorate in powder is gradually added to hot nitric acid. Cl and O gases are evolved, and a mixture formed of nitrate and perchlorate, easily separable by crystallization. Perchlorate of potash is anhydrous, and decomposes like the chlorate, though only at a temperature over 400°, into chloride and free oxygen. It does not appear to be deliquescent, unlike nearly all the other perchlorates. Although it contains about 7 per cent. more oxygen by weight than the chlorate (46.21 per cent. as against 39.13

per cent.), it does not, according to Stadion, react so violently with carbonaceous bodies as the chlorate. It may never have been tried as a constituent for explosive mixtures like gunpowder, but it should be so tried, as it appears likely to possess valuable capabilities in this regard. HENRY WURTZ.

Perchlo'ric Acid. Perchloric monohydrate is a liquid acid of great energy, comparable well in some respects with oil of vitriol, being a colorless liquid, of density 1.782 according to Roscoe, which does not freeze at — 35° C. Its composition is $H_2O.Cl_2O_7$. With two equivalents of water it combines to a solid crystalline compound, with great evolution of heat in the combination. This latter Roscoe found to have a density of 1.811 when melted at 50° C. The density in solid form he apparently did not determine. Perchloric monohydrate cannot be kept in the liquid form, as it sooner or later explodes spontaneously. By contact with some organic substances it also instantly explodes with terrible energy, so that it is a dangerous material to handle. It is prepared from the potassic perchlorate (see PERCHLORATES) by simple distillation with sulphuric acid. No use has yet been discovered for it. HENRY WURTZ.

Per'cidæ [Lat. *perca*, "perch"], a family of fishes typified by the common yellow perches of Europe and the U. S. The body is elongated; covered with ctenoid scales, and with a continuous lateral line concurrent with the back; the head conic and more or less compressed; the opercula more or less armed, the preoperculum being serrated and the true operculum armed with spines; the mouth variable in size, but with a more or less vertical cleft; teeth villiform, on the jaws as well as palate; branchial apertures ample; branchiostegal rays seven; dorsals two, the anterior with many spinous rays, the posterior with soft ones; anal small, far behind; ventrals thoracic, each with one spine and five rays. The skeleton has numerous vertebræ (in the perch 21 + 20 — 21); the stomach is cæcal, and pyloric cæca are developed. The family, as thus defined, has received its limits from recent writers (*e. g.* Gill and Günther); formerly it was extended to include the Serranidæ and related types, but as now limited embraces only fresh-water fishes distinguished by the increased number of vertebræ and other associated characters. To it are to be referred, besides the large and familiar species of the group, numerous small fishes distributed among the fresh waters of the U. S., which have been grouped by Prof. Agassiz under the common names Ethiostomata and Ethiostomidæ. The family with these forms is confined to the temperate and colder waters of the northern hemisphere. The best-known genera are *Perca*, including the common yellow perches; *Stizostedium* or *Lucioperca*, including the pike-perches; *Acerina*, represented by the ruffles of Europe; *Aspro*, also confined to the Old World; and *Percina*, confined to the New World. The other genera are mostly represented by small species, rarely met with by any except the professed ichthyologist. THEODORE GILL.

Per'cival (JAMES GATES), M. D., b. in Kensington parish, Berlin, Conn., Sept. 15, 1795; graduated at Yale in 1815, and took his medical degree in 1820; resided for a short time in Charleston, S. C., and published several small volumes, chiefly of poetry; was appointed assistant surgeon in the army in 1824, and detailed as professor of chemistry, mineralogy, and geology in the West Point Academy, but at his own request was soon transferred to Boston, where he engaged in literary and editorial work; removed in 1827 to New Haven, Conn., and for a time assisted Dr. Webster in preparing his *Dictionary;* engaged in 1835 in the geological survey of that State; became distinguished as a linguist, and wrote much poetry which was at one time highly popular; but, though not without conspicuous merits, his poetry is nearly all crude and half-written, and it has been consequently for the most part forgotten. Percival was a man of melancholy disposition, and throughout life was hard pressed by poverty. In 1854 he became State geologist of Wisconsin. D. at Hazel Green, Wis., May 2, 1857.

Percola'tion [Lat. *per*, "through," and *colo*, to "strain"], in pharmacy and chemistry, sometimes denotes simply filtration (see WATER), but more frequently it designates the preparation of tinctures and fluid extracts by means of a process essentially that of lixiviation or leaching. The drugs to be acted on are coarsely powdered and packed in a funnel-shaped percolator, through which the menstruum slowly drips, or sometimes it is forced through by the air-pump. There are many forms of the percolator, some of them combining the principle of dialysis.

Percops'idæ [Gr. πέρκη, "perch," and ὄψις, "appearance"], a family of fishes represented by a single genus (*Percopsis*), confined to North America. The form is trout-like, and the fish is sometimes mistaken for the young of trout and salmon. The body is covered by moderate scales with comb-like margins; lateral line well defined and nearly straight, but somewhat concurrent with the back; head conical, compressed; opercular apparatus with all the bones present and unarmed; mouth small, but with a lateral cleft; upper jaw with its margin formed by the intermaxillary bones alone; teeth villiform on the jaws, but none on the palate; branchial apertures ample; branchiostegal rays six; one true dorsal fin, with branched rays; an adipose fin also developed as in the Salmonids; the anal small; ventrals thoracic. The family was considered by Prof. Agassiz, who first described its type, as one of the most remarkable of living fishes, and was referred by him either to the vicinity of the Percidæ, or considered as perhaps the type of a peculiar order; it is now, however, generally admitted to be most closely related to certain South American forms (Haplochtonidæ, etc.), and more distantly to the Salmonidæ. There appear to be several species, but the typical one is *Percopsis pellucidus*, originally obtained from Lake Superior. THEODORE GILL.

Percus'sion [Lat. *percussio*], a medical term denoting a peculiar branch of auscultation, by which the presence or absence of air and fluid in certain internal organs is ascertained by the aid of artificial sounds. These sounds are produced either directly by tapping with the fingers or a small hammer tipped with india-rubber on the surface of the body just above the place to be investigated, or mediately by the aid of a pleximeter, and struck either with the fingers or with a hammer. (See AUSCULTATION.)

Percussion-Caps. See FULMINATES.

Per'cy, an historical family of England, descended from William de Percy, a companion of William the Conqueror, who derived his name from the village of Percy in Normandy. The barony of Alnwick was acquired by Henry de Percy in the reign of Edward I. His grandson having married into the royal Lancastrian family, Henry Percy, father of the celebrated Hotspur, was created by Richard II. earl of Northumberland in 1377. The first four earls of this family took prominent parts in the "wars of the Roses," and all perished in battle or by assassination. The title became extinct in 1537, but was revived in 1557 in favor of Thomas Percy, who was beheaded at York 1572 for conspiring against Elizabeth. His brother Henry, eighth earl, was charged with conspiring in favor of Mary, queen of Scots, and was murdered in the Tower of London June 21, 1585; Henry, the ninth earl, was imprisoned many years in the Tower for alleged participation in the Gunpowder Plot of 1605. The title having again become extinct in 1670, it was revived in 1749 in favor of Seymour, duke of Somerset, a grandson of the last earl. His son-in-law, Sir Hugh Smithson, took the name of Percy, succeeded by permission of Parliament to the earldom in 1750, and was made first duke of Northumberland 1766. His son Hugh (known as Earl Percy) was engaged in the battle of Lexington, succeeded to the dukedom June 6, 1786, and d. July 10, 1817. The career of his son, Algernon Percy, fourth duke, has been given under the title NORTHUMBERLAND, DUKE OF.—The present representative of the family is ALGERNON GEORGE PERCY, LL.D., sixth duke, b. May 2, 1810, who succeeded to the title Aug. 22, 1867, and became lord of the admiralty 1858. Northumberland House, Charing Cross, the London residence of the Percies for many generations, was sold to the board of public works in 1873 for £500,000, to be pulled down for the opening of a new street, and the duke employed a considerable part of that sum in the improvement of Trafalgar Square.

Percy (HENRY), surnamed HOTSPUR, son of the first earl of Northumberland, b. in England May 20, 1364; became famous in the wars of France and of the Scottish border; defeated and killed Douglas at Otterburn (Chevy Chase) 1388; joined Henry of Lancaster 1399, aiding him to obtain the English throne; was rewarded with the wardenship of the East Marches and the gift of the Isle of Man; was distinguished at the battle of Homildon Hill 1402; took up arms with his father to place Mortimer, earl of March, on the throne, and was killed at the battle of Shrewsbury, July 21, 1403. He is immortalized in Shakspeare's *Henry IV.*

Percy (THOMAS), D. D., b. at Bridgenorth, Salop, England, Apr. 13, 1728; was educated at Christ Church, Oxford, where he took his master's degree 1753; became vicar of Easton Maudit and rector of Wilby 1756; domestic chaplain to the duke of Northumberland 1766; chaplain in ordinary to the king 1769; dean of Carlisle 1778; bishop of Dromore 1782. D. at Dromore, Ireland, Sept. 30, 1811. His best-known work, *The Reliques of Ancient English Poetry* (1765), had a wide influence in developing a taste for ballad literature and antiquities. He translated Mallet's *Northern Antiquities* (1770), and collected a mass

of ancient tales and poetry which were not printed until 1868. Among his other works is a *Key to the New Testament.*

Perdic'cas, a celebrated Macedonian general to whom Alexander the Great on his deathbed gave his ring, the symbol of the royal power; held the empire together for a short time by his superior energy and talents, but when it became evident that he himself aspired to the crown, a coalition was formed against him by Antipater, Crateros, and Ptolemy, and on his expedition against Ptolemy he was assassinated in 321 B. C., near Memphis, by his own soldiers.

Perdic'inæ [Lat. *perdix*, "partridge"], a sub-family of Tetraonidæ, containing the partridges and quails of the Old World. These are distinguished by a comparatively

The Common Partridge of Europe.

slender and depressed bill, and the lower mandible has an unarmed margin. There are numerous species, 85 having been recognized by G. R. Gray; these are found chiefly in the tropical regions of Africa and Asia, but species also extend to Northern Europe and Asia, as well as Australia, Tasmania, and New Zealand. They have been variously combined in genera, but by Gray they are all included in five genera—viz. (1) *Ptilopachus;* (2) *Ithaginus*, with three sub-genera; (3) *Francolinus*, with nine sub-genera; (4) *Perdix*, with seven sub-genera; and (5) *Coturnix*, also with seven sub-genera. The common European partridge belongs to the genus *Perdix*, the common quail to *Coturnix*. The American species known under the same names have no relation to these, but belong to a peculiar sub-family, contradistinguished from the Perdicinæ by the stout bill and armed lower jaw. (See ORTYGINÆ.)

THEODORE GILL.

Per'egrine Fal'con (*Falco peregrinus*), a hawk formerly much used in falconry. It is bold, graceful, swift, docile, strong, and destructive, and was the favorite among the noble falcons, though less powerful than the lanner and the jerfalcon. The female peregrine is the bird which is, *par excellence*, called falcon; the male is the tercel, and is smaller than his mate.

Perei'ra (JONATHAN), M. D., F. R. S., b. in Shoreditch, London, May 22, 1804; studied at Finsbury for four years; received a medical education; was licensed by the Apothecaries 1823; became fellow of the Royal College of Surgeons 1825; apothecary and chemical lecturer to the Aldersgate Street Dispensary 1823; professor of materia medica in the same school 1832; took the doctor's degree at Erlangen 1840; became a fellow of the Royal College of Physicians 1845; physician to the London Hospital 1851; was one of the examiners of London University. D. (in consequence of a fall) at London Jan. 20, 1853. His great work was the ***Elements of Materia Medica and Therapeutics*** (1839–40), still a standard authority; also published a ***Treatise on Diet*** (1843), ***Lectures on Polarized Light*** (1843), and other works.

Perekop', town of European Russia, government of Taurida, on the isthmus of the same name, which connects the Crimea with the mainland. The town, which was formerly strongly fortified, is still of great strategical and commercial importance, as it is situated at a point where all the roads leading from Southern Russia into the Crimea connect. Its trade in salt produced from the salt lakes in the vicinity is very extensive. Pop. 5000.

Père Marquette', tp. of Mason co., Mich. Pop. 954.

Pereslavl', or **Perejaslavl,** an old town of European Russia, government of Poltava, at the confluence of the Alta and the Troobezh. It has 11 churches, among which are several cathedrals, and many educational institutions. Pop. 7218.

Pereslavl'-Zalies'ki, a manufacturing town of European Russia, government of Vladimeer; its cotton fabrics are exported even to China. Pop. 6335.

Pe'rez (ANTONIO), b. at Monreal de Ariza, Aragon, Spain, in 1541, was a natural son of Gonzalo Perez, who was many years a secretary of Charles V. and Philip II.; was educated at the University of Louvain, studying also at Venice and at Madrid; became secretary of state to Philip II. on the death of his father in 1567; was the chief agent of that treacherous monarch in many of his secret crimes, especially in the assassination of Juan de Escovedo 1578; was tried for that crime, imprisoned, and exiled from the court; was again arrested for the same crime in 1590, when, being put to the torture, he confessed the act, but accused the king of complicity; escaped to Aragon in April, where he placed himself under the protection of the *fueros* or privileges of that kingdom; was twice seized by royal command and handed over to the Inquisition, but on both occasions released by the people, thus giving rise to a rebellion which ended in the suppression of the *fueros* of Aragon. Perez escaped to France Nov., 1591; resided in England as secret agent of Henry IV. 1593–95; published in London his *Relaciones*, giving his own account of his romantic adventures (1594), and was the author of *Cartas Familiares* and several other works, elegantly written. D. at Paris Nov. 3, 1611. (See Mignet's *Antoine Perez et Philippe II.* (1845).)

Perez (JOSÉ JOAQUIN), b. at Santiago, Chili, in 1801; was secretary of legation in France 1829–31; minister to Buenos Ayres 1832; subsequently deputy in Congress, councillor of state, minister of finance, of the interior, and of foreign affairs; president of the chamber of deputies and of the senate, and was president of the republic during two terms (1861–71). During his administration that republic enjoyed internal peace and prosperity, and great material improvements were carried out. During a nominal war with Spain, Valparaiso was burned by a Spanish squadron, and one or two Spanish men-of-war were captured by the Chilians, but no attempt at invasion of the country took place.

Perform'ance (law), the doing by a party to a contract the very acts which by its terms he is bound to do, whereby he is wholly discharged from the obligation. When the contract creates a pecuniary obligation only, either in the form of debt or damages, such discharge thereof is ordinarily denominated "payment," which is merely a particular instance or species of performance; so that the latter term is practically confined, in the technical nomenclature of the law, to the doing of any and all acts, other than the payment of money, stipulated to be done, by means of which the legal duty arising from the agreement is fully satisfied.

JOHN NORTON POMEROY.

Per'fumes [Lat. *per*, "through," and *fumus*, "smoke"], **Chemistry of.** Of all the senses, those mysterious media through which matter acts upon mind, there is certainly none more mysterious or more interesting than the sense of smell. Our present concern is not, however, so much with the sense itself as with the nature of the bodies that excite it. It may be said that as a general thing *volatile* bodies are odorous, but there are numbers of exceptions to this, one of the most eminent exceptions being that most abundant of all volatile bodies, *water*, which when pure is, to the best of our belief, absolutely devoid of odor, at least to the human sense. When it is said that animals can "smell water" at a distance, it is probable that they smell some odorous effluvium proceeding from organic decay that accompanies the vapor from the water. Nevertheless, it can by no means be asserted that pure water itself may not have a positive odor to these animals. Other exceptions are certain gases, which are held to be but the vapors of liquids that are volatile at temperatures below the normal range. It must be admitted, nevertheless, that the inodorous gases are among those which have never been positively proved to be convertible into liquid form, such as *oxygen*, *hydrogen*, and *nitrogen*. Two other *incondensable* gases, however—carbonic oxide and marsh-gas—are asserted by some to possess distinct though feeble odors;

and no general principle can here be deduced. The division of odors into two classes, those to be called *perfumes*, and those which are not such, presents also much difficulty in a scientific sense. Odors which are most repulsive to some are attractive, and often even highly enjoyable, to others. This is even true with the same individual, in the case of many odors, with reference to the degree of *intensity* of the odor, many volatile bodies existing which almost all consider fragrant when diffused in very minute proportion throughout the air, but are most offensive and even nauseating when concentrated. The probability seems to be that many vapors have their odors fully developed only when diffused thinly throughout a large mass of air, as if this development were really due to some agency—for example, *ozone*—in the air itself; in other words, that the odorous power, so to speak, over the sense of smell, were only developed by chemical action. There are many surprising facts known that bear upon this hypothesis; among them the almost infinitesimal amount of some substances —such as *musk*, for instance, which will give out odor for an almost indefinite period. Some scientists, among them our eminent American chemist, Robert Hare, have thus been led to consider the possibility that odors may be transmitted to the sensorium, as the perception of colors is transmitted to the retina, through the *ethereal medium*, and not by actual contact of material particles. This, however, is a subject yet belonging almost wholly to the realm of speculation, no adequate experimental foundation of facts for scientific induction having been laid.

The whole mass of what are technically called *perfumes*, or sometimes *aromatic* substances, belongs chemically to the compounds having a basis of carbon and hydrogen. It is of interest in this connection that among chemists of late there has grown up a mode of classifying all carbohydrogen compounds in two great series—the "fatty series" and the "aromatic series," the latter comprising the homologues of benzene and their derivatives, with a great mass of coal-tar products and natural essential oils (including the large *terpene* group), all believed by many chemists to constitute a natural family, distinguished from the fatty series by peculiarities of constitutional or molecular structure, which are represented (on the blackboard) by certain groupings of symbols in fanciful and symmetrical forms, such as their laws of "atomicity" allow to be contrived and varied with ease. Admitting the reality of such a distinction into two natural families, and that this may hereafter be established by the discovery and demonstration of some cause of such distinction, the term "aromatic" is certainly unfortunate, in appearing to imply that the distinction is thereby defined, and that the bodies possessing agreeable aroma are to be placed in the series thus designated. Whereas, among the alcohols, and particularly among the compound ethers, of the fatty series, are found bodies of the most exquisite aromas and perfumes of the most delicious fragrance. Indeed, almost all the artificial fruit-essences, which are now quite important articles of trade as used for flavoring foods, drinks, and confectionery, as well as in perfumery, pertain to the fatty series. A few examples may be given of the composition of some of the more important of these commercial fruit-essences, as a matter of general interest.

Essence of—

Pineapple	contains	chloroform 1, aldehyde 1, ethyl-butyrate 5, amyl-butyrate 10, glycerine 3.
Strawberry	"	ethyl-nitrate 1, ethyl-acetate 5, ethyl-formate 1, ethyl-butyrate 5, glycerine 3.
Pear	"	ethyl-acetate 5, amyl-acetate 10, glycerine 10.
Apple	"	aldehyde 2, amyl-valerate 10, chloroform, ethyl-nitrate, and ethyl-acetate 1 each, glycerine 4.
Grape	"	œnanthic ether 10, chloroform, aldehyde, and acetic ether 2 each, methylic salicylate 1, glycerine 10.

The glycerine in these mixtures is merely to unite and retain the different ethers, some of which are quite volatile. Great numbers of such preparations are now made and largely employed. Unfortunately, their aroma is evanescent, and often liable to change rapidly by the volatilization of some of the ingredients, so that the confectionery, etc. flavored with them rapidly deteriorates.

Among the class of products called *essential oils* is found the great bulk of the ingredients of *natural* perfumes. To give any account that would have detail enough to be useful of the great variety of these substances would be impossible to us, and we cannot do better than refer the reader for such details to the *U. S. Dispensatory* of Drs. Wood and Bache (pp. 584 to 626, inclusive, and 1299 to 1314, inclusive), a work which is to be found in almost every drug-store. HENRY WURTZ.

Per'gamus, an ancient city of Mysia, Asia Minor, was founded by Greek colonists on the northern bank of the river Caïcus, 120 stadia from the sea. In the general confusion which reigned after the death of Alexander the Great, the city became important as the stronghold of Lysimachus. His governor, Philetærus, made himself independent, and Attalus I. (241–197 B. C.) succeeded in establishing a kingdom of which Pergamus became the capital. The Romans favored this new state as a useful ally against Macedonia and Syria, and at different times Phrygia, Lydia, Pisidia, Lycaonia, and Pamphylia were added to it. Meanwhile, the capital became one of the greatest and most magnificent cities of Asia Minor, celebrated for its architectural monuments, its splendid library, its grammar school, its invention of parchment, etc. On his death (133 B. C.) King Attalus III. bequeathed his possessions to the Romans, and they made Pergamus the focus of all the great military and commercial routes of Asia Minor. Under the Byzantine rule it rapidly declined, but the splendid and extensive ruins around the modern BERGAMA (which see) testify to its former importance.

Per'gola, town of Italy, provinces of Pesaro and Urbino. Pop. (1874) within its municipal limits, 8953.

Pergole'si (GIOVANNI BATTISTA), b. at Jesi, near Ancona, Jan. 3, 1710; entered the conservatory of music at Naples in 1717; produced his first oratorio and his first opera in 1731; was appointed chapel-master at the church of Loretto in 1734. D. at Torre del Greco, near Naples, Mar. 16, 1736. Of his operas, only one, *La Serva Padrona*, achieved a great success, but his church music, cantatas, masses, oratorios, and several trios for string instruments occupy a high rank in the history of music.

Per'ham (SIDNEY), b. at Woodstock, Me., Mar. 27, 1819; was for some years a teacher, afterwards a farmer; served in the legislature and on the State board of agriculture; was county clerk of Oxford 1858–61; member of Congress 1863–69; and governor of Maine 1870–71.

Perham Plantation, tp. of Aroostook co., Me. P. 79.

Pe'ri [a Persian word, identical with *fairy*], in the folk-lore of Oriental lands, the male or female spirits or *jins*, who are the offspring of fallen spirits, but are themselves guiltless, beautiful, happy, and beneficent immortals. They are hostile to the *devs*, or wicked ones, but friendly to man. In consequence of their birth they can never enter Paradise.

Pericarditis. See HEART DISEASES.

Pericar'dium [Gr. περί, "about," and καρδία, the "heart"], the fibro-serous sac which surrounds the heart. Its outer fibrous part is very dense and strong; its inner or serous lining membrane is continuous with that which covers the heart. It secretes a thin lubricating serous fluid which facilitates the motions of the heart.

Per'icarp, in botany, every part of a ripe fruit situated on the outside of the placenta, which is the name of that copious development of cellular tissue out of which the ovules arise.

Per'icles, b. at Athens about 495 B. C., descended on the father's side from the Pisistratidæ, on the mother's from the Alcmæonidæ; received the instruction of Zeno and Anaxagoras; served with distinction in the army, and entered, about 469 B. C., on his political career as a member of the democratic party. He proposed or aided in carrying laws according to which the funds of the public treasury were employed for the benefit of the poorer classes. It became the law that citizens should be paid when serving in the army, on a jury, or when performing any other public duty, even when attending the religious festivals; and thereby it became possible for the poorer classes to take part more actively in public life. By these laws Pericles gained the attention and favor of his party, and soon he attained the absolute leadership of it by his eminent talents, his impressive or rather irresistible eloquence, his shrewdness and adroitness in party manœuvring, his grand and wise plans, etc. A great victory was achieved over the aristocratic party in 461 B. C.; its position was undermined and its leader was crushed. The Areopagus, which was the principal political organ of the Athenian oligarchy, lost almost entirely its influence as a party organ by the introduction of a new jury-system; and after his unsuccessful campaign against Mount Ithome, Cimon was impeached, and shortly after banished by ostracism. Pericles was now in reality the ruler of the state. Cimon was recalled in 454 B. C., but on the proposition of Pericles, and it was said that there existed an agreement between them, according to which Cimon should command the army on its foreign expeditions and Pericles govern at home. After the death of Cimon, in 449 B. C., the aristocratic party was reorganized by one Thucydides, and once more arrayed against Pericles. In 444 B. C., Pericles was accused of squandering the public money or employing it for inappropriate purposes, but the attempt to overthrow

him failed. Thucydides was banished by ostracism, and henceforth there existed in Athens no really effective opposition to Pericles. He was arraigned once more for embezzling some of the gold destined for the statue of Athene in the Parthenon; his friends were repeatedly attacked; Phidias died in prison, Anaxagoras was banished, and Aspasia was saved only by great exertions. But these and other similar events were nothing more than the outbursts of a desperate envy and maliciousness. There are no instances in which any important measure of Pericles was frustrated by an internal opposition. It was the great aim of his policy to make Athens the brilliant and magnificent political centre of a united Greece. He opposed his countrymen's extravagant plans of conquest in Egypt, Carthage, or Sicily, and concentrated his whole energy on the affairs of Greece herself. Athens stood at the head of a confederacy of several Greek states for defence against a possible Persian invasion. This confederacy held its meetings and kept its treasury at Delos. By Pericles' dexterous negotiations both the meetings and the treasury were transferred to Athens, and, furthermore, the contributions of the allies were commuted from actual service to a sum of money, for which Athens alone undertook to furnish the whole military armament. Thus, the supremacy of Athens was established, and it was further developed by the successful settlement of new colonies, by supporting the democratic parties in the Greek states, etc. Of great influence too in this respect were the magnificence of the city and the splendor of the life led in it. It was the time of Phidias, Socrates, Sophocles. The Parthenon and the Odeon were built, and that most stupendous of all architectural constructions of Greece, the Propylæum. Commerce flourished, and many branches of industry were carried to perfection. Hospitality and elegance in social intercourse, magnanimity and magnificence in all public affairs, distinguished life in Athens at this period, and the foreigner who visited the city was as delighted as he was astonished. But Athens—or, more properly, Pericles, for he was the soul of all her great undertakings—had an unrelenting rival in the Spartan aristocracy. The Peloponnesian war drew nearer and nearer, and, although Pericles warded it off for several years by bribery, at last it became inevitable. In the same year that it broke out the city was fearfully devastated by the plague. Next year, Pericles died (429 B. C.), and with his death began the decline of Athens, first in political power, then in literature and art, and soon also in commerce and industry.

CLEMENS PETERSEN.

Perier′ (CASIMIR), b. at Grenoble, department of Isère, France, Oct. 21, 1777; was educated at Lyons; served for a short time in the army; engaged then in the large and prosperous banking business established at Paris by his father and elder brother; was elected a member of the Chamber of Deputies in 1817, and became one of the leaders of the opposition under Charles X. After the revolution of July, 1830, he was prime minister to Louis Philippe from Mar. 13, 1831, to his death by cholera, May 16, 1832, and as such he occupied a distinctly defined standpoint, the so-called *juste-milieu*, which he vindicated with great vigor, and also with partial success. Attempts at insurrection were speedily put down, and his resistance to the differently colored tendencies of anarchy, ultramontane and radical, which showed themselves in France after 1830, was very effective. Guizot, who in several respects was his political disciple and heir, has given a very vivid and impressive picture of him in his *Mémoires*.

Per′igee [Gr. περί, "about," and γῆ, "earth"], in astronomy, that point of the moon's orbit which is nearest to the earth. Anciently, when the sun and planets were supposed to circulate around the earth, the term was also applied to them.

Périgueux′, the ancient *Vesunna*, town of France, department of Dordogne, on the right bank of the Isle. The old part of the city, containing the magnificent cathedral and many interesting Roman remains, consists of narrow and gloomy streets, but it is encircled by new and elegant boulevards occupying the site of the old walls and ramparts. A large trade in liqueurs, truffles, partridges, and wine, and some manufactures of paper and woollens, are carried on. Pop. 21,864.

Perihe′lion [Gr. περί, "about," and ἥλιος, "sun"], in astronomy, that point in the orbit of a planet or comet which is nearest to the sun. Its position or longitude is one of the elements by which the orbit is determined.

Per′im, a small island belonging to Great Britain, in the Strait of Bab-el-Mandeb, at the entrance of the Red Sea, 13 miles from the African coast and 1½ miles from the coast of Yemen. Area, 7 square miles. Pop. 211. It rises about 230 feet from the sea, is rocky, nearly destitute of vegetation, and without water, but it has a good harbor on its southern coast, and its fortifications command the strait on both sides. The passage generally used by vessels going to or from the Red Sea is the narrow one between the island and the Arabian coast. Perim was first occupied by the English in 1799, while Napoleon was in Egypt. It was given up in 1801, but again occupied and fortified in 1857, on account of the building of the Suez Canal. It is under the command of the governor of Aden.

Pe′riod [Gr. περίοδος, "going round"], a term used in chronology, history, and rhetoric. In chronology it is sometimes synonymous with CYCLE (which see); sometimes it forms a subdivision of a cycle, and sometimes it denotes a cycle of cycles. In history it is nearly synonymous with *epoch*, though generally "epoch" is used for such divisions of history as are characterized, not to say governed, by the predominant spirit of one single individual—as, for instance, the epoch of Pericles; while "period" is applied to such divisions as are principally characterized by events which seem to obey some objective law—as, for instance, the period of the Crusades. In rhetoric it means a compound sentence from one full stop to another, although the simple sentence, from one full stop to another, is sometimes called a period.

Period, in music, a division consisting of two or more phrases or sections. (See RHYTHM.)

Period′icals, a vague title usually applied to a class of publications differing from newspapers in being devoted, not to the occurrences of the day, but to literature or to special departments of knowledge. They are consequently of very various forms, sizes, and periods of publication, but the most general types are the monthly and quarterly magazines. There is still a large class of weekly journals which combine the characteristics of the newspaper with those of the literary periodical, but with the rapid progress of journalism the weekly newspaper, once the chief medium for the communication of passing events, has been supplanted in great part by the daily journal, and the time cannot be far distant when the latter will enjoy a monopoly of the communication of news, and the weeklies will pass entirely into the domain of periodicals. The establishment of periodicals devoted to special branches of knowledge (other than theology) is comparatively of recent date, the earlier periodicals having usually embraced the whole field of literature. Of these, the first in the order of time was the *Journal des Savants*, a critical review, which, however, could scarcely be called a "periodical," inasmuch as it made its appearance at irregular intervals. With brief interruptions it has ever since continued, becoming in 1816 the organ of the French Academy. The only widely-known French periodical of the present day is the *Revue des Deux Mondes*, a fortnightly magazine established in 1829, to which the most eminent French authors contribute. The weekly *Illustration*, however, though chiefly devoted to the recording of passing events, has many of the characteristics of a literary periodical. In England the periodicals, strictly so called, of the eighteenth century were dreary affairs. In 1802 the *Edinburgh Review* (quarterly) was started by Jeffrey, Brougham, and Sydney Smith, and was the precursor of the *Quarterly* (1809), the *Westminster* (1824), and the *British Quarterly* (1845), all of which have achieved important positions in the literary world. The English and American monthly magazines, which now form so important an element in literary history, are of still more recent origin, the oldest of the existing monthlies of recognized merit being *Blackwood's*, established 1817. *Fraser's* (1830), *Macmillan's* (1859), *Cornhill* (1859), the *Contemporary*, and the *Fortnightly* are now (1876) the leading English monthlies. In the U. S. many monthly magazines have been started, but few have long survived. Among the existing American monthlies of high rank *Harper's* (1850) is the oldest, others being the *Atlantic* (1857), *Scribner's*, the *Galaxy*, *Lippincott's*, the *Eclectic*, and the *Overland*. Among those no longer published, *Sartain's*, the *Knickerbocker*, *Putnam's*, and *Old and New* deserve honorable mention. The *North American Review* (quarterly), established at Boston in 1815, is the acknowledged leader of its class of publications, its chief competitor being the *International Review* (six times a year), started at New York in 1874. The theological, medical, legal, and other professional magazines of the U. S. are mainly of recent date, but have become very numerous.

Periodic′ity, a physiological and pathological term denoting the regular or nearly regular recurrence of certain phenomena in animal life. In the healthy state the menstruation, and in the state of disease the paroxysms of intermittent fever, are obvious instances of periodicity; and all phenomena of animal life seem to have a tendency to periodicity, such as sleep, hunger, the relieving of the bowels, etc. At all events, any function of animal life is greatly impaired by a high degree of irregularity in its

exercise, and the first indication of a diseased state is generally a disturbance of the natural or acquired periodicity of the various functions of life.

Periœ'ci [Gr. περίοικοι, "dwellers round about"], in Laconia and other ancient Dorian lands, the descendants of the ancient inhabitants of the country. The Periœci were freemen, and not strictly vassals, much less serfs like the Helots, but they were inferior in social rank and political rights to the Spartiatæ. They occupied the inferior kind of lands, were artisans, merchants, and sailors, and had, at times, a share in the government. They might, at least at some periods, intermarry with the Dorians, and they served in war even as hoplites, though not in the same corps with Dorians. They were in many cases people of wealth and refinement.

Perios'teum [Gr. περιόστεον, "around the bones"], the strong fibrous membrane which surrounds the bones, excepting only the parts covered with cartilage. It is found also around the roots of the teeth, and lines the sockets in which the teeth are fixed. That which covers the outside of the skull is the *pericranium*, and that within the skull is the *dura mater;* but the *dura mater* of the spinal cord is distinct from the periosteum. The periosteal membrane is called *endosteum* when it lines the medullary cavity of a bone. The periosteum is continuous with the tendons and ligaments. It is very vascular, and plays an important part in the growth and nutrition of bone. Thus, in operations for the removal of diseased bone the periosteum should be carefully peeled off and left *in situ*, and in many cases new and healthy bone will be developed from it, especially if the patient be young.

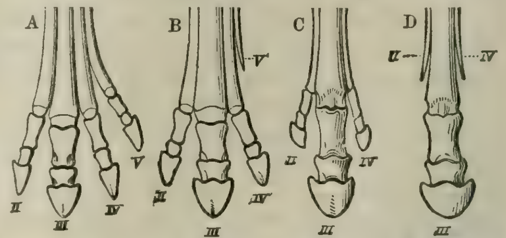
Periosti'tis [Lat.], the inflammation of the periosteum, is sometimes caused by a syphilitic, scrofulous, or perhaps rheumatic dyscrasia, but is very commonly induced in boys and young men by a sudden exposure to severe cold, as by bathing in very cold water after violent exercise, by standing long in cold water, and the like. It is a very painful disease, and is best treated by local poultices, by opiates, and by free incisions. Cases due to any specific cause will require special constitutional treatment.

Peripatetic Philosophy. See ARISTOTLE.

Per'iplus [Gr. περίπλους, "a sailing round"], a Greek compound word meaning circumnavigation, but applying particularly to the circumnavigation of Africa by Hanno, the Carthaginian. By some writers the account of Hanno's famous voyage is regarded as fabulous, but the weight of both evidence and opinion is against their hasty conclusions. The description given by Herodotus, of the trees in India "bearing wool which surpassed that of sheep in beauty," was long regarded as an absurd fabrication, while later the tales of Marco Polo, of "the wondrous land of Cathay," were utterly discredited. Certainly, nothing would seem to be more probable than that an enterprising, commercial people like the Carthaginians should make some effort to become acquainted with the form, extent, resources, and character of the country which they inhabited. As to the terminus of Hanno's cruise, authorities differ; some asserting that he turned back, owing to a scarcity of provisions, from Gorilla (now St. Thomas) Island; others, that he kept on to the Arabian Gulf, whence he sent messengers home by land. On one point all are agreed—namely, that Hanno was absent from Carthage five years, and that when he returned to it he delighted the people of that city with marvellous accounts of the dangers he had experienced by land and by sea, and of the curious birds, beasts, and fishes fallen in with during his wanderings. His logbook was deposited in the temple of Saturn. It was entitled *An Account of the Voyage of Hanno, Commander of the Carthaginians, round the parts of Libya, beyond the Pillars of Hercules.*

FOXHALL A. PARKER.

Perissodac'tyla [Gr. περισσός, "unequal," and δάκτυλος, "a toe"], a sub-order—or, according to some authors, an order—of the hoofed animals (Ungulata), so named because the digits are of unequal size. These are unpaired or uneven, the third being the largest and most exserted, the fourth nearly coequal in size and position with the second, and the fifth on the hind foot at least atrophied; the articulating phalanges, as well as carpal and tarsal bones, are correspondingly modified; the astragalus has the anterior or inferior articulate surface divided into two very unequal facets; the femur is provided with a third trochanter, and its shaft is perforated at the back part by the medullary artery; the dorso-lumbar vertebræ are in increased number—*i. e.* not less than twenty-two (d. 18 — 19 + 1, l. 3 — 6). The skull has the intermaxillary bones tectiform or shelving in a roof-like manner above, and united at the symphyses, and the incisors, when present, are implanted nearly vertically, and are parallel to their roots; the stomach is cæcal; the cæcum very much enlarged and sacculated. The sub-order thus distinguished includes three families, represented by liv-



A, *Orohippus* (Eocene); B, *Mesohippus* (Miocene); C, *Hipparion* (Pliocene); D, *Equus* (Quaternary and Recent).

ing forms; the tapirs (Tapiridæ), rhinoceroses (Rhinocerotidæ), and horses (Equidæ). In previous geological ages numerous others, more or less related to them, flourished. The affinities of these forms were, to some extent, recognized by Cuvier, and still more by De Blainville, but the sub-order was first distinctly introduced with formal characters by Prof. Owen. The accompanying figures will exemplify the various modifications of the feet in recent as well as extinct types of the order. THEODORE GILL.

Peristal'tic [Gr. περισταλτικός, "compressing"] **Motion,** the name given to certain movements which take place in the alimentary canal, the term being generally restricted to the worm-like action by means of which the food is carried to and fro over the mucous membrane of stomach and intestines. The walls of both stomach and intestines are made up of two layers of involuntary muscular tissue, which are arranged as an external longitudinal and an internal circular; the outermost layer of the intestine is serous, and is simply a reflexion of the peritoneum. The internal coat consists of a mucous tissue, varying in structure in different parts. Between the external and internal muscular layers is situated the *plexus myentericus* of *Auerbach*, to which reference will be made farther on. From the anatomy of the parts it is easy to perceive how, by the simple action of its muscular walls, the food after its entrance into the stomach is first moved about in this organ, and then, having passed into the small intestine, is carried onward by the gradual contraction and relaxation, which, starting from above, is continued downward. The contraction of the circular fibres diminishes the calibre of the gut, and at the same time the shortening of the longitudinal layer tends to the onward movement of the alimentary substances. During the processes of digestion this movement is readily observed by opening the abdomen of a living animal, and it will be seen that the movement continues for a short time, then ceases, to be renewed. Not only does the muscular wall carry the food toward the outlet of the canal, but often after the mass has been pushed, or rather squeezed, for a certain distance downward, it is carried back again in the opposite direction (antiperistaltic movement). There is probably little if any peristaltic action while the intestine is empty, it being the stimulus of food which causes it. The alimentary mass, coming in contact with the periphery of the nerves situated in the mucous membrane, imparts a certain amount of irritation, which is followed by muscular movement—*i. e.* contraction and relaxation—probably through the agency of the *ganglionic plexus myentericus* of *Auerbach;* and this slow, gradual passage of the food backward and forward is required for the processes of digestion. The varied theories attributing the peristaltic motion to the action of bile, blood in the veins or arteries, etc. are not worthy of comment. J. W. S. ARNOLD.

Peristeria. See HOLY SPIRIT PLANT.

Peritoneum. See PERITONITIS.

Peritoni'tis [Gr. περιτείνειν, to "stretch over"], inflammation of the peritoneum, a serous membrane investing the viscera of the abdomen; popularly designated "inflammation of the bowels." The peritoneum has two layers, and constitutes a closed sac; the external layer lines the abdominal walls; the internal is reflected over the stomach and intestines, liver, spleen, ovaries, uterus, and bladder. These opposed surfaces are smooth and lubricated by secreted serum, permitting the free movements of the viscera, their ascent and descent in respiration, and the peristaltic movements of the bowels. Traumatic peritonitis is the result of bruises, wounds, and surgical operations. Idiopathic peritonitis is a primary inflammation; it may result from perverted conditions of the blood or from checked perspiration and chilling of the abdomen or lower extremities. Local peritonitis is a frequent occurrence, the inflammatory process being limited to the perito-

neal investment of a single viscus, as the liver, uterus, or ovary. Puerperal peritonitis, or metro-peritonitis, is inflammation of the uterus and peritoneum occurring in women following confinement. (See PUERPERAL FEVER.) Tubercular peritonitis is chronic and slowly progressive, consisting in the deposition of successive strata of inflammatory lymph, alternating with miliary tubercles, with interspersed masses of caseous matter, or yellow tubercle; tubercle usually coexists in the lungs and other organs. Acute peritonitis, as a rule, is of sudden onset. Abdominal pain is its prominent symptom, at first localized, but quickly diffused over the entire abdomen. The pain is increased by pressure, by the movements of respiration, and by tension of the abdominal muscles. The breathing is therefore chiefly thoracic, the diaphragm fixed to prevent abdominal movement, and the respiration is correspondingly shallow, restrained, and rapid. The limbs are retracted upon the body to relax tension of the abdominal surface. There is temporary paralysis of the muscular coat of the bowel; constipation results, also extreme flatulent distension of the intestines, and general tumefaction of the abdomen, which, when percussed, is resonant—a condition termed tympanitis. The inflamed surface is so extensive, invests so many important organs, producing extensive peripheral nerve-irritation as well as impressions on the plexuses of the sympathetic nerve, that the constitutional depression is very marked. The face is pale, haggard, and anxious, wearing an expression of great suffering. The teeth are set, the lips tightly drawn, the eye set and sunken, the cheeks collapsed—in extreme cases constituting the *Hippocratic facies*, or *facies griffé* of the French. Peritonitis is always a dangerous disease, but its termination will depend upon early diagnosis and a correct treatment, conducted with vigor and persistence. When incipient, it may be aborted or limited by local use of ice or cold water, local dry cupping, cardiac sedatives, as veratrum and digitalis, and a single prompt saline purge. If fully developed, opium is the supreme remedy, to allay pain and secure absolute rest of the intestines from their physiological peristaltic action. In peritonitis the tolerance of opium is very great. The cold water or ice pack, if judiciously used, will be of value during the acute period of the disease, but later warm and anodyne applications are preferable. The diet during the disease should be liquid, and cathartics should be avoided.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Per′iwinkle, a popular name of various half-shrubby and herbaceous erect or trailing plants of the genus *Vinca* and order Apocynaceæ. The *V. major*, *minor*, and *herbacea* of the gardens are hardy European plants. *V. rosea*, a fine greenhouse evergreen shrub, grows wild in most tropical regions, and also in Florida, where it was not improbably introduced. But it is probably a native of the West Indies, etc., rather than of the Old World.

Periwinkle, a name applied to the numerous species of *Littorina* and similar genera. The *Littorina littorea* is in Great Britain extensively used as food, and is agreeable to the taste, but in the U. S. is hardly ever employed as food.

Per′jury (law). The crime of perjury at the common law—that is, independent of all statutory modification—is defined by Lord Coke as follows: Where a lawful oath is administered by any one who hath authority to a person in any judicial proceeding, who swears wilfully, absolutely, and falsely in a matter material to the issue or cause in question, either by his own act or by the subornation of others. Certain requisites were therefore necessary in order to constitute the offence—viz. (1) an *oath* must be administered, (2) by a person having lawful authority and jurisdiction, (3) in some pending judicial proceeding, (4) the matter testified must be false, (5) and wilfully so, not the result of mistake or surprise or inadvertence, (6) and must be absolute, not the mere expression of an opinion, (7) and must be material to the questions awaiting decision in the controversy. It is plain that the common law left many instances of false swearing outside of this definition. Statutes of the U. S. and of the individual States have supplied the defect, and have greatly enlarged the scope of the crime. In the first place, the effect of an *affirmation* has been made the same as that of an oath. The second important modification consists in embracing all cases of wilfully false statements, when material, made in proceedings not judicial, wherever the law requires or even authorizes an oath or affirmation to be administered to a person in order to protect a public or a private right or to enforce a public or a private duty. A reference to one or two of these statutes will be sufficient as illustrations of the whole. A general act of Congress, originally passed in 1825, and contained with all its substantial features in the *U. S. Revised Statutes*, provides that "if any person in any matter or proceeding where an oath or affirmation shall be required to be taken under any law of the U. S." shall wilfully swear or affirm falsely, he shall be guilty of perjury. In New York the crime embraces all cases of oaths or affirmations legally administered (1) in judicial proceedings; (2) when required by law as necessary for the prosecution or defence of any private right or for the ends of public justice; (3) when lawfully required by any judicial, executive, or administrative officer. In many of the States the statutory language describes the oaths as "required" by law, while in many others it speaks of them as "required or authorized" by law. It is a well-established doctrine that a person cannot be convicted of perjury upon the unsupported testimony of a single witness, since there is then only an oath opposed to an oath. It is sufficient, however, if the direct testimony of one witness for the prosecution, fully substantiating the charge, is corroborated in some material point by other and independent evidence. The punishment is imprisonment in the State's prison, with sometimes a fine in addition. JOHN NORTON POMEROY.

Per′kins, tp. of Sagadahoc co., Me. Pop. 71.

Perkins, tp. of Erie co., O. Pop. 1291.

Perkins (CHARLES CALLAHAN), A. M., b. at Boston, Mass., Mar. 1, 1823; graduated at Harvard University 1843; has published in London *Tuscan Sculptors* and *Italian Sculptors*—works of great research and highly illustrated.

Perkins (ELISHA), b. at Norwich, Conn., Jan. 16, 1741, was the son of Dr. Joseph Perkins of Plainfield, Conn. The son established and supported an academy at Plainfield, where he practised medicine with great success. In 1796 he announced the invention of metallic tractors for the cure of rheumatism, gout, and the like diseases. His son went to Europe with the tractors, where, as well as in America, the new cure, called "Perkinism," attracted great attention, and was favorably received even by physicians. Lord Rivers presided over a Perkinian institution in which many marvellous cures were wrought solely by the power of imagination, for the tractors were simply pins of iron and brass which were drawn over the affected part. In Copenhagen the medical faculty published a voluminous report in favor of Perkinism; and when in 1803 the English physicians had begun to see through the imposture, T. G. Fessenden produced his *Terrible Tractoration* as a defence of Perkins and a satire upon the doctors. Perkins afterwards invented a remedy of great alleged value in the cure of fevers, and during a yellow-fever season in New York went there to test its value, but himself fell a victim to the disease, Sept. 8, 1799. He was a man of great native endowments, public spirit, and generosity, but it seems impossible to clear him of the charge of falsehood with regard to his tractors, which he pretended were made of a peculiar combination of metals, but which in reality were of common brass and iron.

Perkins (GEORGE H.), U. S. N., b. Oct. 20, 1836, in New Hampshire; graduated at the Naval Academy in 1856; became a lieutenant in 1861, a lieutenant-commander in 1862, a commander in 1871; served with distinguished gallantry as the executive officer of the Cayuga at the passage of Forts St. Philip and Jackson and capture of New Orleans in 1862, and commanded the iron-clad Chickasaw at the battle of Mobile Bay, Aug. 5, 1864, where his conduct attracted the attention of Rear-Admiral Farragut, who in his official report of the battle says: "I cannot give too much praise to Lieut.-Com. Perkins, who, though he had orders to return North, volunteered to take command of the Chickasaw, and did his duty nobly."

FOXHALL A. PARKER.

Perkins (GEORGE ROBERTS), LL.D., b. in Otsego co., N. Y., May 3, 1812; was principally self-educated; was teacher of mathematics at the Clinton Liberal Institute 1831–38; professor of mathematics in the State Normal School 1844–48; principal of that institution 1848–52; superintended the erection of the Dudley Observatory; deputy State engineer 1858, and State surveyor. Author of a series of mathematical textbooks, and contributed to scientific periodicals. D. at New Hartford, N. Y., Aug. 22, 1876.

Perkins (JACOB), b. at Newburyport, Mass., July 9, 1766; was in childhood apprenticed to a goldsmith; invented a new method of plating shoe-buckles; was employed in 1797 to make dies for the State coinage; invented soon afterwards a machine for cutting and heading nails at a single operation, and was the originator of the use of steel, instead of copper plates, for engraving bank-notes. After residing some years in Boston and New York, he engaged in business in Philadelphia as a bank-note engraver in 1814; went to England in 1818; obtained a contract for supplying plates to the Bank of Ireland, and during a course of years originated many curious ex-

periments. He was the inventor of the steam-gun, of the bathometer for measuring the depth of water, of the pleometer for registering the speed of vessels, and largely aided in perfecting the manufacture of the steam-engine. D. at London July 30, 1849.

Perkins (James Handasyd), b. at Boston, Mass., July 31, 1810, nephew of Col. Thomas H. Perkins, in whose counting-room he was a clerk 1828–30; visited England and the West Indies 1831–32; settled at Cincinnati 1832, and studied law; devoted himself to literature; edited the *Evening Chronicle* and the *Cincinnati Mirror;* became a Unitarian minister 1839; pastor of a church 1841–47; was the first president of the Cincinnati Historical Society 1844; wrote valuable historical papers on the Western States in the *North American* and the *New York Reviews;* published *Annals of the West* (1847), and was identified with the causes of education and prison discipline. In a fit of depression he drowned himself in the Ohio River at Cincinnati Dec. 14, 1849.

Perkins (Jonathan Cogswell), b. at Ipswich, Mass., Nov. 21, 1809; graduated at Amherst College 1832; studied at the Cambridge Law School; was admitted to the bar 1835; practised law successfully thirteen years, editing and annotating several valuable legal textbooks; was elected State senator 1847; became judge of the court of common pleas 1838. Practised law at Salem, Mass., and d. there Dec. 12, 1877.

Perkins (Justin), D. D., b. at West Springfield, Mass., Mar. 12, 1805; graduated at Amherst College 1829, and Andover Theological Seminary 1832; was tutor at Amherst 1832–33; went to Persia as a missionary of the A. B. C. F. M. 1833; laid the foundation of the Nestorian mission at Oroomiah Nov., 1834; established schools; created a modern literature in the Nestorian dialect of Syriac, into which he translated the whole Bible and several religious and educational books; visited the U. S. with Mar Yohannan, a Nestorian bishop, 1842; made another visit 1848; finally returned to the U. S. Aug., 1869. D. at Chicopee, Mass., Dec. 31, 1869. Author of Syriac commentaries on Genesis and Daniel, of *Eight Years in Persia* (1843), and *Missionary Life in Persia* (1861).

Perkins (Col. Thomas Handasyd), b. at Boston, Mass., Dec. 15, 1764; went as a supercargo to Batavia and Canton 1789; formed a partnership with his elder brother, James, and was for many years largely engaged in trade to Canton, Calcutta, and the N. W. coast of America; acquired great wealth; was a strenuous opponent of Pres. Madison's administration during the war of 1812–15; represented Boston nearly twenty years in both branches of the State legislature; retired from active business about 1823; was the largest contributor to the Mercantile Library Association; took a prominent part in the erection of the Bunker Hill Monument, and subsequently in that of the Washington Monument; was the projector of the Quincy Railway (1827), the first built in the U. S.; gave his mansion on Pearl street, valued at $40,000, as an asylum for the blind; was a liberal benefactor of the Massachusetts General Hospital, and with others of his family contributed $60,000 to the Boston Athenæum. D. at Boston Jan. 11, 1854.

Perkins' Plantation, tp. of Franklin co., Me. P. 149.

Per'kinsville, post-v. of Weathersfield tp., Windsor co., Vt., on Black River.

Perkio'men, tp. of Montgomery co., Pa. Pop. 2056.

Per'leberg, town of Prussia, province of Brandenburg, on the Stepnitz, has manufactures of beetroot-sugar, wadding, and chicory. Pop. 6485.

Perm, the easternmost government of European Russia, comprises an area of 128,623 square miles, with 2,173,501 inhabitants. The larger, central part of the country is covered by the Ural Mountains, which attain a height of 4000 feet, rising through very gentle slopes from the surrounding meadow-lands, and entirely covered with forests. The climate is very severe. In the middle of September the snow comes, the rivers freeze, and all transportation is carried on by sledges; at lat. 60° N. all cultivation ceases. Nevertheless, the country produces sufficient grain and cattle for its home consumption. The chief branch of industry is mining. Gold, silver, platina, iron, salt, coal, alabaster, marble, and diamonds are found, and some of the mines are very rich. Perm iron is celebrated in Europe, and is produced annually to the value of $30,000,000. The platina-mines are said to be the richest in the world. A very important transit-trade between Asia and Europe is carried on.

Perm, town of European Russia, capital of the government of Perm, on the Kama. It is the see of an archbishop, and carries on, besides a large trade in the products of its own industry, a most extensive transit-trade in European and Asiatic products. Pop. 22,859.

Perman'ganates, compounds with bases of *permanganic anhydride,* Mn_2O_7. Permanganates have in crystalline form a dark-red or brownish color. With combustible bodies they deflagrate like the nitrates and chlorates. They are all soluble in water, and many are deliquescent. Permanganate of silver is the least soluble salt, and according to Mitscherlich may be caused to precipitate in great part in a crystalline form by mixing concentrated alkaline permanganates with concentrated solution of argentic nitrate. The solutions of these salts have an intense red color and enormous tinctorial power, a surprisingly small quantity tingeing red a very large volume of pure water. They are reduced and destroyed with rapidity by oxidable matters, especially of the organic kind; so that water slightly tinged with a permanganate constitutes a very delicate test for deoxidizing matters, the color being destroyed thereby. A weak solution of a permanganate is used in volumetric analysis, in the laboratory, for determination of oxidable substances. Certain contaminations of drinking waters, products of putrefaction, are readily detected by adding to the water a little weak solution of permanganate, which may tinge the water for a minute or two, but if these impurities are present the color will rapidly fade or turn brownish. By virtue of their high oxidating power permanganates are much used in disinfection.

Potassic permanganate is the salt which is employed for disinfecting and as a chemical reagent, and has therefore become an article of commerce. A brief statement of its preparation will hence be appropriate. The method most recommended is that of Béchamp of Montpellier, who mixes 10 parts of fine powder of black oxide of manganese intimately with 12 parts of potash in concentrated solution, dries thoroughly, puts into an earthenware retort, heats and passes over the mass oxygen, or air free from carbonic acid, as long as absorption continues. The mass is then dissolved, and the excess of potash neutralized—not with a mineral acid, as usual, but with a current of carbonic acid gas, passed until the liquid becomes purple. It is then decanted, evaporated at a moderate heat, and crystallized. Purity is obtained by recrystallization. Permanganate of potash crystallizes in beautiful and brilliant dark-purple prisms. It dissolves in five times its weight of water. It is anhydrous, and its formula is $K_2O.Mn_2O_7$. H. Wurtz.

Permangan'ic Acid. This acid is preparable from the permanganate of potash by distillation with somewhat diluted sulphuric acid at a very low temperature, not over 160° F. Violet-colored vapors pass over, and condense to a singular greenish-black liquid, which has a lustre of a *metallic* character. It is very deliquescent, and causes spontaneous combustion on contact with several organic bodies by virtue of its energetic oxidizing power. Its formula in this form is $H_2O.Mn_2O_7$. The anhydride, Mn_2O_7, has never been isolated. H. Wurtz.

Permian Group. See Geology.

Permuta'tions [Lat. *permutatio*], the results obtained by writing a certain number of letters, or factors, in every possible order, so that all the letters shall enter each result, and each letter but once. Thus, the letters a, b, and c may be written abc, acb, bac, bca, cab, and cba. Here there are three letters and $1 \times 2 \times 3$, or 6, permutations. To determine the number of permutations of n letters, n being any whole number, let us denote the number of permutations of $n - 1$ letters by Q; if we now introduce a new letter, it is obvious that it may have n places in each of the Q permutations of $n - 1$ letters; that is, it may be written before the first letter of each, between each two letters, and after the last letter of each; hence, the whole number of permutations of n letters is $Q \times n$. Now, the number of permutations of 3 letters is $1 \times 2 \times 3$; hence, the number of permutations of 4 letters is $1 \times 2 \times 3 \times 4$. Proceeding from this conclusion, we infer that the number of permutations of 5 letters is $1 \times 2 \times 3 \times 4 \times 5$, and so on indefinitely. Hence, the number of permutations of n letters is the continued product of the natural numbers from 1 to n, inclusive, n being any whole number. If the actual product indicated by each permutation is found, it will be equal to a fixed quantity in each case. The theory of permutations finds an important application in the deduction of formulas for combinations and arrangements, and these in turn are used in developing the theory of probabilities. (See Davies' *New Bourdon*, pp. 317–322.) W. G. Peck.

Pernambu'co, province of Brazil, S. of Parahiba, and bordering on the Atlantic, comprises an area of 61,068 square miles, with 1,250,000 inhabitants. It contains extensive meadows teeming with cattle, and large tracts of the most fertile soil covered with plantations of cotton, sugar-cane, and coffee, or with forests yielding the most valuable kinds of timber and wood.

Pernambuco, city of Brazil, with respect to size the third, with respect to commercial importance the second, of the country, is at the mouth of the Biberibe, in lat. 8° 4′ S., on a low but extremely fertile plain covered with sugar and cotton plantations, and producing all varieties of tropical fruits. Its excellent harbor is formed by a reef extending for several miles along the coast, and acting as a breakwater, on whose northern extremity is a lighthouse marking the entrance into the harbor. The city itself, which was founded by the Dutch, and which, not only in its single buildings, but also in the general character of its architecture, shows a Dutch influence, consists of three parts: Recife, on a narrow peninsula; Boa Vista, on the river-shore; and San Antonio, on an island in the river; which three parts are connected by elegant iron bridges. Recife forms the business part of the city, and has several broad and elegant streets; and, although the city has no very remarkable public buildings, its general appearance is neat, and in many parts even beautiful, on account of the promenades and gardens with their wonderful tropical vegetation. The two principal articles of export are sugar and cotton. In 1868 no less than 48,624 tons of sugar were exported, and 197,994 sacks of cotton (160 pounds each). Besides these two articles, large quantities of rum, hides, dyewood, and coffee are shipped from this port. The pop. of the city is estimated at from 90,000 to 100,000.

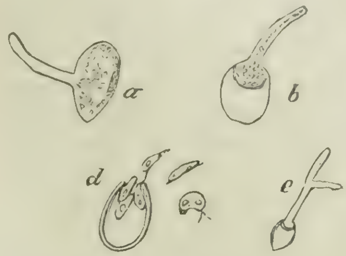
Per′nau, town of Russia, government of Livonia, at the entrance of the river Pernau into the Gulf of Riga, is regularly built and was formerly fortified. Pop. 9527.

Peronosporeæ, an order of Fungi in which the conidia are aërial, and produced either singly or in rows on the surface of the foster-plant, and whose oöspores are produced by the action of a pollinodium upon the contents of an oögonium which is buried in the substance of the foster-plant. This small order, comprising only two genera, includes species which, with a single exception, are all parasitic on living herbaceous plants. They appear to the naked eye either like a white frost or in white powdery spots on green leaves and stems, particularly on the lower surfaces of leaves. The order includes some of the most destructive of Fungi, as that which causes the potato-rot, the lettuce, onion, and American grapevine mould, and the white mould of cabbages, mustard, and other cruciferous plants. The mycelium of the species of this order pervades all parts of the plants on which they are parasitic, extending from the flowers, as seen in *Peronospora violacea* and *Cystopus candidus*, to the roots, of which we have a familiar example in the potato-rot. The hyphæ or threads of the mycelium are not often divided by cross-partitions, and are in most species furnished with *haustoria*, or suckers, by means of which they not only make their way between, but also force their way into, the cells of the foster-plant, and are thus more easily enabled to attach themselves and to absorb nourishment. In some species, as in *Cystopus candidus*, the haustoria are nothing more than little knobs, while in *Peronospora parasitica* they are so large as almost to fill up the cells into which they have made their way. The haustoria are more readily seen in the stem than the leaf. The mycelium of the species of this order is extremely sensitive to moisture. In dry weather it remains comparatively dormant, but in wet seasons grows rapidly through all parts of the plant, and finally pushes its way through the stomata into the air, as in the genus *Peronospora*, or, as in *Cystopus*, bursts through the epidermis in irregular spots. We shall first consider what takes place in *Peronospora*, where the mycelium pushes through the stomata and does not rupture the epidermis.

Fig. 1.

From this fact we see why the presence of a *Peronospora* is first made known to the eye as a frostlike spot on the under surface of the leaves. The hyphæ, after passing through the stomata, branch in different ways according to the species; irregularly, as in *Peronospora infestans*, Mont.; dichotomously, as in *P. effusa*, Grev. (Fig. 1); trifarously, as in *P. viticola*, B. & C.; or stellate, as in *P. gangliformis*, Berk. At the tips of the branches are borne the conidia or asexual spores, which are formed by a swelling of the terminal part of the mycelium, which is separated from the rest of the mycelium by a cross-partition. The conidia are always more or less oval in shape, and fall very easily from their attachments. If the conidia fall on any wet or moist surface, they germinate in a very short time, sometimes as quickly as an hour. The method of germination varies in different species, and may be of three different kinds. First, as in *Peronospora effusa*, Grev., a germinal tube may be given off from the side of the spore, as shown in Fig. 2, *a*; secondly, the germinal tube may be given off from the end of the spore, as in *P. gangliformis*, Berk. (Fig. 2, *b*); thirdly,

Fig. 2.



we may have a more complicated development, as in *P. infestans*, Mont., and *P. viticola*, B. & C., where the contents of the conidia divide into small bodies, from three to seventeen in number, which burst through the wall of the conidia, and then swim rapidly about for from fifteen to thirty minutes by means of two cilia attached at the side. At the expiration of this period they come to rest, the cilia fall off, and in a short time a germinal tube is produced which soon assumes all the characters of the original *Peronospora* mycelium. In Fig. 2, *c*, is represented one of the conidia of *Peronospora infestans*, in which the contents are dividing so as to form zoöspores; in *d* the zoöspores, with their two vibrating cilia, have forced their way out of the conidia; and *e* represents one which has come to rest and shot out a germinal tube.

When the mycelium of any *Peronospora* has made its way through the stomata into the air and borne conidia, it has, of course, spread through the leaf, stem, or whatever part of the plant it may be to such an extent as to absorb all the nourishment of the plant-cells themselves, and, contemporaneously with the appearance of the conidia, we have a blackening of the leaves, stems, etc., which indicates the death of the foster-plant from the ravages of the *Peronospora*. In many cases, however, before this blackening occurs, a change has taken place in the threads of the mycelium imbedded in the tissue of the leaves and stems. Certain filaments are observed to enlarge until a spherical outline is attained. A cross-partition then forms, which separates the spherical part from the rest of the mycelium. In the mean while, another filament has grown until it comes in contact with the spherical portion of the first, and its terminal portion is also separated from the rest of the mycelium by a cross-partition. Fig. 3 represents the change just described; *b* and *a* respectively represent the ends of two mycelial threads, which are shut off from the rest by cross-partitions; *a* is the *antheridium*, *b*, the *oögonium*, in which the protoplasmic contents, *o*, are collected in a spherical mass at the centre. The fertilization of *o*, which is to form the oöspore, is effected by the growth from the antheridium of a small process, *p*, which, from its resemblance to a pollen-tube, has been called the *pollinodium* by De Bary. Whether the pollinodium makes its way into, or merely touches the surface of, the mass *o*,

Fig. 3.

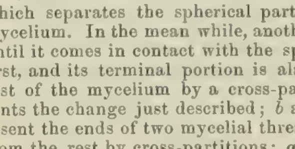
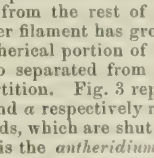


Fig. 4.



has never been satisfactorily proved. As the result of impregnation a coating of cellulose is formed around *o*, and it becomes the oöspore, as is shown in Fig. 4, where *b* represents the mother-cell, as in Fig. 3, and *a* the shrivelled remains of the antheridium. The outer cellulose wall of the oöspore is often developed into ridges or spines, and is

of tough, resisting nature, generally able to endure the cold of winter without injury, whereas the conidia are destroyed by freezing. The oöspores, which are never aërial, but buried in the leaves or stems, are set free by the rotting of the tissue in which they are enclosed. The germination of the oöspores has been observed only in *Peronospora Valerianellæ*, Fuckel. In that species the thick outer membrane bursts and a germinal tube grows out.

The species of *Peronospora* are rather numerous, and are distinguished from one another by the branching of the filaments which bear the conidia, by the shape, color, and mode of germination of the conidia, and by the size and markings of the oöspores. As a rule, species of *Peronospora* are limited in their habitat to a single species of phanerogams or to a few nearly-related species. *Peronospora infestans*, Mont., is limited to the potato and the tomato. When a *Peronospora* occurs on more than one species of phanerogam, it sometimes happens that the oöspores are not found on all of them. This is also the case with the species of *Cystopus*. *Cystopus candidus*, for example, which is very common on Cruciferæ, bears conidia abundantly when parasitic on *Capsella*, but no oöspores; whereas when parasitic on *Sinapis* oöspores abound.

Of the species of *Peronospora*, *P. infestans*, Mont., which is the cause of the potato-rot, deserves special notice. In 1842, and again in 1845, the potatoes cultivated in the U. S., as well as in a great part of Europe, were attacked by a violent disease which in the course of a few hours caused whole fields to become black and rotten. The general direction of the epidemic was from W. to E. The source of the trouble was at length found to be a parasitic fungus, which Montagne described as *Botrytis infestans*. The disease has occurred several times since 1845, and in fact it prevails to a certain extent almost every damp season, but never with such severity as in 1845. In that year the crop was entirely destroyed, and in countries like Ireland and Nova Scotia, where the potato constituted an important article of diet, there was great distress. Numerous prizes were offered for a remedy, but without success, although botanists examined the habits of the fungus very thoroughly. The most exhaustive account of the subject was given by De Bary in the *Annales des Sciences* (4th series, vol. xx. 1863). He studied the germination of the conidia which has been referred to above, and found that the germinal tubes could enter any part of the potato-plant. He even found the ground under infected plants filled with the moving zoöspores. The most important question was to ascertain how the disease was propagated from year to year, for the conidia, which are abundant in summer, cannot survive the cold of winter. No oöspores were found by which the disease could be propagated, and it began to be surmised that the oöspores, if they existed, must be in some wild species of *Solanum* growing in Peru or the neighboring countries, or else that they must be found in some plant not nearly allied to the potato. During the summer of 1875, Mr. Worthington G. Smith of England discovered the oöspores in the leaves of some cultivated American varieties of potato, and published an account of them in the *Gardener's Chronicle* of July 17, 1875, and in the *Quarterly Journal of Microscopic Science* of Oct., 1875, where two photographs of preparations are given. The only other useful plant which, so far as is known, is attacked by the potato-rot is the tomato. There is no direct cure for the disease. For its production to any very injurious extent a wet, rather warm, season is necessary. The leaves and stems of diseased plants should be destroyed to prevent the fungus spreading. Fig. 5 gives a view of the mycelium of the potato-rot fungus passing through a stoma and bearing conidia.

Fig. 5.

Cystopus, the remaining genus of the Peronosporeæ, resembles closely the genus *Peronospora*, except in the structure of the conidia. In *Peronospora*, as we have seen, they are borne singly at the tips of branching threads; in *Cystopus* they are in rows which are packed closely together. W. G. FARLOW.

Pe'rote, post-v. and tp. of Bullock co., Ala. P. 1538.

Pérouse, La. See LA PÉROUSE.

Perpendic'ular [Lat. *perpendicularis*], a style of Gothic architecture which flourished in England during the fifteenth century. While in France, Gothic architecture became debased by being overloaded and by running into the fantastic (see FLAMBOYANT), it degenerated in England by becoming stiff, dry, and meagre, as if the aim had been to confine architecture to the use of straight lines only. One of the most prominent specimens of this style is the cathedral of Winchester; also most of the colleges at Oxford and Cambridge belong to it. But with the Perpendicular style followed the open timber roof, which is often elaborated with great beauty; an interesting example is the roof of Westminster Hall, built by Richard II.

Perpet'ual Mo'tion, a term employed to denote an assumedly possible form of mechanism, which having been set in motion by some natural force, should continue always to move, and should at the same time be capable of at once constantly restoring the force expended in moving it, and of performing useful work besides. The mechanical absurdity involved in this notion is to ordinary minds self-evident the moment the proposition is distinctly stated. In spite of this, however, there have been found a surprising number of individuals so completely and incorrigibly blind to the error as to have devoted their whole lives to attempts to solve the fascinating problem. Gravity is the natural force which, in nearly every instance, these schemers have endeavored to compel to undo its own work, and to do additional work besides. With this view there have generally been employed wheels provided with a variety of contrivances by which it was imagined that weights descending on one side might be made to carry up on the opposite side other equal weights to the same height, which latter by descending in turn might maintain the motion. Strictly speaking, if there were no friction or other sources of resistance in the case, a wheel set into rotation would continue to revolve for ever, and would need none of these contrivances of lifted and descending weights to maintain its uniformity of velocity. It would therefore be a perpetual motion, but not a perpetual motion in the sense intended by the schemers with whom the expression originated. It would do no work. The planets are examples of perpetual motion upon a grand scale, but this is owing only to the fact that they encounter no sensible resistance in their paths through space.

The history of the very numerous mechanical conceptions by which the different seekers after a *working* perpetual motion have hoped to accomplish their end would form a very entertaining chapter, but a chapter without practical utility. Those who would pursue the subject further will find a good account of it in Dircks's *Perpetuum Mobile*, London, 1861. Montucla's *Histoire des Mathématiques* contains also notices of the delusion, and the scientific journals of the last century in Europe have scattered through them descriptions of numerous such projects.

F. A. P. BARNARD.

Perpetuities. See ANNUITY.

Perpignan', town of France, capital of the department of Pyrénées-Orientales, on the Tet, is a fortress of first rank, and commands the passage between France and Spain. It has distilleries, bell-foundries, and manufactures of leather, cork, and woollen fabrics, and an active trade in oil, wine, corn, and fruits. Pop. 27,378.

Perquim'ans, county of N. E. North Carolina. Area, 250 square miles. It is bounded S. by Albemarle Sound, and traversed by the navigable Perquimans River. It is in part marshy; its soil is light and productive. Corn is the leading product, but of late cotton is cultivated with great success. Flour is a leading article of manufacture. Cap. Hertford. Pop. 7945.

Perrault' (CLAUDE), b. at Paris in 1613; studied medicine, but devoted himself afterwards to architecture; designed the façades of the Louvre and the Observatory of Paris; translated Vitruvius (1673–84); published several volumes of essays on physics and architecture. D. at Paris Oct. 9, 1688.—His brother, CHARLES PERRAULT, b. Jan. 12, 1628, d. May 16, 1703, was a very prolific poet and miscellaneous writer, but he is now known only through the sarcasms of Boileau, and through a small book which he published pseudonymously, *Les Contes des Fées*.

Perrenot, de (ANTOINE). See GRANVELLE.

Per'rinton, tp. of Monroe co., N. Y. Pop. 3261.

Perron, du (ANQUETIL). See ANQUETIL-DUPERRON.

Perrot' (GEORGES), b. at Villeneuve-Saint-Georges, department of Seine-et-Oise, France, Nov. 12, 1832; studied from 1855 to 1858 at the French school in Athens; made in 1861 a journey of exploration in Asia Minor; dwelt for some time at Ancyra investigating the famous inscription

on the temple which the Galatians built there in honor of Augustus; and wrote *Exploration archéologique de la Galatie et de la Bithynie* (1863), *Souvenirs d'un Voyage en Asie Mineure* (1864), *Essai sur le Droit publié et privé de la République Athénienne* (1867), etc.

Perrot (Nicholas), b. in France early in the seventeenth century; obtained a good education; came to Canada, and became an Indian trader, acquiring great influence among the Western tribes, whose languages he learned; rendered great services to several Canadian governments, and was the discoverer of the lead-mines on the river Des Moines, Ia. Author of journals largely employed by Charlevoix and other writers.

Per'ry [Lat. *pirum*, "pear"], a drink made extensively in England from the juice of the coarser kinds of pears, in much the same way as cider is made. Perry is sweeter than cider, and is largely used as a beverage. It is popularly regarded as an antidote for mushroom-poisoning.

Perry, county of W. Alabama. Area, 740 square miles. It is uneven, very fertile, and well wooded. Cotton and corn are leading products. It is traversed by several railroads, and by the Cahawba River, which it is proposed to render navigable. Cap. Marion. Pop. 24,975.

Perry, county of Central Arkansas. Area, 530 square miles. It is hilly, broken, well timbered, and contains beds of coal. The valleys are fertile, and adapted to cotton and grain culture. The Arkansas River washes the N. E. border. Cap. Perryville. Pop. 2685.

Perry, county of S. Illinois. Area, 485 square miles. It is very fertile, well wooded, and abounds in excellent coal. Cattle, grain, and wool are leading products. The county is traversed by the Illinois Central, the St. Louis Alton and Terre Haute, and the Iron Mountain Chester and Eastern R. Rs. Cap. Pinckneyville. Pop. 13,723.

Perry, county of S. Indiana, bounded S. and S. E. by the Ohio River. Area, 450 square miles. It is very hilly and remarkably fertile, producing much corn, wool, tobacco, and live-stock. Good coal and iron ore abound. The county has large and increasing manufacturing interests. Cap. and principal town, Cannelton. Pop. 14,801.

Perry, county of S. E. Kentucky. Area, 700 square miles. It is mountainous, with some fertile valleys. Corn is the leading product. Coal is found, which has here a prospective value only. Drained by the head-streams of the Kentucky River. Cap. Hazard. Pop. 4274.

Perry, county of S. E. Mississippi. Area, 1116 square miles. It is level, sandy, and mostly covered with dense pine forests. It is watered by affluents of the Pascagoula River. Cap. Augusta. Pop. 2694.

Perry, county of S. E. Missouri, bounded N. E. by the Mississippi River, which separates it from Illinois. Area, 430 square miles. It is uneven, heavily timbered, and fertile. Live-stock, grain, and wool are leading products. Lead and iron are found. Cap. Perryville. Pop. 9877.

Perry, county of Central Ohio. Area, 400 square miles. It is hilly, fertile, and contains beds of good coal. Cattle, wool, tobacco, and grain are staple products. Stone and earthen ware is a leading article of manufacture. The county is traversed by the Cincinnati and Zanesville R. R. Cap. New Lexington. Pop. 18,453.

Perry, county of Central Pennsylvania. Area, 475 square miles. It is bounded E. by the Susquehanna River, is traversed by the Juniata River and the Pennsylvania R. R., and by several parallel wooded mountain-ridges, with broad, beautiful, and fertile valleys. Live-stock, grain, hay, and wool are leading products. Leather, flour, metallic wares, etc. are manufactured. Iron ore is extensively mined. Cap. New Bloomfield. Pop. 25,447.

Perry, county of Middle Tennessee, bounded W. by the Tennessee River. Area, 375 square miles. It is somewhat uneven, very fertile, and produces corn and live-stock. Cap. Linden. Pop. 6925.

Perry, tp. of Johnson co., Ark. Pop. 495.

Perry, tp. of Perry co., Ark. Pop. 366.

Perry, p.-v., cap. of Taylor co., Fla.

Perry, post-v. of Upper Town tp., cap. of Houston co., Ga., on Central R. R. of Georgia, located in the centre of the great cotton-growing section, contains important industries, with 1 weekly newspaper. Pop. of v. 836.
Edwin Martin, Ed. "Journal."

Perry, p.-v. and tp., Pike co., Ill. P. of v. 798; of tp. 2161.

Perry, tp. of Allen co., Ind. Pop. 1280.

Perry, tp. of Boone co., Ind. Pop. 1109.

Perry, tp. of Clay co., Ind. Pop. 1340.

Perry, tp. of Clinton co., Ind. Pop. 1220.

Perry, tp. of Delaware co., Ind. Pop. 1163.

Perry, tp. of Lawrence co., Ind. Pop. 982.

Perry, tp. of Marion co., Ind. Pop. 2452.

Perry, tp. of Martin co., Ind. Pop. 1760.

Perry, tp. of Miami co., Ind. Pop. 1667.

Perry, tp. of Monroe co., Ind. Pop. 1513.

Perry, tp. of Noble co., Ind. Pop. 3135.

Perry, tp. of Tippecanoe co., Ind. Pop. 1481.

Perry, tp. of Vanderburg co., Ind. Pop. 1719.

Perry, tp. of Wayne co., Ind. Pop. 876.

Perry, tp. of Buchanan co., Ia. Pop. 1633.

Perry, post-v. of Spring Valley tp., Dallas co., Ia., on Coon River and the Des Moines Valley R. R.

Perry, tp. of Davis co., Ia. Pop. 722.

Perry, tp. of Jackson co., Ia. Pop. 1273.

Perry, tp. of Marion co., Ia. Pop. 465.

Perry, tp. of Plymouth co., Ia. Pop. 74.

Perry, tp. of Tama co., Ia. Pop. 713.

Perry, post-v. of Kentucky tp., Jefferson co., Kan., on the Kansas Pacific R. R., has 2 school buildings, 3 churches, 1 newspaper, 2 hotels, a telegraph-office, 2 steam-elevators and corn-shellers, and stores. Corn, pork, wheat, and railroad ties are shipped from here. Pop. of v. 403.
H. G. Evans, Ed. "Times."

Perry, post-v. and tp. of Washington co., Me., on Passamaquoddy Bay. Pop. 1149.

Perry, post-v. and tp. of Shiawassee co., Mich., on Looking-glass River. Pop. 1058.

Perry, tp. of St. François co., Mo. Pop. 1351.

Perry, p.-v. and tp., Wyoming co., N. Y., at the outlet of Silver Lake, is the southern terminus of Rochester and Pine Creek R. R., has an academy, a bank, a weekly newspaper, and manufactories. P. 167; of tp. 867.

Perry, tp. of Allen co., O. Pop. 1235.

Perry, tp. of Ashland co., O. Pop. 1452.

Perry, tp. of Brown co., O. Pop. 3016.

Perry, tp. of Carroll co., O. Pop. 932.

Perry, tp. of Columbiana co., O. Pop. 4388.

Perry, tp. of Coshocton co., O. Pop. 932.

Perry, tp. of Fayette co., O. Pop. 1194.

Perry, tp. of Franklin co., O. Pop. 1297.

Perry, tp. of Gallia co., O. Pop. 1514.

Perry, tp. of Hocking co., O. Pop. 1745.

Perry, post-v. and tp. of Lake co., O., on Lake Erie and the Lake Shore and Michigan Southern R. R. P. 1208.

Perry, tp. of Lawrence co., O. Pop. 2215.

Perry, tp. of Licking co., O. Pop. 897.

Perry, tp. of Logan co., O. Pop. 922.

Perry, tp. of Monroe co., O. Pop. 1116.

Perry, tp. of Montgomery co., O. Pop. 2029.

Perry, tp. of Morrow co., O. Pop. 1044.

Perry, tp. of Muskingum co., O. Pop. 991.

Perry, tp. of Pickaway co., O. Pop. 1415.

Perry, tp. of Pike co., O. Pop. 748.

Perry, tp. of Putnam co., O. Pop. 637.

Perry, tp. of Richland co., O. Pop. 686.

Perry, tp. of Shelby co., O. Pop. 1208.

Perry, tp. of Stark co., O. Pop. 1736.

Perry, tp. of Tuscarawas co., O. Pop. 1089.

Perry, tp. of Wood co., O. Pop. 1323.

Perry, tp. of Armstrong co., Pa. Pop. 3877.

Perry, tp. of Berks co., Pa. Pop. 1680.

Perry, tp. of Clarion co., Pa. Pop. 1568.

Perry, tp. of Fayette co., Pa. Pop. 1445.

Perry, tp. of Greene co., Pa. Pop. 1292.

Perry, tp. of Jefferson co., Pa. Pop. 1222.

Perry, tp. of Lawrence co., Pa. Pop. 806.

Perry, tp. of Mercer co., Pa. Pop. 914.

Perry, tp. of Snyder co., Pa. Pop. 1016.

Perry, post-v. and tp. of Dane co., Wis. Pop. 1051.

Perry (Amos), b. at Natick, Mass., Aug. 12, 1812; graduated at Harvard College 1837; was for many years teacher of high schools and seminaries at New London, Conn., and Providence, R. I.; was consul to Tunis 1862–67, and published in 1869 a volume containing the results of careful researches upon the sites of Carthaginian cities.

Perry (Arthur Latham), b. at Lyme, N. H., Feb. 27, 1830; graduated at Williams College 1852; became profes-

sor of history and political economy in that institution 1854, and in 1875 pastor of a church at Williamstown. He was at one time a writer upon the Springfield *Republican*, and is author of *The Elements of Political Economy* (1866), a work which is considered the scientific exponent of Free Trade doctrines.

Perry (Capt. CHRISTOPHER RAYMOND), b. at South Kingston, R. I., in 1761; was a sailor from boyhood; served in privateers and in the American navy during the Revolutionary war; was taken captive and thrown into the famous prison-ship Jersey, where he was kept for some months; again entered the merchant service, and was appointed post-captain in the U. S. navy in 1798, when war with France appeared imminent. Retiring from the navy in 1801, he was appointed collector of Newport, where he d. June 8, 1818. His five sons were all officers in the navy during the war of 1812 (see PERRY, OLIVER H. and MATTHEW C.), and several grandchildren now follow the same profession.

Perry (Com. MATTHEW CALBRAITH), brother of Oliver Hazard, b. at South Kingston, R. I., in 1795; entered the navy as a midshipman Jan. 16, 1809; served under Commodores Rodgers and Decatur; was promoted to lieutenant July 24, 1813; cruised on the coast of Africa in the Cyane 1819, and fixed the locality of the first settlement in Liberia: commanded the schooner Shark in the West Indies 1821–24, where he captured several pirates; was made commander Mar. 21, 1826, and captain Feb. 9, 1837; served many years on foreign stations, especially in the Mediterranean; took an important part in the introduction of steam as a motive-power in vessels of the navy; commanded successively the navy-yard at Brooklyn, the W. African squadron, and the West Indies squadron during the war with Mexico, in which he occupied nearly all the Mexican seaports of the Gulf, captured the city of Tabasco, and co-operated in the siege and bombardment of Vera Cruz. In 1852, Com. Perry was sent to Japan at the head of a naval expedition, and succeeded by skilful negotiation in opening that country to foreign commerce (1854). An elaborate *Report of Com. Perry's Expedition to Japan*, edited by Rev. Dr. Francis L. Hawks and Mr. George Jones, was published by order of Congress in 3 quarto vols. (Washington, 1856). D. at New York Mar. 4, 1858. A magnificent bronze statue has been dedicated to his memory on the public square of Newport, R. I.

Perry (Com. OLIVER HAZARD), son of Christopher Raymond, b. at South Kingston, R. I., Aug. 23, 1785; entered the U. S. navy as midshipman Apr. 7, 1799; cruised with his father in the West Indies 1799–1800; was engaged in the war against Tripoli 1804–05; became lieutenant Jan. 15, 1807, and at the outbreak of the war of 1812 was in command of a flotilla of gunboats on the Atlantic coast, when in Feb., 1813, he was transferred at his own request to serve under Com. Isaac Chauncey on Lake Ontario. He took an active part in the attack upon Fort George; was appointed to fit out a squadron upon Lake Erie, which he successfully accomplished at Presque Isle (now Erie), Pa.; and having equipped nine small vessels, attacked and captured the British fleet near Put-in Bay, O., Sept. 10, 1813. This action, known as the "battle of Lake Erie," or more commonly as "Perry's victory," obtained him an immense popularity, partly attributable to the sententious manner in which it was announced by the famous despatch, "We have met the enemy, and they are ours." Congress rewarded him with a vote of thanks, a medal, and the rank of captain. Perry co-operated with Gen. Harrison in his operations at Detroit and at the battle of the Thames, Oct. 5, 1813, and in the following year was employed upon the Potomac and in the defence of Baltimore. He commanded the Java in Decatur's squadron in the Mediterranean 1815; was sent to the Spanish Main in command of a squadron June, 1819; ascended the Orinoco to Angostura in July; was seized with yellow fever, and d. at Port Spain, on the island of Trinidad, the day of his arrival there, Aug. 23, 1819. His remains were removed to Newport in a ship of war by order of Congress, and buried in the cemetery of that city Dec. 4, 1826, where an imposing obelisk was erected by the State of Rhode Island. In Sept., 1860, a marble statue of Com. Perry, by Walcutt, was erected at Cleveland, O. (See his *Life*, by Capt. Alexander S. Mackenzie, 2 vols., 1841.)

Perry (WILLIAM STEVENS), D. D., b. at Providence, R. I., in 1832; graduated at Harvard 1854; studied theology; became rector of an Episcopal church at Geneva, N. Y., about 1869; secretary of the house of clerical and lay deputies of the General Convention of the Episcopal Church. Author of several publications relating to American history, among which are *Connection of the Church of England with Early American Discovery and Colonization* (1863), *Documentary Annals of the Colonial Church, Questions on the Life and Labors of the Great Apostle* (1868), *Churchman's Year Book* (1870); and edited papers relating to the *History of Virginia 1650–1776* (1870); elected bishop of the diocese of Iowa 1876.

Per'rymansville, post-v. of Hall's Cross Roads tp., Harford co., Md., on the Philadelphia and Baltimore R. R.

Perry's, tp. of Jackson co., Ala. Pop. 621.

Per'rysburg, post-v. and tp. of Cattaraugus co., N. Y., on Cattaraugus Creek and the Erie R. R., includes the village of Versailles and a portion of Cattaraugus reservation of Seneca Indians. Pop. 1313.

Perrysburg, p.-v. and tp., Wood co., O., on Maumee River, on Dayton and Michigan R. R., has 1 newspaper and an active trade. P. of v. 1835; of tp. 4100.

Perry's Mill, post-v. of Champlain tp., Clinton co., N. Y., on the Chazy River and the Ogdensburg and Lake Champlain R. R. Pop. 276.

Perrysville, post-v. of Highland tp., Vermilion co., Ind., on the Wabash River. Pop. 690.

Perrysville, a b. of Milford tp., Juniata co., Pa., on the Juniata River. Pop. 559.

Per'ryton, tp. of Mercer co., Ill. Pop. 1085.

Perryville, post-v. of Boyle co., Ky., noted for the severe battle of Perryville or Chaplin's Mills fought here Oct. 8, 1862. Pop. 479.

Perryville, p.-v., Cecil co., Md., on Chesapeake Bay and Philadelphia Wilmington and Baltimore R. R.

Perryville, p.-v., cap. of Perry co., Mo., has 1 newspaper. P. 501.

Perryville, post-v. of Perry tp., Ashland co., O.

Per'ryville Court-house, post-v. and tp., cap. of Perry co., Ark., on the Fourche la Fave River.

Persecu'tions, The Ten, of the Christian Church, certain periods in which new enactments were passed against Christianity or existing ones enforced with unusual rigor, and refer specially to the persecutions under Nero (64), Domitian (95), Trajan (107), Hadrian (125), Marcus Aurelius (165), Septimius Severus (202), Maximinus (235), Decius (249), Valerianus (257), and Diocletian (303).

Persep'olis, the Greek name of the ancient capital of Persia, whose Persian name is not known, stood in a fertile and beautiful plain (now called *Merdusht*), 35 miles N. E. of Shiraz, near the confluence of the Araxes (now Bendamir) and the Medus (now Pulwân). Of the age and history of the city very little is known. It was not the residence of Cyrus, who had his palace at Pasargada, unless this be the same city, as assumed by some antiquarians. But Xerxes and Darius Hystaspis resided here, and in their time the city was known to the Greeks as a wonder of splendor and magnificence. By Alexander the Great it was completely destroyed, and it is mentioned in history only once afterwards, when Antiochus Epiphanes visited it for the sake of plunder (2 Macc. ix. 1). Of the city itself no traces can now be found, though it is probable that it occupied the same site as afterwards the Mohammedan fortress Istakhr. But of the palaces some very interesting ruins are still extant, known by their local name, *Chel Minar* ("Forty Columns"), or, since the time of Fergusson, by the name of "Xerxes' Hall." They consist of a stupendous substructure of cyclopean masonry, forming a platform 1500 feet long, 936 feet wide, and divided into three terraces, to which magnificent flights of stairs give access. Of the buildings, a magnificently sculptured staircase, the entrance to a propylæum, and a number of columns 60 feet high, are still standing. (For further details see Fergusson, *Palaces of Nineveh and Persepolis Restored* (1851); Rawlinson, *The Five Great Ancient Monarchies* (1871); P. V. N. Meyers, *Remains of Lost Empires* (New York, 1875).)

Per'seus, in Greek mythology, the son of Zeus and Danaë, a grandson of Acrisius, king of Argos; was driven into exile together with his mother, and educated in Seriphos, one of the Cyclades; conquered Medusa by the aid of Hermes and Athene, and cut off her head; returned after many adventures to Argos, from which Acrisius fled to Thessaly, and settled afterward at Tiryns. In ancient art he is represented very similar to Hermes.

Perseus, a son of Philip V., succeeded to the Macedonian throne in 179 B. C., and continued his father's policy. After a preparation of seven years he commenced war against Rome with an excellent army, a full treasury, and important alliances. But his execution of the plan was as slovenly as his preparations had been energetic. The incompetent Roman generals were repeatedly defeated, but Perseus did not understand how to use his victories; and while the war dragged on for several years without any decisive result, the avarice of the Macedonian

king and the shrewdness of the Roman diplomates alienated all his allies from him. At last, L. Paulus Æmilius was sent as commander-in-chief to the theatre of war. He arrived in March, began active operations in June, and finished the war, after a campaign of thirteen days, by the battle of Pydna, June 22, 168 B. C. The Macedonian army, although fighting with great valor, was completely routed, and Perseus fled with his money-chest to Samothrace. He was afterwards delivered up to the Romans, and held in captivity at Alba, in Italy, where he died. He was the last king of Macedonia.

Persever'ance of the Saints, The Doctrine of, is one of the Five Points of Calvinism. It teaches that the true believer, the recipient of divine grace, will never fall away into perdition, but will be kept by divine power unto eternal life. The opponents of this doctrine believe in the possibility of a fatal lapse from a state of grace.

Per'sia [Per. *Iran*], country of Western Asia, extends between lat. 25° 30′ and 39° 50′ N., and lon. 44° and 62° E., bounded N. by Caucasus, the Caspian Sea, and Asiatic Russia; E. by Afghanistan and Beloochistan; S. by the Indian Ocean, the Strait of Ormuz, and the Persian Gulf; and W. by Asiatic Turkey; comprises an area of 635,000 sq. m., and is divided into the following 11 provinces: Ghilan, Mazanderan, and Astrabad to the N.; Khorassan and Kerman to the E.; Laristan, Farsistan, and Khuzistan to the S.; Looristan, Irak-Ajemi, and Azerbaijan to the W.; which provinces, again, are subdivided into 25 governments.

The *surface* forms a vast plateau elevated 4000 feet above the sea to the E., 3000 feet to the W., and 2000 feet in the centre, and surrounded on all sides, except to the E., where it continues uninterruptedly into Afghanistan and Beloochistan, by high, wild mountain-ranges, which send forth numerous branches and spurs. From Mount Ararat, skirting the valley of the Tigris, and sending down into its plains a number of torrents which generally dry up during the hot summers, runs a bleak but lofty range of mountains, which soon splits into several parallel ranges, and forms along the southern border of the plateau a wild alpine region, leaving between its foot and the Persian Gulf only a narrow belt of coast-land, low, sandy, hot, and arid. On the northern edge of the plateau, from 10 to 50 miles from the Caspian Sea and continued into Afghanistan, runs the Elbrooz range, whose highest peak, Mount Demavend, an extinct volcano, situated N. E. of Teheran, rises about 20,000 feet, and is noted for the hot sulphur springs at its southern foot and the frequent earthquakes which visit the surrounding country. The coast-land along the Caspian Sea is low, hot, but well watered and covered with a tropical vegetation. The plateau itself has no rivers and few streams, but is dotted all over with salt lakes—Urumeyah to the N. W., 90 miles long and from 20 to 30 miles broad; Bakhtegan to the S. E., 70 miles long and 8 miles broad. The eastern and central parts of it form a vast desert, covered in some places with fine sand, which rises in the slightest wind in huge clouds enveloping and often burying the traveller; in others with a saline efflorescence several inches deep, which glitters in the sunlight like frost-flowers. In other parts of the plateau the soil consists of loam, lime, and calcareous conglomerate, very fertile when sufficiently watered. Extensive coal-fields have been discovered at Kasbin; salt, sulphur, naphtha, and marble abound; iron, copper, and lead are found in the Elbrooz range; very remarkable are the turquoise-mines at Madena in the province of Khorassan.

The *climate* is very dry everywhere in the country except in the Caspian coast-lands. In the valleys it is hot, with mild winters. In the plateau the winter, from the middle of December to the middle of February, is generally severe and the snowfall heavy, while during the summer, from the middle of June to the middle of August, the thermometer sometimes rises to 110° in the shade. Spring and autumn are perfectly delightful, and, in spite of its great extremes, the climate is generally healthy. On account of the dryness both of the climate and the soil the country bears in many places a naked and barren aspect, but wherever sufficient water can be procured and irrigation is carried on the life of nature develops immediately into a fairy-tale. Persia is the home of the rose and the nightingale. Although trees are generally scarce, the slopes of the Elbrooz range along the Caspian Sea and all of the mountains in Laristan are clad with magnificent forests of oak, elm, beech, walnut, and fir, and on the plateau large tracts are covered with tamarisks, terebinths, acacias, shrubs, and thorny bushes. In the valleys the cypress and myrtle abound, the fig grows wild, the mulberry and olive are cultivated in large plantations, the vineyards yield strong and highly-flavored wines; apples, pears, apricots, peaches, cherries, oranges, and pomegranates of unsurpassed quality are raised in the orchards, and the gardens teem with roses and geraniums. The date-palm grows in the oases of the desert, and dates are a common article of food. The cereals are wheat of excellent quality, rice, maize, and barley. Vegetables and leguminous plants, especially beans and cabbages, abound, and the melon of Ispahan is as celebrated as the Messina orange and the Malaga grape. It is characteristic of Persia, for its climate and soil, not for its method or energy of cultivation, that many of the fruits which it produces are unequalled in nourishing power, in savoriness, in richness of flavor, and in beauty of appearance by any of the same kind produced elsewhere on the earth. Cotton sufficient for the demand of the country, tobacco of excellent quality, sugar, etc., are also easily cultivated. The northwestern part of Persia contains the same animals as Southern Europe, only the tiger is added. The southwestern contains those of Hindostan, among which is the lion. In the central parts, in the desert, and on its borders the antelope and wild-ass abound, deer of various kinds, the wild-hog, and the hyæna. The domestic animals are camels, horses of a large and strong breed, asses and mules for beasts of burden, sheep and lambs for wool and meat, cows almost exclusively for milking, goats for their hair and for milking. The wild-ass and the moufflon are much hunted. Birds are numerous—besides common poultry, the wild-pigeon, the snipe, the partridge, the wren, the swallow, and, above all, the nightingale; the duck on the Caspian Sea, the pelican on the Persian Gulf. Fish are scarce except on the shores of the Caspian Sea.

The *population* is estimated at from 5,000,000 to 8,000,000. About 1,000,000 are located in the cities, of which Teheran and Tabreez are the largest; Meshed, the holy city; Ispahan, the capital; Kermanshah, the manufacturing centre; Reshd and Balfurosh on the Caspian Sea, and Bushire on the Persian Gulf, the principal ports. About 3,000,000 dwell in villages, of which there are about 8000, with a population varying from 300 to 2000. The rest are nomadic tribes, generally known under the name of Ilijats or Iliyats. The prevailing religion is Mohammedanism of the Shiah form; Sufism and other forms are found and tolerated. The Parsees or Guebres, followers of Zoroaster, are few—only about 7000—and like the Jews, whose number is estimated at 16,000, they are often subjected to persecution. The number of Armenian and Nestorian Christians is larger, and they are respected. The American Presbyterians have a mission in the city of Urumeyah. The Ilijats consist of various races—Turks, who immigrated from Toorkistan many centuries ago, but still preserve their native language; Leks, descending from the old Persians; Koords, and Arabs—all of whom speak Persian or Persian dialects. The social position of these tribes is very vague. Some of them have settled and begun to till the soil, but most of them are still wandering with their flocks and tents from place to place, and very often they swerve from hunting and herding into robbery and pillage. The villagers are a bright and handsome race, pursuing agriculture in a somewhat rude and primitive manner, though successfully; good soldiers, often capable of reading and writing, generally happy and contented, though much exposed to the extortions and injustice of the officials. The city population is polished and courteous, but false; quick-witted and enterprising, but cunning; with refined and even literary tastes, and open to European civilization. They have carried several branches of industry to a high degree of perfection, such as the manufacture of arms and jewelry, of silks and woollens, especially carpets and shawls, of perfumes and elegant knick-knacks, etc. Their commerce with India and Western Europe over the Persian Gulf, with Turkey through Asia Minor, with Russia over the Caspian Sea, is considerable. Wheat, raw silk, silkworm-eggs, woollens, tobacco, etc. are largely exported. They are said to be very wealthy, but the rapacity of the government compels them to conceal their wealth. The exterior of their houses is generally indifferent, but the interior is often very comfortable and elegant, not to say luxurious and voluptuous, and beautiful gardens usually surround their dwellings. The government is a pure despotism. The shah's power over the lives and property of his subjects is not only unlimited by any law, but even unrestrained by any social power, such as a church, an aristocracy, a public opinion, etc. And as the shah's power is absolutely despotic, so is that of his officials with respect to those below them—a social state which, lasting for centuries, could not fail to stunt the development of the country and spoil the character of the nation. Of late, however, as more frequent and intimate relations have been established between Persia and Europe, social improvements have begun to be introduced.

The *history* of Persia begins with Cyrus. The Aryan tribes which in times immemorial emigrated from the regions of the Indus River formed two empires—one in Persia, the present Farsistan, and one in Media, the present

Irak-Ajemi. In Media originated the powerful religion of Zoroaster, and Media was also, in political respects, the principal empire in these regions until Cyrus (in 558 B. C.) rose at the head of a general Persian revolt, threw off the Median yoke, conquered Media itself, and established an empire of which Persia was the centre. To Persia and Media he added countries inhabited by Semitic races, Babylon and Assyria. His son, Cambyses (529–522), conquered Egypt and Northern Africa, and for two centuries Persia was the most powerful empire in the known world and the centre of civilization. Its enormous cities, Persepolis, Pasargada, Babylon, Susa, and Ecbatana, where thousands of human lives were annually exhausted in building the palaces, temples, and gardens, appeared like fairy-tales to the wondering eye, and its armies—huge multitudes in which the most different arms, tactics, habits, and tongues mingled together in bewildering confusion—fell irresistibly like avalanches or swarms of grasshoppers upon the neighboring countries. But a history in the proper sense of the word this empire has not. There are no great popular movements, resulting in new enterprises and new institutions, to record. Its history is that of its monarchs; it is dissolved in a series of biographies which will be found in this book under the proper names. Under the reigns of Darius Hystaspes (521–486) and Xerxes (486–465) a singular occurrence took place. The great central plateau of Asia Minor nowhere reaches the Mediterranean, except to the S. It stops suddenly at some distance from the sea, girded on a large curve by a range of lofty but bleak mountains, and leaving at its feet a belt of coast-land which sometimes expands into large plains, though it is generally cut up by rocky spurs into narrow valleys opening upon the sea. Here flourished the Greek colonies, city by city, and when Darius incidentally came in contact with them and undertook to subdue them, he met with an unexpected resistance; they were supported by their countrymen from the other side of the Ægean. Indignant, he sent an army into Greece, but it remained on the plains of Marathon. His son, Xerxes, pushed forward the whole avalanche. Myriads of archers, horsemen, runners, leapers, charioteers, etc. descended upon Greece; thousands of ships gathered from Caucasus, Syria, and the Nile; and the Greek waters and its valleys resounded with the yells of the barbarians. But at Salamis, Platææ, and Mycale the foreigners were silenced for ever. To Persia these events were of no immediate consequence; they were only a foreboding. But in the reign of Darius Codomannus (336–330) Alexander landed in Asia at the head of an army which in its power of acting simultaneously at many points without dissolving, and of concentrating itself on one point without breaking, looked as if it were one compact body, one single man, one intelligence; it was like the Greek statue, a true representative of the Greek civilization. The coast-land from the Pontus to the Nile was first conquered; here lived everywhere Greeks. Then Alexander threw himself into the interior of the vast empire, stabbed the colossus in the heart, and it fell. After the death of Alexander the history of civilization drew more and more to the West, and the Eastern countries sank more and more into insignificance. Persia belonged for some time to the kingdom of the Seleucidæ, but in 248 B. C. the Parthians, a tribe occupying the present Khorassan, revolted under Arsaces, conquered Persia, and established an independent kingdom of Parthia, which under the dynasty of the Arsacidæ successfully withstood the Romans. In 228 A. D. one Ardshir, who called himself a descendant of Cyrus, overthrew the Arsacidæ, made Persia proper the controlling power, and founded the dynasty of the Sassanidæ, of which Sapor II. (310–384) and Chosroes II. (590–628) have become celebrated, the former for his victories over Julian the Apostate, and the latter for his successes against the Byzantine empire and for the general magnificence of his reign. After the battles of Cadesia (636) and Nehavend (641) Persia was conquered by the caliphs, and Mohammedanism was introduced by the sword. Persian civilization, however, was not destroyed by the Arabs, as will be seen from the article on PERSIAN LANGUAGE AND LITERATURE, and, although subsequently the country was repeatedly overrun and devastated—in the twelfth century by the Seljook Turks, in the thirteenth century by the Mongols, in the fourteenth by Tamerlane—it rose again to prosperity in the sixteenth and seventeenth centuries under the Soofee dynasty. It is this toughness of the nation, in connection with the great resources of the country, which of late has again attracted much attention to Persia. The present dynasty, the Kajars, which ascended the throne in the latter part of the eighteenth century with Aga Mohammed, has not been successful in war; Feth Ali (1797–1834) lost in his two wars with Russia (1813 and 1824) Georgia, Mingrelia, Erivan, Nakhitchevan, and Talish; and Nasr-ed-Din, who ascended the throne in 1848, was deeply humiliated by the English in 1857. But the shah's journey in Europe in 1873 has opened Persia, at least to some extent, to European ideas and European enterprise, and great results are anticipated. CLEMENS PETERSEN.

Per'sia, post-v. and tp., Cattaraugus co., N. Y., on Cattaraugus Creek and the Erie R. R., includes part of the village of Gowanda. Pop. 1220.

Per'sian Berries, the berries of *Rhamnus infectorius*, and used by calico-printers and dyers as a source of a yellow coloring-matter.

Persian Gulf, an inlet of the Arabian Sea through the Gulf of Oman and the Strait of Ormuz, and between Arabia and Persia. It is 650 miles long, 250 miles broad, receives the water of the Shat-el-Arab, and contains many islands, most of which are barren and desolate. The pearl fisheries along the Arabian coast are celebrated.

Persian Insect Powder. See FEVERFEW.

Persian Language. Next to the Arabic, Persian is the most important of all the Mohammedan languages. The word *Persian*, whether as the name of the country or the language, is a misnomer. Pars or Fars is a province of the great empire of Iran, and it is only because the language of its capital, Sheeraz, became the fashionable mode of speech that the name *Parsee* was applied to the entire language.

The Persians present a marked contrast to their Arab neighbors; they stand, indeed, much in the same relation to them as the French do to the English. The Persian is volatile, quick, and witty; while the Arab is stolid and slow, but possesses nevertheless a certain sense of the humorous. Poetry and the fine arts have always been cultivated in Persia, but Persian literature, as we now have it, dates entirely from the establishment of the Mohammedan religion. At the time of Mohammed's birth Amishirwan the Just reigned over Persia. There were then two languages current in the empire—*Deri*, or the court language, a dialect of the Parsi, and *Pehlavi*, the learned language, which derived its name from Pehlav, a tract of country bordering upon Persian Irak. Pehlavi poetry no longer exists, the religious zeal of the Mohammedan conquerors having destroyed every trace of it; but although we have no Pehlavi poetry, constant allusions to its existence are to be found in Persian authors. When the Arabs conquered Persia, and the government fell into the hands of men of that race, it was only natural that the language of the conquerors should be forced upon the people. The principal literature of the early Arabs was in the form of poetry. As an old Arabic proverb says, "The registers of the Arabs are the verses of their bards;" and as the art of versification had been already reduced by them to a most elaborate system, its influence soon began to be felt by the Persians. This, and the efforts which Mohammedan fanatics made to suppress all traces of the pagan literature, soon resulted in the complete adoption of the Arabic form of verse. But the national character of Persia nevertheless broke through, and showed itself behind its foreign dress; and the poets of Persia, although they could not throw aside the Arabic measures altogether, began to modify them to suit their own taste, and readily invented metres of which the Arabic itself was not susceptible.

Until the time of the Seljookian princes Arabic continued to be the official language of the court, and to make use of any other in composition was considered illiterate and vulgar. The first who broke through this restraint and braved the sneers of his pedantic contemporaries was Amid el Mulk el Kendi, vizier of Togrul Beg.

The Persian language is essentially an Aryan speech. As at present used, however, it contains a vast number of Arabic words; indeed, it possesses an unlimited power of drawing upon that language whenever it becomes necessary to enlarge its own vocabulary, and this, of course, gives it a peculiar richness and copiousness of expression. The construction is simple and the accent soft and musical. The character used in writing it (called *talik*) is a graceful modification of the Arabic handwriting (*neskhi*), to which it bears the same relation as the italic does to the Roman character with us. A still further modification, a current hand called *shikasteh*, is employed in ordinary correspondence. The similarity between Persian and the European languages appears to have struck even the ancients. Seneca, for instance, tells us that after the Macedonian conquests a great intermixture took place of the Asiatic and European races. Traces of this and of an even closer relationship may still be seen in the great similarity of structure and language which exists between the Greek and the Persian. Many words in both languages are as nearly as possible identical; *e. g.* πατήρ, *peder;* μήτηρ, *mâder;* δυσμενής, *dushmen;* ἵστημι, *îstem;* and a thousand others which the comparative philologist would at once detect. In the time of the caliph Mamoon, at the beginning of the ninth century, the Pehlavi

language was still cultivated by learned Persians. In the preface to a book entitled *Javidan Khirad* (a collection of proverbs and maxims attributed to the ancient Persian king Hosheng) we are told that the Pehlavi original was discovered by a certain Zoban, minister of the prince of Cabool, and translated into Arabic by Hasan ibn Sahel, Mamun's prime minister, by one Khizir ibn Abdallah, "a man well skilled in Pehlavi, and one who could read it offhand."

Abundant materials exist for the acquisition of Persian. The principal English works are the following: *Persian Grammar*, by Sir William Jones (ed. by Lee, London, 1828); Mirza Ibrahim's *Persian Grammar* (London, 1841); Richardson's *Persian and Arabic Dictionary* (London, 1852); Palmer's *Concise Dictionary, Persian-English and English-Persian* (London, 1875).

History.—For the history not only of Persia, but of the whole Eastern world, Persian literature possesses the amplest materials. Under the monarchs of the Sassanian dynasty (beginning 226 A. D.) materials had been collected for a history of Persia, and Yezdigird I. early in the fifth century ordered an abstract of them to be made. This was translated from the Pehlavi, and continued by later princes up to the account of the Mohammedan conquest. From these old records the poet Firdausí (b. 940 A. D.; d. 1021) composed the *Shah-nama*, or "Book of Kings," for the conqueror Mahmud of Ghazni. This is a magnificent epic of 60,000 couplets, embracing the whole of the legendary history of Persia from the remotest times until the death of Yezdigird. The book is remarkable for the pure Persian in which it is written, there being only a very small admixture of Arabic words. (Abridged translation of the *Shah Nameh* by J. Atkinson, Oriental Translation Fund, London, 1832; *Le Livre des Rois par Aboul Kasim Firdousi*, publié et traduit par Jules Mohl, Paris, 1838–68, 6 vols. folio, forming part of the Collection Orientale; *The Shah Nameh of Firdousee*, by Turner Macan, Text and Glossary, Calcutta, 1839, 4 vols.)

The oldest of the prose historians is Tabari (b. 838 A. D.; d. 922), who wrote a history of Persia down to the times of the khalifate. His work has been translated for the Oriental Translation Fund. (*Chronique d'Abou Djafar Muhammed Tabari*, par Zotenberg, Paris, 1836.) The book was originally written in Arabic, but only the Persian version of it exists in a complete state. In the fourteenth century Yahya bn Abd-ul-latif, Cazwini (d. 1351 A. D.), published a comprehensive general history entitled *Lubb-et-tawarikh*, or "Pith of History." Mohammed ibn Khavend-shah Mirkhond (b. 1432; d. 1493 A. D.), author of the *Rauzat us Safa*, or "Meadow of Purity," a history of Persia from the Creation to A. D. 1471. (*History of the Early Kings of Persia, etc., from the original Persian of Mirkhond*, by D. Shea, Oriental Translation Fund, London, 1832.) His son, Khondamir, who was attached to the court of Báber soon after the invasion of India (1528), wrote an abridgment of his father's work under the title *Khulasat el Akhbar*, "Abstract of Information." It is in ten books, and is an excellent epitome of Eastern history. The *Habib us Siyar*, or "Biographer's Friend," another esteemed historical work, by the same author, Khondamir. There is a very excellent history of Persia, written about 1300 A. D. by Wassaf of Shiraz; an account of it is given by Sir Gore Ouseley in his *Notices of Persian Poets* (Oriental Translation Fund, London, 1846), where, amongst other extracts from the work, he gives a story which is the exact counterpart of the well-known English legend of "Whittington and his Cat." Besides these general histories, there are a great many histories of particular reigns and periods too numerous to mention here.

I have confined myself to purely Persian works, but in addition to these there is a large number of works written in that language in India, and relating for the most part to the affairs of that country. Of these, the most important are the *Ayin i Akbari*, or "Institutes of Akbar the Great," emperor of Hindostan, vol. i. (translation by Blockman, vol. ii.; text by do., *Bibliotheca Indica*, Calcutta, 1867–74); *Tarikh i Ferishta*, a general history of India by Muhammed Kasim Hindu Shah, surnamed Ferishta (d. about 1612 A. D.), (ed. by Gen. Briggs, Bombay, 1831, 2 vols., folio; translated by A. Dow, London, 1770–72; do. translated by Gen. Briggs, London, 1829, 4 vols., 8vo); and the *Siyar ul Mutaakkherin*, or "Modern Biography," a history of India down to recent times; this last has been translated into English with the title *A Translation of the Seir Mutagharin*, by Gholam Hossein (Calcutta, 1789, 3 vols.); Briggs's *History of the Mohammedan Power in India* (London, 1829); the *Siyar ul Mutakherin*, translated by J. Briggs (London, 1832). The best histories of Persia in English are—*The History of Persia from the Earliest Period to the Present Time*, by Sir John Malcolm (2 vols., London, 1815); *A General Sketch of the History of Persia*, by Clements Markham (London, 1874); *Persia, Ancient and Modern*, by John Piggott (London, 1874). A most complete and interesting account of the native historians of Persia is given in *A Descriptive Catalogue of the Historical Manuscripts in the Arabic and Persian Languages preserved in the Library of the Royal Asiatic Society of Great Britain and Ireland*, by W. H. Morley (London, 1854).

Poetry.—Of the various forms of Persian poetry, the most important are—(1) the *Masnavi*, or "Rhyming Couplets," which answer to our own "heroics," epic, narrative, and didactic pieces being generally written in this metre. (2) The *Ghazal*, or "Ode." These are for the most part ostensibly anacreontic songs, love and wine being the constant theme, but they are really highly metaphorical religious writings, expounding the peculiar theosophic views of the most extraordinary sect the East has ever produced, the Sufi dervishes. (3) The *Casidah*, or "Idyl," which is generally employed in panegyric. The principal poets of Persia are the following: Rudaki, lived in the reign of Nasr, grandson of Ismael Samani, founder of the Samany dynasty (circa 940); he was born blind, but wrote magnificent lyrics, some few of which have come down to us. (See Malcolm's *History of Persia*.) Firdausi has already been mentioned in the account of the historians; in addition to his great work, the *Shah Nameh*, he wrote a bitter satire on his ungrateful master, Mahmud, which is usually prefixed to the epic itself; and a poem entitled *Yusuf u Zuleikha*, or "The Loves of Joseph and Potiphar's Wife," a favorite subject with the Persian bards. The latter has never been translated, but copies of the original are not rare in India. One of the most original and extraordinary poets of Persia was Omar Kheiyam (d. 1123). He was a great astronomer and mathematician, and to him we owe the work called *Aljebr u el Mukabileh*, on the science which still bears the name "algebra" which he gave it. His poems consist entirely of *rubaiyat*, or quatrains; they breathe a spirit of advanced free thought, which sometimes, indeed, verges on atheism; but they have at the same time a strange mixture of refined sentiment, philosophical cynicism, and manly feeling, which makes them unlike any other composition of the kind. They have been edited with a French prose translation by J. B. Nicolas (Paris, 1867), and a small selection in English verse has been published by Quaritch (London, 1869). Omar Kheiyam in his youth was an intimate friend of Hasan Sabah, the original "Old Man of the Mountain" and founder of the celebrated sect of Hashashin or Assassins. Anvari (d. 1190 A. D.) Anhad-ud-din Anvari was b. at Mahna in Khavaran, and attracted the notice of Sultan Sanjar, the sixth of the Seljukian dynasty. He was an astrologer as well as poet, but having predicted a terrific storm on the occasion of the conjunction of the seven planets in Libra (Sept. 16, 1186), and failed signally, he relinquished the former profession. His principal works are *Kasidahs*, or "Odes," which enjoy even now a great reputation in Persia. They are full of fine and even sublime conceptions, nervous and elegant language, and original conceits. The whole Divan or "collected works" of Anvari have been lithographed at Tebriz during the present reign. (*Two Kasidahs of the Persian Poet Anvari*, *Journal of Philosophy* (Cambridge, England, vol. iv. p. 1, 1872); *The Tears of Khorassan* (translation of one of the last-mentioned odes, *Asiatic Miscellany*, Calcutta, 1785, p. 287).) Saadi Muslih-ud-din Saadi of Shiraz (b. about 1176 A. D.; d. 1275 A. D.), next to Háfiz enjoys the greatest reputation of any Persian poet. He is a master of elegant style, and many of his works are marked by a very high tone of moral sentiment. That by which he is best known in Europe is the *Gulistan*, or "Rose-garden," a beautiful collection of moral stories in prose and verse. Saadi was a great traveller, and is said to have been the first person who composed verses in the *Zaban i Rekhta*, or Hindostani language. M. Garcin de Tassy quotes some maccaronic verses of the poet in support of this hypothesis in the *Journal Asiatique* for Jan., 1843. (*Select Fables from Gulistan*, by S. Sullivan (London, 1774); *The Gulistan*, with an English translation by Gladwin (Calcutta, 1806; reprinted London, 1808 and 1827); *The Gulistan in Persian*, by Eastwick (Hertford, 1850); do. by F. Johnson (London, 1863); *The Gulistan*, translated into prose and verse by Eastwick (Hertford, 1852); *The Gulistan*, translated into English by John Platts (London, 1873); *The Boostan of Sadi*, with commentary and dictionary of words by Maulavre Tummuzdey (4th ed., Cawnpore, 1882); *Le Boustan de Sadi*, texte Persan avec un commentaire Persan, par C. H. Graf (Vienne, 1858).) Ferid-ud-din Attar (d. at a very advanced age 1230 A. D.) was an eminent Sufi and poet. His principal work is a collection of tales and parables in verse entitled *Mantik ut Tair*, or "The Language of Birds." It has been edited with a French translation by M. Garcin

de Tassy (Paris, 1863). Abu Mohammed ibn Yusuf, generally called Sheikh Nizami of Ganjah Nizami (d. about 1200 A. D.), wrote a *Khamseh—i. e.* a collection of five didactic poems embodying Sufiistic doctrines. Of these the most celebrated are perhaps the *Laila wa Majnun*, an Arabian love-story, and the *Sikandar-Nameh*, or "History of Alexander the Great." Nizami's style is terse and rather difficult, but at the same time very forcible. Few poets contain more subtle thoughts and pregnant expressions; and while other Persian poets generally err on the side of verbiage and prolixity, Nizami frequently falls into the opposite extreme. Besides the five poems above mentioned. Nizami wrote a *Divan*, or "Collection of Odes, Elegies, etc." (The *Sikandar Nama* of Nizami (Calcutta, 1852); *Part of the Khirad Nama*, ed. by Dr. A. Sprenger (Calcutta, 1852); *Makhzan el Asrar*, ed. by Bland (London, 1844).) Maulavi Rumi, Jelal-ud-din Rumi, the founder of the sect of Mevlaviyeh dervishes (b. 1207; d. 1272), is the great exponent of the mystic doctrines of the Sufis. He was a contemporary of Saadi, the author of the *Gulistan*. His immortal work, the *Masnavi*, consists of six long books in rhyming couplets. It contains a complete exposition of the Sufi doctrines, and forms a perfect *repertoire* of all the tales, legends, fables, and apologues current in the East. This narrative portion of the work is written in a lively, unaffected style, but the long speculative digressions, to which the stories serve merely as introductions, though instructive and often beautiful, are somewhat tedious to a European reader. So highly is the book esteemed throughout the Mohammedan world that it has acquired the title of the "Koran of Persia." In addition to the *Masnavi*, Jelal-ud-din wrote a *divan* of beautiful lyrics, some of which have been translated into English verse by Prof. Falconer in the *Asiatic Journal* for 1842. The collection of Maulavi Rumi's minor poems is generally known in India by the name of *Kulliyat Shems Tabriz*, Shems Tabriz being his *takhallus* or *nom de plume*. Shems-ud-din Mohammed, Hafiz (d. 1389 A. D.). (See art. HAFIZ.) Jami (b. 1414 A. D.; d. 1493 A. D.) wrote a *Khamseh* in imitation of Nizami, including a *Sikandar Nameh*, a "History of Alexander the Great," and *Yusuf u Zuleikha*, a subject also treated by Firdausi; it is by the last-named poem that he is best known. Jami also published a *divan* of lyrical odes. His poetry is much more light and elegant in character, and more full of feeling, than Nizami's, but it lacks the stately grandeur and profound thought which distinguish the latter. (*Medjnoun et Laila*, poëme traduit du Persan de Djamy par A. L. Chezy (Paris, 1838); see *Zeitschrift der deutschen morgenländischen Gesellschaft*, vols. xxiv.–xxv.) Hatifi (d. about 1520 A. D.) was a nephew and pupil of Jami, and wrote many beautiful poems, amongst them one entitled *Laila u Mejnun*, which has been edited by Sir William Jones (Calcutta, 1787); his works gave promise of peculiar excellence, and he would no doubt have become one of Persia's greatest poets had he not been cut off prematurely by death. Khakani, Afzal-ud-din Ibrahim, called after his royal patron, Khakan Manuchehr Shirwan Shah, Khakani, d. about 1186 A. D. He is perhaps the most forcible writer in the Persian languages, and his poetry is distinguished by a peculiar loftiness of thought and sublimity of style. He is best known by his odes and satires, and by a charming poem containing an account of the countries through which he passed on his way to Mecca, and called *Tuh fat ul Irakain*, "A Present from Persian and Arabian Irak." (*Mémoire sur Khâcâne, poëte Persan du xii^e Siècle*, par N. de Khanikoff, *Journal Asiatique*, vol. iv., 1864, pp. 137–200; vol. v., 1865, pp. 296–367.) Emir Khosru of Dehli (b. 1253 A. D.; d. 1324 A. D.) was of Tartar origin, being sprung from the tribe of Hazara Lachin, near Balkh. He came to Hindostan, and settled at Puttiala near Dehli, where, thanks to the influence of his father-in-law, he obtained an important post at the court of Tughlak Shah in Dehli. He was a very voluminous writer, and his poetry is marked by great wit and exuberance of fancy. He is best known by five Sufiistic romances after the model of the *Khamsah* of Nizami. We must not omit to mention the wild and stirring improvisations of the robber-poet Kurroglou, who flourished about the middle of the seventeenth century, and who, although writing in a half-Turkish patois, may yet be considered as a representative of the rustic muse of Persia. (*Specimens of the Popular Poetry of Persia, as found in the Adventures and Improvisations of Kurroglou*, translated by A. Chodzko, Oriental Translation Fund, 1842.) There is an immense crowd of minor poets in the ranks of Persian versifiers, but those mentioned above are the standard and really important ones.

The aim of the Oriental poets is not, as with our own, to discover and produce new conceits and new trains of thought. Indeed, the introduction of an entirely novel and original simile is considered rather a breach of good taste than otherwise. But then, upon the other hand, the wealth of the language enables them to clothe a single idea in an almost infinite variety of forms of expression, and it is in this direction that their ingenuity and invention are exercised. In order, then, to become able to read any fresh poet with ease, it is necessary for the learner to adopt the native method, and make himself perfectly acquainted with all the minutiæ of the works of *one* of the standard classical writers, and this will give him a ready key to all the rest.

The present reign has produced a poet of no mean pretensions, Hakim Kaani, poet-laureate to the shah. His poems have been printed at the imperial press at Teheran, and form a large folio volume. Kaani has a most astonishing command of language and rhythm, and while following closely the ancient traditions of Persian poetry as to the form, he has not disdained, nevertheless, to infuse into his works a spice of modern learning, a slight *soupçon* of European civilization, which imparts a novel and pleasing character to his style. Dr. A. Sprenger's *Catalogue of the Arabic, Persian, and Hindustany MSS. in the Library of the King of Oudh* (vol. i., Calcutta, 1854) contains short biographical notices and accounts of the works of all the principal Persian poets.

Ethics, Science, Fiction, and Miscellaneous Works.—The number of these works which Persian literature contains is so numerous that it would require a large volume to give anything like an adequate account of them. The modern Persians, like other Oriental nations, have been stimulated into intellectual activity in recent times by their increased communications with the West, and the result has been that a number of useful works on educational and scientific subjects have been translated from the various European languages. The old standard authors, however, still hold their ground, and are studied with as much ardor as ever. The most esteemed and best-known miscellaneous works are—*Akhlak i Jelali*, a treatise on Persian moral philosophy, by Jelal-ud-din (lithographed at Lucknow at Munshi Nawal Kishore's press; a translation of the work appears amongst the publications of the Oriental Translation Fund, London); the *Akhlak i Muhsini*, by Hussem Vaiz Kashifi (translated by Keene, Hertford, 1852), another much esteemed work on the same subject; the *Gulistan* of Saadi, already mentioned in the notices of poetical works; the *Anwar i Suheile*, the Persian version of the fables of Bidpai, by Hussem Vaiz Kashifi (Persian text ed. by Col. J. W. Ouseley, Hertford, 1851; do. translated into prose and verse by E. B. Eastwick, Hertford, 18—); the *Dabistan i Mazahib*, by Mohsin Fani, a most interesting account of the rise, progress, and doctrines of various religious sects throughout the East. It contains, amongst others, a history of the ancient religion of Persia, of Hindooism, and of the different sects of Mohammedanism. (*The Dabistan*, translated with notes and illustrations by David Shea and Anthony Troyen, Paris, 1843, 3 vols.) The *Beharistan*, or "Spring Garden," of Jami, is a charming collection of tales, anecdotes, and aphorisms, and contains, besides, short biographies of twenty-eight of the principal poets of Persia. The text, with a German translation, was published in Vienna (1846) by Baron Schlechta Wessehrd. One of the most interesting works in Persian is the *Tezkerah i Ahuara*, or "Memoirs of the Poets," by Daulat Shah, who finished it about 1486 A. D. It is divided into a preface and nine chapters, each chapter containing biographies of about twenty poets, written in a most entertaining style, with extracts from and criticisms upon their works. It is also filled with historical details of great interest and importance, and displays great research and critical acumen in its compilation. De Sacy has a notice of this work in the *Notices et Extraits IV.*, pp. 220–272, but it has never been translated or published as a whole. It forms the groundwork of Von Hammer's *Geschichte der schönen Redekünste Persiens.*

E. H. PALMER.

Per'sifer, tp. of Knox co., Ill. Pop. 853.

Persigny', de (JEAN GILBERT VICTOR FIALIN), DUKE, b. at Saint-Germain-Lespinasse, department of Loire, France, Jan. 11, 1808; entered the army, but was discharged in 1830 on account of insubordination; became a contributor to the *Temps*; founded in 1834 *L'Occident français*, a Bonapartist organ; became very intimate with Louis Napoleon; took part in the affair of Strasbourg, from which he escaped, and about which he wrote *Relation de l'Entreprise du Prince Napoléon-Louis* (London, 1837); took part also in the descent on Boulogne, where he was captured and imprisoned; was restored to liberty by the revolution of 1848; chosen aide-de-camp to Napoleon and elected a member of the Legislative Assembly; played an important part in the *coup d'état*, and was minister of the interior from Jan., 1852, to Apr., 1854, and again from

Nov., 1860, to June, 1863; was created a duke in 1863. D. at Nice Jan. 13, 1872. The letters on public affairs which he now and then published are believed to have been inspired by Napoleon himself.

Persim'mon, a tree and its fruit, the *Diospyros Virginiana*, a tree of the U. S. and of the order Ebenaceæ. The common persimmon tree has a fruit which is excessively astringent until over-ripe, but after hard frosts have brought it to the verge of decay is a very sweet and agreeable fruit. The wood is used for lastmaking and other turnery. (See DATE-PLUM.)

Per'sius (AULUS PERSIUS FLACCUS), b. at Volaterræ, in Etruria, Dec. 4, 34 A. D., of a rich equestrian family; received a careful education in the schools of Rome; became a pupil of Cornutus the Stoic; moved in the most elegant circles of the capital; was acquainted with Lucanus and Seneca. D. very young, Nov. 24, 62. Six satires by him, comprising 650 hexameter lines, are still extant, edited by Jahn in 1843 and by Heinrich in 1844; and it is probable that he wrote no more, and even left these in an unfinished state, as he wrote seldom and slowly. In antiquity these satires were read and appreciated more perhaps than any other production of Latin literature; they were studied and quoted, not only by the pagan authors, but also by the Christian Fathers, such as Augustine, Lactantius, and Hieronymus. In the darkest periods of the Dark Ages they were still read, and their present standing is indicated by the circumstance that there are fourteen English and twenty French translations of them. They are, nevertheless, not easy to understand. But on a more intimate acquaintance, a pure, enthusiastic, and earnest soul reveals itself, which, feeling itself fettered by the corruption and depravity of the age, fights the foe as best it can. Later editions, with English commentary, by Macleane, by Conington (with an English translation), and by Gildersleeve (New York, 1875).

Per'son [from the Lat. *persona*, a "mask"], a term used in grammar to indicate the relations between him who speaks, him who is spoken to, and him who is spoken of; which relations exhaust the whole sphere to which they belong, and are respectively denominated first, second, and third person.

Person, county of North Carolina, bounded N. by Virginia. Area, 360 sq. m.; is undulating, fertile, and contains copper ores, graphite, and slate. Products, corn and tobacco. Cap. Roxborough. Pop. 11,170.

Personal Equation. See EQUATION, PERSONAL.

Personal Property, in law, denotes property or right of ownership in things personal as contradistinguished from things real. The inherent physical differences between immovables (lands) and movables (chattels) are so great that some distinction between the rules of law concerning them has existed among every civilized people. This was true of the Romans, and is alike true of all the modern nations which have based their legislation upon that of Rome. In no other jurisprudence, however, are the differences and contrasts between the rules pertaining to personal and those pertaining to real property so many, so wide, and so sharply defined as in the common law of England; and they have not been obliterated, nor even modified in any essential feature, by the statutes of the various States of the U. S. This double kind of property in the English law was entirely due to feudalism. The feudal system dealt wholly with lands. It developed from its primitive customs a series of arbitrary rules controlling the acquisition, ownership, inheritance, and transfer of lands, which, with some statutory modifications, became consolidated into the real-property law of England and of the U. S.; while property in chattels, which were few in number, and of little value or importance when compared with real estates, was left to be regulated by more simple and natural methods, partly borrowed from the Roman law and partly derived from certain doctrines of the common law. According to the classification made by the ordinary text-writers, things personal, which are the objects of personal property, are separated by a threefold division into (1) chattels, (2) chattels-real, and (3) things- (or *choses*) in-action; but to the first of these divisions alone the name "thing" is strictly applicable, for the other two are properly species of rights, and not the physical objects of rights. (1) Chattels include all tangible material objects which are in their nature movable, and are not permanently affixed to the soil so as to become in contemplation of law a part thereof. In England certain movables called "heirlooms" form an exception to this general definition, and are considered as belonging to the land, but they are unknown to the law of the U. S. (See HEIRLOOM.) Among the most familiar examples of chattels are horses, cattle, and other animals, household furniture, goods, wares, and merchandise, ships and other vessels, coin, annual crops even while growing; perennial plants, such as grass and the fruits of trees, are not chattels until severed from the land. Ores when mined, rocks when quarried, clay, sand, and gravel when dug and ready for use, are also chattels. So also are written instruments, contracts, bonds, notes, and the like when considered merely as tangible objects, without reference to the rights secured by them, although their value may depend upon and be measured by such rights. A chattel may be so affixed to the soil as to become a part thereof, and it is sometimes a difficult question to determine whether a particular article retains its original character as a chattel or has been converted into a fixture and a portion of the realty. (See FIXTURE.) (2) Chattels-real are simply the leasehold interests in land held by tenants for years—not the land itself, which is necessarily owned in fee by some one, but the temporary estate therein conferred upon a tenant by means of a letting. A chattel-real is therefore a peculiar species of *right*, at most an inferior grade of property in the soil, and its only feature of resemblance to personal property in general consists in the fact that upon the death of the lessee the unexpired portion of his term passes to his executors or administrators, and not to his heirs. By modern text-writers these leasehold interests are uniformly treated of in connection with real estates. (3) Things- (anciently called *choses*) in-action are claims or demands in favor of one person to recover something of value, which may always be estimated in money, due upon contract or other obligation from another person. Under this head are embraced all debts and all claims for damages resulting from the breach of contracts or from the commission of torts. Although, in a mercantile point of view, these credits of various kinds are justly considered as the representatives of value, and by their means the business of the world is transacted, and they are regarded as constituting property, yet in a legal point of view, and using the words in their true sense, it is a strange misnomer to describe things in action as forming a species of personal property. This classification shows the utter want of scientific conceptions among the ancient common-law writers. The very distinguishing element of the legal right conferred upon the holder of a thing-in-action consists in the fact that it is *not* a property right. As long as the thing-in-action exists, the holder thereof has no property whatever in the money or other article of value to which it relates; as soon as the holder becomes proprietor of the money or other article, and by the very fact of so becoming the owner, the thing-in-action is gone, its force as a claim is spent, it ceases to exist. The common law recognized this principle, and many of its rules concerning the use of different actions were expressly contrived to enforce the doctrine. A thing-in-action, therefore, instead of being a kind of property, is a right against some determinate person, which, if consummated by the holder, may result in his acquisition of property in money or some other thing.

The most important legal element which distinguishes personal property from real is its mode of devolution on the death of a proprietor. Lands are inherited directly by the heirs or are transferred immediately to the devisees. All personal property, including chattels-real and things-in-action, passes in the first instance to executors or administrators, and from them the creditors, next-of-kin, and legatees derive their possession and title. The whole process is the creature of statutes. At a very ancient day the English king succeeded to the personal property of a deceased intestate. Subsequently, this power of the king became transferred to the bishops, who took the goods, not as trustees, but as absolute owners. They were supposed to devote such acquisitions to pious uses, but in fact appropriated them to their own purposes. This unjust authority was gradually taken away by Parliament. A statute (13 Edw. I. ch. 19) compelled the bishops to pay the debts of the intestates out of the funds which they received. A second statute (31 Edw. III. ch. 11) deprived the bishops of their former power to administer, and directed them to appoint "the next and lawful friends of the deceased person intestate to administer his goods." This jurisdiction was retained by the bishops through their spiritual courts until its abolition in 1856. In the statute 21 Hen. VIII. ch. 8 it was determined from what classes of persons and in what order among the next-of-kin the administrator should be selected. Finally came the celebrated "statute of distributions" (22 and 23 Chas. II. ch. 10). Prior to this enactment the administrator appointed by the bishop, after paying the debts of the deceased, retained any surplus as his own absolutely. Pursuant to the rules introduced by the new legislation, the administrator is made a trustee in respect of such surplus, and is bound to distribute it, under the direction of the court, among the next-of-kin of the deceased in a certain fixed order and in certain determinate shares. The system thus finally adopted

by Parliament was substantially copied from the first three chapters of the 118th Novel of Justinian, in which that emperor had remodelled the law of successions. The "statute of distributions" has been re-enacted with more or less variations of detail, but without any change in its general features, by most of the American States. The duties of executors are the same as those of administrators, except that the surplus, after discharging the debts, is applied in payment of legacies, instead of being distributed among the next-of-kin.

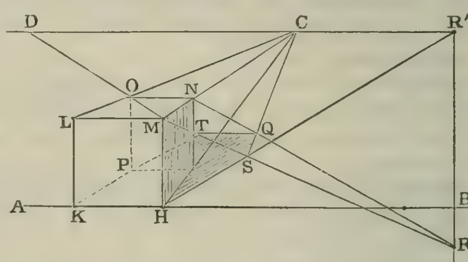
The modes by which personal property may be acquired are simpler and more natural and less connected with arbitrary forms than those by which real property is transferred. They may be classified as follows: I. Where a person acquires by his own act, without connection with or transfer from any other immediate owner; often called "original" acquisition. This class embraces (1) Occupancy, by which the captor of wild animals or the finder of abandoned articles becomes owner thereof from the mere act of appropriation. (2) Prescription, by which, through the statute of limitations, an adverse possessor may acquire property when his possession has lasted the statutory time. (3) Natural increase. (4) One's own labor, or, in the nomenclature of the Roman jurists, "accession." Whatever things a person constructs from his own materials are clearly his. If a person, acting in good faith and reasonably supposing that they were his, uses the materials of another to construct an article, the property in the product becomes his. But this result does not follow if the materials of another were originally taken by fraud or wilful trespass. The patent right of the inventor and copyright of the author fall within the present division, although they must be referred to a statutory origin. II. When the property is acquired on the occasion of the death of the former owner. This class includes succession by will and through intestacy. III. When the property is acquired from a former living owner. This general class is separated into two subdivisions: *First,* when the transfer is made by the act and with the consent of the former owner—namely, (1) by donation, or transfer by gift without consideration; (2) by contract, or transfer for a valuable consideration, the most important instance being that of sale; (3) by marriage. At the common law the husband became owner of the wife's chattels, and entitled to her things in action. (For the modern legislation in the U. S. abrogating this doctrine see the article MARRIAGE, AND MARRIED WOMEN.) *Second,* when the transfer is made without the former owner's consent. The methods included in this subdivision are all based upon the acts or defaults of the former owner, but lack the element of his own volition which characterizes those of the preceding subdivision. The law supplies this want by substituting an official consent. All these methods are in fact sales, the transfer being either made by an officer having authority, or to an officer by virtue of some positive enactment. The most important are sheriffs' sales on execution, assignments in bankruptcy or insolvency proceedings, and transfers to receivers under a judicial order or decree. Property in things personal may be absolute or qualified. Qualified or special property is limited in respect to its duration and the capacity to use and transfer which it confers.

JOHN NORTON POMEROY.

Personifica'tion, or **Prosopopœ'ia,** in rhetoric, is a figure in which inanimate objects or abstractions are made to possess the attributes of living things.

Persons, or **Parsons** (ROBERT), b. at Nether Stowey, Somersetshire, England, June 24, 1546; educated at St. Mary's Hall and at Baliol College, Oxford, where he graduated 1568, and became dean; left Oxford in 1574, in consequence of his conversion to Roman Catholicism; resided for a time in the Netherlands; studied medicine and law at the University of Padua; entered the Society of Jesuits at Rome July, 1575; studied divinity in the Jesuits' college at Rome; took orders as a priest; was sent by Pope Gregory XIII. to England, along with Edmund Campion and other Jesuits, July, 1580, to attempt the conversion of that kingdom to Roman Catholicism; travelled in disguise among his coreligionists; became the object of energetic measures on the part of the English government; escaped to the Continent 1581; opened a seminary for English youth at Eu in Normandy 1584; became rector of the English college at Rome and provincial of the English missions; communicated with James VI. of Scotland in behalf of his mother, Mary, queen of Scots, then awaiting execution, and visited in her behalf the courts of France, Spain, and Portugal; founded seminaries for English Roman Catholics at Valladolid, San Lucas, Seville, and Lisbon, and at St. Omer, France, 1593; became a second time rector of the English college at Rome 1594, and made an unsuccessful attempt to be appointed cardinal 1596. D. at Rome Apr. 18, 1610. Author of several treatises in favor of the doctrines of the Church of Rome, which appeared in London under assumed names, among which were *A Brief Discourse* (1584), *The Christian Directory* (1583–91), *A Conference about the next Succession to the Crown of England* (1594), and *A Treatise of the Three Conversions of England* (1603–04). For issuing the first and the third of these works the printers were hanged and quartered, and it was made high treason to own a copy of the latter book, which advocated the claims of the infanta of Spain to the English throne. Gibbon attributed his youthful conversion to Roman Catholicism to the writings of Persons.

Perspec'tive [Lat. *perspicio*], the art of representing an object on a surface so that it shall present to an eye situated at a particular point the same appearance that the object itself would present if the surface were removed. Such a representation of any object is called its perspective. To conceive what is meant by the perspective of an object, imagine a transparent plane to be placed between the eye and the object, and let straight lines be drawn from every point in the visible portion of the surface to the eye. Each of these lines pierces the transparent plane in a point, and if each point thus determined is properly tinted, the resulting picture will present the same appearance as the object itself. This picture is the perspective of the object as just defined. The art of perspective is divided into two parts: (1) the correct delineation of the principal lines of the object; and (2) the proper shading and coloring of the picture to produce the desired effect of distance and tint. The first part is called *linear perspective,* and the second part is called *aërial perspective.* The former is purely mathematical, and it alone will be considered in this article.



A perspective drawing may be made on any surface whatever, but in what follows we shall suppose it to be made on a plane, which, for convenience, will be taken in a vertical position and between the eye and the object; this plane is called the perspective plane, and any object lying on the same side of it as the eye is said to be in front, and any object lying on the other side is said to be behind the perspective plane. The lines that are drawn from the different points of an object to the point of sight are called *visual rays;* all the visual rays that are drawn from a right line of the object, or from a plane curve passing through the point of sight, make up a *visual plane;* and all the visual rays that are drawn from any other curve make up a visual cone. The art of linear perspective consists in passing visual planes and visual cones through the principal lines of the object, and finding their intersections with the perspective plane. The method of proceeding depends on a few simple principles of plane and of descriptive geometry, of which the following two are most frequently used: (1) If two lines are drawn through any point of an object, their perspectives will intersect, and this point of intersection is the perspective of the given point. (2) If visual planes are passed through any number of parallel lines of the object, they will intersect each other in a visual ray parallel to the given lines, and the point in which this ray pierces the perspective plane will be a point common to the perspectives of all the given lines.

The following definitions are necessary to a complete understanding of the method of applying the preceding principles: The *centre of the picture* is the orthogonal projection of the point of sight on the perspective plane. The *horizon of the picture* is the horizontal line of the perspective plane which passes through the centre of the picture. The *vanishing point* of any straight line is the point at which a parallel visual ray pierces the perspective plane: all parallel lines have a common vanishing point. A *perpendicular* is a line perpendicular to the perspective plane: all perpendiculars vanish at the centre of the picture. A *diagonal* is a horizontal line that makes an angle of 45° with the perspective plane: two diagonals can be drawn through any point, one inclining to the right and the other

to the left; there are, therefore, two vanishing points of diagonals, both in the horizon of the picture—one on the right and the other on the left of the centre, and at distances from that point equal to the distance of the eye from the perspective plane. If a visual ray parallel to a system of diagonals inclines to the right, those diagonals vanish at the right-hand point; if it inclines to the left, the corresponding diagonals vanish at the left-hand point. A *parallel* is a line parallel to the perspective plane: the vanishing point of a system of parallels is at an infinite distance, and consequently the perspectives of a system of parallels are parallel to each other and to the given parallels.

The object to be put in perspective is usually given by its projection on a horizontal plane, and by the distances of its several points above or below their horizontal projections. The perspective of any point is determined by the intersection of the perspectives of a diagonal and of a perpendicular through that point. The perspective of the shadow of any point upon any surface is determined by the intersection of the perspectives of a ray of light through the point, and of the projection of that ray on the given surface. Hence, the perspective of the shadow of a point upon a horizontal plane lies on the perspective of the ray through the point, and on the perspective of the horizontal projection of that ray. As an illustration of this method of perspective, called the method by diagonals and perpendiculars, let us find the perspective of a cube and the perspective of the shadow which it casts on the horizontal plane of its base, the rays of light being parallel. Take the perspective plane through the front face of the cube, and let A B represent the intersection of the plane of the lower base of the cube with the perspective plane. Let C be the centre of the picture, and let D C, parallel to A B, represent the horizon; also let D be the left-hand vanishing point of diagonals, R the vanishing point of rays of light, and R′ the vanishing point of horizontal projections of these rays; R′ is in a perpendicular through R to A B, and also in the line D C. Construct the square H L to represent the front face of the cube, and it will be its own perspective. The edges of the cube that pierce the perspective plane at H, K, L, and M are perpendiculars, and their indefinite perspectives may be found by drawing lines from these points to C. The diagonal through the upper left-hand vertex of the back face pierces the perspective plane at M and M D in its perspective; the point O in which M D cuts L C is therefore the perspective of this vertex. The edges of the cube parallel to L M and K H are parallel to the perspective plane, as are also the edges parallel to L K and M H, and consequently their perspectives are parallel to the lines themselves. Hence, if we draw O N and O P parallel to L M and L K, and then construct a square on these lines, it will be the perspective of the back face of the cube. The figure H O is then the required perspective of the given cube.

To find the perspective of its shadow on the horizontal plane A B, we draw M R, which will be the perspective of the ray of light through M, and H R′, which will be the perspective of the horizontal projection of that ray; the point S in which these lines intersect is the perspective of the shadow of the point M, and H S is the perspective of the shadow of H M. The shadow of the edge M N is a perpendicular; hence, we draw S C and N R, intersecting at Q; then is S Q the perspective of the shadow cast by M N. The shadow of N O is a parallel; hence, we draw Q T parallel to O N, and limited by a line from O to R; then is Q T the perspective of the shadow cast by N O. The line T P is the perspective of the shadow cast by the edge O P. The perspectives of the shade and shadow of the cube, so far as they are visible, are indicated by the shaded part of the drawing.

In the application of the rules for perspective it is often necessary to find the perspective of a circle; this is readily done by means of the following rule: Draw a tangent to the given circle parallel to the perspective plane, and find the perspective of the diameter that passes through the point of contact; draw the perspective of a diagonal through its middle point, and find the corresponding diagonal; through the point in which this diagonal intersects the diameter referred to draw a chord parallel to the perspective plane, and find the perspective of this chord; then on the two perspectives found, as conjugate diameters, construct an ellipse, and it will be the perspective of the given circle. The perspectives of other curves may be found by constructing the perspectives of a sufficient number of points, and then drawing a curve through them.

The true *panorama* is a perspective drawing, made on the inner surface of a vertical cylinder with a circular base, the point of sight being taken at some point of the axis of the cylinder.

Certain meteorological phenomena may be explained by means of the principles of *celestial* or spherical perspective. The dome of the heavens, which we call the celestial sphere, has its centre at the eye, and consequently every straight line not passing through the eye is projected upon it in the arc of a great circle. It often happens that clouds are thrown into parallel lines by currents in the atmosphere; they are then seen projected on the sky in great circles, intersecting each other at two points of the horizon diametrically opposite to each other. The line giving these points is parallel to aërial currents. In the warm and moist air of the tropics the parallel rays of the setting sun are often visible as they pass through our atmosphere; when projected against the sky they appear to be arcs of great circles, intersecting at the sun and at a point diametrically opposite to it. W. G. Peck.

Perspiratory Glands. See Histology.

Per Stir′pes (law), a technical term, originally of the Roman law, transferred to the English and American, and, like the correlative phrase *per capita*, used in the statement of those rules which regulate the succession to the property of a deceased owner. Whenever the heirs and next of kin of the deceased, being in unequal degrees of relationship, or his remote descendants in the same degree, inherit his lands or succeed to his personalty, not in equal portions, but in such shares as their respective *stocks* or deceased ancestors would have received if living, they are said to take *per stirpes*—that is, by the stocks—or by representation, the living descendants standing in the place of, and representing, their immediate dead ancestor, who is regarded as a *stock* of descent. Thus, if the intestate had originally three sons, two of whom are living, and the third has died leaving four children, and the whole estate is divided into three equal parts, one for each of the surviving children, and one for the four grandchildren taken together, the succession is *per stirpes*, or by representation. The three original sons are the three stocks of descent, and determine the number of shares into which the estate is separated. The children of the deceased son represent their father, and take in a body the portion that he would have received had he survived. If all the sons have died, the first leaving two children, the second three, and the third four, and the property is still divided into three equal parts, one for each group of grandchildren, the succession would also be *per stirpes*, each family of grandchildren representing their father as a stock. The same rule extends to collateral kindred. If the nearest relatives are, for example, two brothers of the intestate and the children of another brother or sister deceased, and the estate is distributed one-third to each of the brothers and one-third to the family of nephews and nieces, they would take by representation, or *per stirpes*. Although the actual mode of inheriting lands and distributing the personalty is regulated by statute, and there is a considerable diversity among the rules applicable to particular instances in the several States, it is the generally-established doctrine that when the heirs and next of kin of the intestate, whether lineal or collateral, stand in unequal degrees of relationship with him, the succession to his property among them is *per stirpes*, or by representation. (See Per Capita.)
John Norton Pomeroy.

Perth, town of Australia, colony of West Australia, on the Swan River, 12 miles above its mouth, had 5007 inhabitants in 1871.

Perth, town of Scotland, capital of Perthshire, is situated at the foot of the Grampian Mountains on the Tay, which is navigable here for vessels of considerable burden and crossed by several elegant bridges. It is a handsome city, with large manufactures of shirtings, ginghams, and shawls, breweries, distilleries, tanneries, dyeworks, and shipbuilding docks, and a very active trade. Pop. 25,585.

Perth, county of W. Ontario, Canada, has a fertile soil. Traversed by the Grand Trunk and other railways. Area, 698 square miles. Cap. Stratford. Pop. 46,522.

Perth, post-v., cap. of Lanark co., Ont., Canada, on the river Tay, is the terminus of a branch of the Brockville and Ottawa Railway. The town is well built of a handsome freestone. It is in a rich mineral and farming district. It has considerable manufactures, 3 weekly newspapers, and a fire department. Pop. of sub-district, 2375.

Perth, post-v. and tp., Fulton co., N. Y. Pop. 1013.

Perth Amboy′, post-v. of Middlesex co., N. J., at the mouth of Raritan River, on Staten Island Bay, and on the Rahway branch of the Pennsylvania and the New York and Long Branch R. Rs., has a spacious harbor, a female seminary and public school, 6 churches, 2 banks, 2 weekly newspapers, a cork manufactory, and stores. Pop. 2861.
H. Farmer. Ed. "Middlesex Co. Democrat."

Perth′shire, central county of Scotland, area 2834 sq. m., with 133,500 inhabitants. Part of the ground is occu-

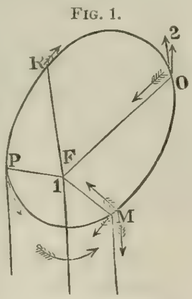
pied by the Grampian Mountains, whose highest peak, Ben Lawers, rises 4000 feet, and which are well wooded, affording good pastures and containing many beautiful lakes; part is low plains, with rich soil, producing wheat, barley, oats, potatoes, and fruits.

Pertica'ri (GIULIO), COUNT, b. at Savignano, in the Romagna, in 1779; d. at San Costanzo, near Pesaro, in 1822. After studying at Fano and Pesaro he removed to Rome in 1801, and there took his degree; in 1808 was appointed podestà of Savignano, and in 1812 married Costanza, the daughter of Vincenzo Monti, herself also a poet. Among the writings of Perticari the two following are the most important: *Degli Scrittori del Trecento e dei Loro Imitatori*, and *Dell' Amor Patrio di Dante e del suo Libro sul Volgare Eloquio.*

Perturba'tion [Lat. *perturbatio*, "disturbance"] is the name applied in physical astronomy to the disturbance of the simple elliptic motion of two heavenly bodies about their common centre of gravity; which disturbance may be occasioned by the attraction of a third body or by the eccentric action of the mass of one or other of the principal bodies concerned because of its deviation from a spherical form. The moon and the earth afford a notable example of this in both of the respects here indicated. Were these the only bodies in space, and both truly spherical, with the mass of each symmetrically disposed around its own centre, they would accurately describe similar ellipses around their common centre of gravity, their respective radii vectores (see PLANET) describing areas equivalent among themselves in equal times. The *unequal* and varying action of the sun incessantly *disturbs* all this. Were that action indeed in equal proportion to the masses of the earth and moon, and in the line of their own mutual action, the elliptical orbits around the common focus would both be preserved, though with changed dimensions, in accordance with the principle of the coexistence of forces and their resultant motions. But in no position of the moon can the continuous action of the sun be thus equable. Thus, at the time of new moon, for instance, the moon, being nearer to the sun than the earth, is therefore more powerfully attracted (in proportion to its mass) than the earth; and this *excess* of action is manifested in drawing the *moon away* from the earth. But at the time of full moon, the *earth* being the body attracted by the sun in more than the proportion due to its mass, the effect of this mutual action is manifested in drawing the *earth away* from the moon.

At another time, when the moon, as at M (Fig. 1), is yet in the region near to the position of new moon, so that the *moon* is drawn even there *away* from the earth, then —the direction of motion in the orbit being that indicated by the *bent* arrow—it will be perceived that the attraction of moon and earth acting inward toward F, and the *excess* of solar action (action of sun on moon and moon on sun) already alluded to being operative in the direction of the arrow pointing downward at M, the resultant of the two forces (as indicated in the figure) will in whole or in part pull back or *retard* the moon in her orbit; while in the situation such as that marked at P a like resultant will *accelerate* the orbital motion, and thus the *angular* velocity be *directly* influenced. But this same angular velocity will be *indirectly* influenced by the excess of solar action, modifying that of moon and earth on each other, and thus their distance asunder and the form of the moon's orbit both be changed. When the moon has arrived at O, the *earth* being drawn *away* from the moon toward 2, so as to give the radius vector of the moon's orbit the direction of the arrow line in the figure, the farther extremity of that radius vector will be, as it were, thrown forward; and thus, in effect, what has been styled a *pushing* instead of a *pulling* force be exerted on the moon, so that the motion in the orbit will be *accelerated* at O, instead of being *retarded* as at M. At R, the efficiency, being again that of a *pushing* force, will there *retard* the orbital motion.

FIG. 1.

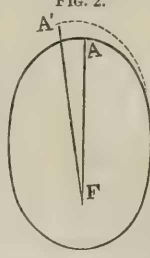


The perturbations change the *form* of the orbit, and will themselves introduce modifications in the perturbative action, both directly and indirectly, and thus the irregularities be excessively multiplied. Then, the earth being spheroidal in form, the *excess* above an inscribed sphere extending from pole to pole will not have the resultant of the moon's action upon *it* the same as though the action of that material were at the very centre of the earth itself, as is very nearly true of the sphere inscribed; but that same spheroidal excess will have that portion of it which at any time is nearer to the moon more forcibly attracted than other portions more remote; and the same will be true, but with less intensity of action, with respect to the perturbation of the same spheroidal excess by the mutual attraction of it and the sun. Hence, nearly the whole of the precession of the equinoctial points; of which more in the sequel.

Periodic perturbations have been characterized as those which depend upon the configurations of the system; and they go through their changes during the period of those configurations or changes of position, to begin their series of effects anew. Thus, as has already been seen, the excess of solar attraction, when most direct, has a tendency at new moon to draw the moon away from the earth, and at full moon to draw the earth away from the moon. Thus, the effect on the whole is to expand the moon's orbit. And as the earth's orbit around the sun is elliptical, with the sun in one focus, the expansion here spoken of will be the greatest when the earth is nearest to the sun (about the 1st of January), and the least at the opposite season of the year (about July 1st); the expansion and contraction of the lunar orbit will therefore recur alternately during successive half years, the whole *period* of change and restoration to very nearly the same state occupying a year.

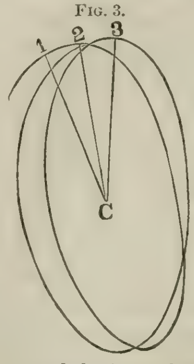
But restoration to exactly the same state after any one period will not recur, and there will thus be left small outstanding remainders, which in the course of ages accumulate *secular* perturbations extending in their course through enormous periods of time. Thus, the larger masses of the solar system being outside of the earth, the tendency of the planetary perturbations is *upon the whole* to draw the earth away from the sun, or expand the earth's orbit very much after the manner already indicated in the case of the moon. Hence, when the earth (Fig. 2) is about approaching what would be its aphelion (or position most distant from the sun), the planetary perturbations draw the earth away to describe something like the dotted line in the figure; insomuch that that orbit is not perpendicular to the direction of F A produced outward; and that is not effected until the earth has passed farther on to A′; so that the major axis of the orbit is found *in advance* of what would be its undisturbed direction. The revolution to return to the like position in the ellipse is therefore more than one complete revolution around the sun, or the *anomalistic* exceeds the *sidereal* year. But as the change of direction here described is only 11.8″ per annum, the whole period of this *secular* perturbation occupies many centuries.

FIG. 2.



This change of direction of the longer axis (or line of the apsides) of the earth's orbit admits of illustration by experiment. Thus, let a weight of some dense material (a leaden weight, if we please) "be suspended by a brass or iron wire to a hook in the under side of a firm beam, so as to allow of its free motion on all sides of the vertical, and so that when in a state of rest it shall just clear the floor of the room or a table placed ten or twelve feet beneath the hook. The point of support should be well secured from wagging to and fro by the oscillation of the weight, which should be sufficient to keep the wire as tightly stretched as it will bear with the certainty of not breaking." Now, let "a considerable" motion "be communicated to the weight, not by merely withdrawing it from the vertical and letting it fall, but by giving it an impulse sideways. Then the axis of the somewhat bent ellipse which the weight describes will be seen to have changed its position at every revolution of the weight, so as to be advanced in the same direction with the weight." (See Fig. 3.) The experiment is that indicated by Sir John Herschel in illustration of "the motion of the apsides of the lunar orbit," the change of direction of which is more rapid than the like change in the earth's orbit. (*Outlines of Astronomy*, 692.) The experiment will succeed very well when the somewhat heavy ball is suspended by a thin string. The reason for the change of direction of the apsides of the experimental curve is that the force drawing the ball to the perpendicular position varies in a *less* ratio than the distance from the *centre* of the curve. Were that ratio preserved, the ball, in accordance with the laws of central forces, would describe an ellipse around the *centre* of the curve, not around the focus. But the condition of an *insufficient* force at the extremities of the line of apsides secures a sufficient-

FIG. 3.



ly approximate imitation of the phenomenon to be illustrated.

Change in Direction of the Nodes of the Moon's Orbit.—When the action of the sun's attraction is as near as may be at right angles to the line N N of the nodes of the moon's orbit, as represented in Fig. 4, the moon (revolving in the

FIG. 4 (*a*).

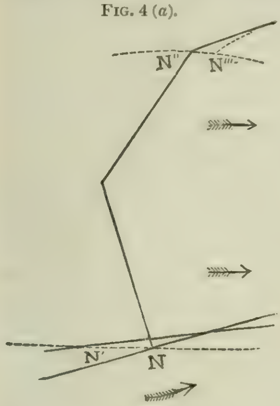
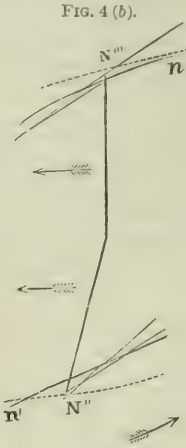


FIG. 4 (*b*).



direction indicated by the bent arrow), when she has passed N, and is on the side *toward* the sun, will be *drawn by him away* from the earth, as heretofore shown; and this more and more, indeed, as she advances toward Q, this action of the sun being withal in the plane of the ecliptic indicated by the dotted curve; and so the tendency will be to pull the moon over into the path which carried backward would intersect the plane of the ecliptic at N′ *behind* N; or the node will seemingly *have gone backward—i. e. retrograded*—while the interior angle at N′, which measures the *inclination* of the orbit so disturbed, will be *less* than the inclination at N. Then, before the moon can reach N‴, she, being drawn away from the earth by the solar force acting in the same plane as before, will move in a path intersecting the plane of the ecliptic at N″ behind N‴. Beyond and behind that, the *earth*, as heretofore described, will be *pulled away* from the moon; and so, as heretofore, we may describe the action on the moon as being in effect that of a *pushing* force instead of a pulling force; and this going on continuously, and on the whole more intensely, the moon, in effect, will describe a path coming from N behind N‴, but with a *less* inclination. At N′ we shall have a similar effect, but with a *greater* inclination, so that while the changes of inclination have been alternately *compensatory*, or nearly so, and thus have shown a *periodical* perturbation, the nodes have throughout retrograded.

When the direction of the sun's action is in the line of the nodes instead of at right angles to that line, the action of the sun will not disturb the position of the nodes, as the line of nodes will lie *in* the plane of his action. But when the solar action, as in Fig. 5, is oblique to the line of the nodes, then the *pulling force* will, while the moon is passing from *q* toward N, throw the position of the node toward which she is tending in the direction *forward* of N′, and the *pushing* force, in the region from *q′* to N‴, will cause the moon to describe a path tending to *n* in *advance* of the node. But in other parts of the orbit the change of position will be retrograde, as in the case of the action at right angles, though not so rapid; so that, under these circumstances, the nodes will retrograde during the greater part of the moon's revolution with regard to them, but advance at other times.

FIG. 5.

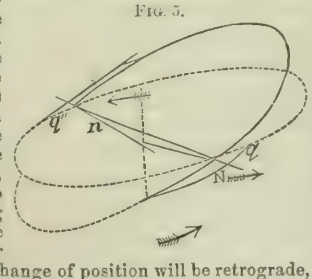
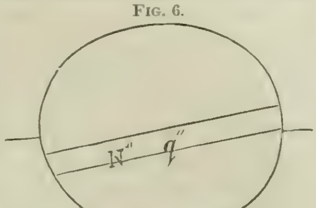


FIG. 6.



Of the Precession of the Equinoxes.—"Suppose in Fig. 6 that instead of one body P, revolving round S, there were a succession of particles not coherent, but forming a kind of fluid ring, free to change its form by any force applied;" then, if the ring revolved in its own plane, its nodes would retrograde by the action of the distant body (sun or moon) in the direction of S, the *majority* of the particles being acted upon in such a way as to induce that, when the action of S was oblique to the line of nodes, and thus overcoming the tendency of the other particles to push or draw the nodes the other way, so that the resultant tendency would superinduce a remaining retrogradation of the nodes of the whole ring. When the action of S was at right angles to the line of nodes, the tendency throughout would insist upon a retrogradation, and when S acted in the line of the nodes, the direction of that line would not be changed. All this is consistent with what has already been illustrated in the case of the moon. "The motion of such a ring, then, as we have been considering would imitate, as far as the recess of the nodes goes, the precession of the equinoxes, only that its nodes would retrograde far more rapidly than the observed precession, which is excessively slow. But now conceive this ring to be loaded with a spherical mass enormously heavier than itself, placed concentrically within it, and cohering firmly to it, but indifferent, or very nearly so, to any such cause of motion, and suppose, moreover, that instead of one such ring there are a vast multitude heaped together around the equator of such a globe, so as to form an elliptical protuberance enveloping it like a shell on all sides, but whose mass, taken together, should form but a very minute fraction of the whole spheroid. We have now before us a tolerable representation of the case of nature; and it is evident that the rings, having to drag round with them in their nodal revolution the great inert mass, will have their velocity of retrogradation proportionally diminished. Thus, then, it is easy to conceive how a motion similar to the precession of the equinoxes, and like it characterized by extreme slowness, will arise from the causes in action." (Sir J. Herschel, *Outlines of Astronomy*, 643 and 647.)

Sir John Herschel in a note notices the seeming objection that the *inscribed sphere*, as well as the elliptical protuberance, might be influenced in the way here described. But the action of sun or moon on this spherical portion, and its reaction on them, being as though its resultant were applied at the centre, there is no leverage with which to bend or otherwise influence the *spherical portion* in *its* rotation, so that the elliptical protuberance will be loaded with all the rest, as already indicated.

In article 668 of his *Outlines of Astronomy*, Sir J. Herschel thus succinctly states some of the grand conclusions of physical astronomy: "We are, therefore, conducted to this most remarkable and important conclusion: viz. that the major axis of the planetary (and lunar) orbits, and, consequently, also their mean motions and periodic times, are subject to none but periodical changes; that the length of the year, for example, in the lapse of infinite ages, has no preponderating tendency to increase or diminution—that the planets will neither recede indefinitely from the sun nor fall into it, but continue, so far as their mutual perturbations at least are concerned, to revolve for ever in orbits of very nearly the same dimensions as at present." (For a more extended and full discussion of the subject of this article reference may be made to the various works on physical astronomy.) S. ALEXANDER.

Peru′, republic of South America, extending along the Pacific Ocean from lat. 3° 20′ to 22° 20′ S., with a maximum length on the coast-line of about 1600 miles, a maximum breadth of 800 miles on the frontier, with Ecuador on the N., chiefly formed by the river Marañon, and a frontier, with Brazil and Bolivia on the E., extending irregularly about 1500 miles, chiefly formed by the Javary and Purus rivers and the summit of one of the ranges of the Andes. The country has nearly the shape of an inverted right-angled triangle, the Marañon being the base and the Pacific coast the hypothenuse. The area is approximately 500,000 sq. m., the pop. variously estimated at from 2,865,000 to 3,417,000. Politically, the republic is divided into 17 departments—Amazonas, Ancachs, Apurimac, Arequipa, Ayacucho, Cajamarca, Cuzco, Huancavelica, Huánuco, Ica, Junin, Libertad, Lima, Loreto, Moquegua, Piura, and Puno—and 2 littoral provinces, Callao and Tarapaca. Lima, the capital, had in 1868 a population of 121,362. The other chief cities are Arequipa, Ayacucho, Cuzco, Callao, Cajamarca, Iquique, Cerro de Pasco, Moyobamba, and Tacna.

Physical Geography.—Peru is traversed from N. to S. by two parallel ranges of the Andes, by which it is naturally divided into three regions, respectively known as the *Coast*, the *Sierra*, and the *Montaña*. The Coast region, lying between the western range of the Andes and the Pacific, varies in width from 60 to 20 miles, and is for the most part a sandy desert, only the valleys of the numerous

small rivers springing from the Cordillera being available for cultivation. Rain is unknown, the S. E. trade-winds having exhausted their moisture in traversing the vast regions E. of the mountains, which sometimes exceed 20,000 feet in height, but cool winds and heavy dews maintain an equable temperature, which rarely rises above 85° or sinks below 60° F. The Sierra, or region between the two ranges of the Andes, is a series of valleys broken by many small spurs of mountains, averages 100 miles in width, is estimated to cover 150,000 sq. m., or nearly a third of the republic, and embraces nine-tenths of the cultivated area and four-fifths of the population. The Sierra consists of—(1) the great plain of Titicaca, on the S. E., comprising the basin of the lake of the same name, lying partly in Bolivia, with an altitude of nearly 13,000 feet; (2) the *Nudo*, or "knot" of Vilcanota, formed by the union of the two ranges of the Andes, with several minor transverse ranges, constituting a region diversified by tropical valleys and vast elevated plateaus, in one of which, containing 15,000 sq. m., is the city of Cuzco, at an elevation of 11,000 feet above the sea-level; (3) the valley of the Apurimac, the most populous part of Peru, stretching N. W. 300 miles in length by 30 in average breadth; (4) the knot of Pasco, another region of table-lands similar to that of Vilcanota, formed by a second union of the parallel ranges of the Cordillera, and noted for its mineral wealth; and (5) the tropical valleys of the Marañon and its great tributary, the Huallaga. To the N. of Pasco is a third more eastern range of the Andes, parallel to the two former, which now rapidly decline in height until, having passed the limits of Peru, they again unite to form the knot of Loja in Ecuador. The Montaña embraces the vast region E. of the Andes, traversed by great navigable rivers, but almost unexplored, and occupied by barbarous tribes of Indians. With the exception of insignificant streams on the coast and the few tributaries of Lake Titicaca the rivers of Peru all form part of the Amazonas system. The Marañon itself, which is considered as the source of the Amazonas, rises in Lake Lauricocha, near the mines of Cerro de Pasco, flows N. W. 500 miles between the ranges of the Andes until at lat. 5° 30′ it bends abruptly eastward and forms the N. boundary of the republic for nearly 1000 miles, until it enters Brazilian territory at Tabatinga. The Huallaga, which rises near the Marañon and flows N., is navigable for steamers 600 miles of its lower course. The Ucayali, formed by the union of the Apurimac and Urubamba, is a river of the first magnitude, considered by many geographers as the true source of the Amazonas, and navigable through most of its course. The Purus, rising near Cuzco, is said to be navigable for 2000 miles, but most of its course is within Brazilian territory. The Lobos and Chincha islands, lying in the Pacific near the Peruvian coast, are remarkable for their vast deposits of guano, which furnish a large part of the revenue of the state. Earthquakes are frequent throughout the Sierra and Coast regions, particularly in the vicinity of Arequipa, where several volcanoes are also found.

Productions and Resources.—The soil of the Peruvian Sierra is extremely fertile, yielding all the ordinary tropical and sub-tropical plants, with many which are peculiar to this region. In the forests of the northern valleys are found scores of valuable cabinet woods, as also the chinchona tree (which yields the precious "Peruvian bark" or quinine), the coca, caoutchouc, the bread-fruit tree, and many varieties of spices. The potato is supposed to be a native of the Peruvian table-lands, where also the sweet potato and the valuable esculent root called *quinoa* abound. Cotton, cacao, the sugar-cane, grapes, and olives are leading objects of cultivation, and many exquisite varieties of fruit are indigenous to the country. Silkworms and cochineal-insects are successfully reared. Besides an abundance of the European domesticated animals, the llama, vicuña, alpaca, and guanaco are found in the upper regions of the Sierra. Fish and fowl abound in the Montaña, and gayly-plumaged birds of numberless species are found in every part. Sea-birds have for ages been so numerous as to have deposited millions of tons of guano at many places on the coast, giving rise to an important branch of commerce, still probably in its infancy, as the coast-region has been very imperfectly explored. The guano-beds, as well as the vast deposits of nitrate of soda recently discovered in the province of Tarapaca, constitute government monopolies of sufficient value to have paid for the construction, within a recent period, of more than 1000 miles of railways, which, traversing the Andes at several points, have connected Puno, Cuzco, Oroya, Huaraz, and other cities of the Sierra with the sea-coast.

Antiquities.—Ancient Peru included also the territories of the modern republics of Ecuador and Bolivia (formerly called Upper Peru), and it is the latter region, around the Lake of Titicaca, which is designated by tradition and by extant monuments as the original centre of aboriginal Peruvian civilization. The island of Coati in that lake was the scene of the appearance of the mythic ancestors of the Incas, Manco Capac and Mama Oello, and on it may still be seen the ruins of large structures of hewn stone in a tolerable state of preservation. At Tiahuanaco, 10 or 12 miles from the shore of the lake, are other ancient edifices, remarkable for the massive blocks of cut stone, 30 feet long by 18 wide, sometimes covered with sculptured figures enclosed in rows of small squares. At Huanuco are two well-preserved pyramidal structures of massive hewn stones with symmetrical triangular-shaped gateways, broad at the base, but rapidly narrowing upward until they are surmounted by lintels formed by single blocks 11 feet in length. The materials of the great "temple of the Sun" and of the fortress of Ollantaytambo at Cuzco were nearly all employed in the construction of the modern city, but the extant remains are of a similar character to those of Tiahuanaco. Fragments of immense stone aqueducts and bridges are found in several parts of Peru, the former having sometimes been more than 100 miles in length, and some of them are still in use. About 20 miles S. of Lima, on the sea-coast, are extensive remains of Pachacamac, a city of later origin than the foregoing, the structures being of adobe, but occasionally employing massive stones. At Cuelap, in N. Peru, a still-existing structure is described as consisting of a solid wall of hewn stone 3600 feet long, 570 feet wide, and 150 feet in perpendicular height, forming the platform for another similar structure 600 by 500 feet, and also 150 feet in height. It is to be regretted that more exact accounts of this remarkable ruin have not been given to the world. Vast remains of paved roads or causeways may still be traced through much of the distance (more than 1000 miles) from Cuzco to Quito. An interesting collection of Peruvian remains was exhibited at the Centennial Exposition at Philadelphia.

History.—Peru was occupied, when discovered by Spaniards early in the sixteenth century, by two comparatively civilized races of cognate origin, the Quichuas and Aymarás, governed by the so-called Inca dynasty, which was traditionally descended from the sun. (See QUICHUAS and INCAS.) The population of Peru at the Conquest has often been calculated as high as 30,000,000, but probably did not reach a third of that number, even including the territories now forming Bolivia and Ecuador, which were then subject to the incas. Peru was conquered and plundered in the fourth decade of the sixteenth century by a small band of Spanish adventurers headed by Francisco Pizarro and Diego Almagro, who put to death the inca Atahuallpa, and placed his half-brother, Manco Capac, upon the throne as nominal emperor. For many years the country was in constant anarchy from insurrections of the natives and civil wars between the conquerors themselves, which resulted in the death of most of the leaders, Pizarro himself having been assassinated at Lima, the city he had founded as a capital, June 26, 1541. A viceroyalty was ultimately established in Peru, which continued to govern that country until July 21, 1821, when independence was proclaimed as a consequence of a successful invasion by a liberating army under command of the Argentine general José de San Martin, already the liberator of Chili. San Martin was made protector, but soon resigned, and was replaced as dictator by the Colombian chieftain Simon Bolivar, who defeated the Spaniards at Gunin and Ayacucho (1824), and they were driven from their last stronghold at Callao in Jan.. 1826. Bolivar retired to Colombia in 1825, and a republican government was formed. In 1836 the Peru-Bolivian confederation was formed under the presidency of the Bolivian Santa Cruz, but it was overthrown in 1839. Numerous civil wars and changes of constitution followed, the principal leaders, Castilla, Echenique, and Vivanco, alternating in the presidency. Slavery was abolished in 1855. A war with the Spaniards, who had seized upon the Chincha Islands, took place in 1866, Bolivia, Ecuador, and Chili being allies of Peru. Col. Prado was president 1865–68, and was succeeded by Col. Balta, who was murdered July, 1872. Don Manuel Pardo was thereupon elected president for a period of four years, expiring in 1876, when Col. Prado became chief magistrate a second time. The first three years of Pardo's administration were marked by financial reforms and great energy in railroad construction, but in 1875 the diminished supply of guano led to a failure to maintain the national credit in the European money-market, a cessation of public works, the bankruptcy of leading business institutions, and a general financial prostration, from which, it is feared, the republic cannot soon recover. (See Prescott's *Conquest of Peru* (1847); Rivero and Tchudi's *Peruvian Antiquities* (New York, 1847); Markham's *Travels in Peru and India* (1862); and E. G. Squier's *Travels in Peru* (1876).)

PORTER C. BLISS.

Peru, city and tp., La Salle co., Ill., at the head of navigation on Illinois River (here crossed by a handsome bridge), and at the S. W. terminus of Illinois and Michigan Canal, is beautifully situated on the Chicago Rock Island and Pacific R. R.; has extensive trade and manufactures, 7 churches, 1 newspaper, 1 hotel, 1 bank, 5 public-school buildings, and 4 grain-warehouses, is lighted with gas, and has a good fire department; 125,000 tons of ice are annually exported to Southern markets, and extensive coal-mines are found in the vicinity. Lines of steamers ply in the summer to St. Louis and Peoria. Pop. of city, 3650; of tp. 3945.

Peru, p.-v. and tp., cap. of Miami co., Ind., at the junction of Toledo Wabash and Western and Indianapolis Peru and Chicago R. Rs., 75 miles N. of Indianapolis, has 2 banks, Howe sewing-machine manufactory, a woollen-mill, basket-factory, carriage-factories, foundries, 1 daily and 3 weekly newspapers. P. of v. 3617; of tp. 1115.

J. A. MILLER, ED. "MIAMI CO. SENTINEL."

Peru, tp., Dubuque co., Ia. Pop. 889.

Peru, post-v. of Belleville tp., Chautauqua co., Kan., on the Middle Caney Creek.

Peru, post-v. and tp., Oxford co., Me., on the Androscoggin River. Pop. 931.

Peru, p.-v. (formerly PARTRIDGEFIELD) and tp., Berkshire co., Mass., on Boston and Albany R. R. P. 455.

Peru, post-v. and tp., Nemaha co., Neb., on the Missouri River. Pop. 1164.

Peru, post-v. and tp., Clinton co., N. Y., on Lake Champlain and the Plattsburg R. R. Pop. 2632.

Peru, post-v. and tp., Huron co., O., on the Sandusky Mansfield and Newark R. R. Pop. 1297.

Peru, tp. of Morrow co., O. Pop. 953.

Peru, post-v. and tp., Bennington co., Vt. Pop. 500.

Peru, tp. of Dunn co., Wis. Pop. 242.

Peru Bal'sam, a balsamic exudate obtained from *Myrospermum Peruvianum*, a handsome tree of the natural order Leguminosæ, growing in the state of San Salvador, Central America. Portions of the bark are bruised by beating with blunt instruments, and subsequently charred by flame. A week or so later the injured bark comes away, and the balsam, which now begins to exude from the exposed wood, is collected on cloths, from which it is afterwards separated by gentle boiling in water. Peru balsam is a dark-brown, viscid substance, like thick molasses, of a rather fragrant odor and a warm, bitterish taste. It is insoluble in water, but mixes perfectly with absolute alcohol and chloroform. It is combustible, giving forth white fumes and a fragrant balsamic odor. It contains a resin, a volatile oil, and cinnamic and benzoic acids. Balsam of Peru was probably introduced into Europe as a medicine about the year 1524, and was considered of great value in bronchial and other respiratory affections, and locally upon ulcers or wounds. But its medicinal virtues are feeble, and other balsams have almost completely superseded it in American practice. It is an ingredient of the compound tincture of benzoin of the *U. S. Pharmacopœia*. EDWARD CURTIS.

Peru'gia [anc. *Perusia*], town of Central Italy, which gives name to the province. It is situated 75 miles S. E. of Florence and 8 miles from the historic Lake Thrasimene (now Lake of Perugia), on a hill near the right bank of the Tiber, 1600 feet above the sea-level. The air is healthful, and the view of the surrounding country, rich in vegetation and most picturesque from the old towns, churches, and castles everywhere scattered over it, is extremely beautiful. The town itself, as seen from below, is most striking. It is well walled, and entered by gates mostly mediæval or modern; but among them is one of the Etruscan period, bearing the inscription "Augusta Perusia" placed on it by Augustus. Some remains of the old Etruscan walls also still exist. The streets, though often steep, are broad, and the squares are flanked by imposing public and private edifices. In the very large Piazza del Duomo there is a superb fountain, the work of Niccolò and Giovanni da Pisa. The churches are numerous (at least 100) and very noteworthy. Some of the palaces contain choice works from the hands of renowned artists, especially the Palazzo del Collegio del Cambio, which is rich in frescoes by Perugino. The Palazzo Publico (1333) is a building of great interest. Many of the fifty convents of Perugia have been suppressed recently, and from these and other sources a most interesting and highly instructive collection of pictures from the best masters of the Umbrian school, such as Perugino, Raphael, etc., has been brought together in the Academy of Fine Arts near the university. Perugia has always been renowned for love of art and literature, and its university (established in 1320) is still flourishing and respectable. Without the gates there are some remarkable antiquities; among others, the Torre di S. Manno, on which is the celebrated cubital writing called by Maffei "the queen of Etruscan inscriptions." Many interesting tombs, Roman as well as Etruscan, have been found in the neighborhood. Perugia was one of the oldest of the twelve chief Etruscan cities, and one of the last to fall before the Romans. In the quarrel between Antony and Octavianus this town espoused the cause of the former, and was cruelly punished by the latter, who afterwards rebuilt it. Its mediæval history has much of the romantic interest common to that of other large Italian towns. It is said to have been an episcopal see from the earliest Christian times, and continues such to the present day. Though always restive under the papal yoke, this town was not united to the kingdom of Italy till 1860—a year after the suppression of political disturbances and a brutal massacre of many of its citizens by the pontifical troops. Perugia manufactures silks, velvets, woollens, liqueurs, etc. Pop. in 1874, within walls, 20,000; suburbs included, 49,500.

Perugia, Lake of [anc. *Lacus Trasimenus*], is a lake of Central Italy, in the province of Umbria, 30 miles in circumference, and surrounded by beautifully wooded hills. Here Hannibal defeated the Romans in 217 B. C.

Perugi'no, Pietro (PIETRO VANNUCCI DELLA PIEVE), friend of Leonardo da Vinci, teacher of Raphael, head of the so-called Umbrian school, which Raphael perfected, b. in Città della Pieve, a small Umbrian town, 1446; d. 1524; began his studies in Perugia, completed them in Florence, returned to Perugia at the age of forty. His best pieces belong to this period. His works mark an era in painting. His best work suggests Raphael. His school is characterized by softness, gentleness, tender grace, and richness of color. The devoutness of expression verged on sentimentality, and, being a manner rather than a feeling, easily became monotonous, affected, and wearisome. Perugino was neither a devout nor an amiable character; his hand was skilful, but his genius was meagre; both in subject and treatment he repeated himself fatiguingly. His finest pictures were painted in Perugia. Excellent examples are in the Vatican, the Pitti Palace in Florence, and the National Gallery in London. O. B. FROTHINGHAM.

Peruvian Antiquities. See PERU, by PORTER C. BLISS, A. M.

Peruvian Bark. See CINCHONA.

Pe'ruwels, town of Belgium, province of Hainaut, has breweries, tanneries, and manufactures of yarn, caps, and beetroot-sugar. Pop. 7775.

Peruz'zi (BALDASSARE), b. at Ancajaro, near Siena, in 1481; studied first the art of painting, and is considered the inventor of perspective architecture painting, but devoted himself afterwards chiefly to architecture; built in Rome the Palazzo Farnesina and Palazzo Massimi; succeeded Raphael as architect of St. Peter's in 1520. D. in 1537, poisoned by a competitor.

Peruzzi (UBALDINO), descendant of an old and distinguished family of Florentine bankers, b. in Florence Apr. 2, 1822, and educated at the École des Mines in Paris. In 1848 he was appointed gonfaloniere of Florence, in which office he did not carry out the views of Guerrazzi, as was expected. After the overthrow of the grand duke in 1859 (to which Peruzzi himself contributed) he was elected member of the Tuscan Assembly, afterwards deputy from Florence to the Italian Parliament. In 1861, Cavour offered him the post of minister of public works, an office which he retained until the fall of the Ricasoli ministry. While Rattazzi was in power Peruzzi threw himself into the opposition, but under the presidency of Minghetti he took the portfolio of the interior, and thus became a member of the ministry which negotiated with Napoleon III. the convention of Sept. 15, 1864, for the transfer of the capital from Turin to Florence. Peruzzi succeeded Count Cambray Digny as syndic of Florence, and he has not only carried out the admirable plans of his able predecessor for the improvement and embellishment of the city, but he has shown great energy in suggesting and executing important projects of his own to the same end. On the occasion of the recent festival at Florence in honor of Michael Angelo the city complimented her syndic with a gold medal.

Pe'saro [anc. *Pisaurum*], town of Italy, province of Pesaro and Urbino, in lat. 43° 55′ N., lon. 12° 54′ E. It lies on the slightly elevated right bank of the Foglia, near its entrance into the Adriatic, and is immediately connected with the larger towns of Southern and Northern Italy by the great railway skirting that sea. Pesaro is strongly walled and commanded by a citadel, and from the agreeable promenade upon the ramparts the view, embracing the neighboring hills dotted with castles and villas, the distant peaks of the Apennines, and the near Adriatic, is very fine. The streets are broad and well paved, and

the town contains many churches and private palaces of considerable interest. The cathedral is remarkable as showing by its three superimposed pavements the great changes of level which have taken place on this coast. Pesaro is probably of Pelasgian origin, was enlarged and adorned by the Romans, and had a bishop as early as 251 A. D. It suffered cruelly from barbarian invasions, and its mediæval life was much agitated. It is the birthplace of many distinguished men, both ancient and modern; among the latter, of Rossini, who bequeathed his large fortune to his native town—after the death of his widow—to be devoted to a musical lyceum. The maritime trade of Pesaro is of some importance, and there is an active traffic in the very fine fruits, grain, beans, silk, hemp in which the adjoining district is so rich. P. in 1874, 19,900.

Pescade'ro, p.-v. and tp., San Mateo co., Cal. P. 659.

Pesca'ra, town of Italy, province of Chieti, the most important station on the railway between Ancona and Foggia. It stands on a river of the same name, here crossed by a fine bridge, and the mouth of which forms a small but secure harbor. The fortifications of Pescara, formerly very strong, but now mostly demolished, begun by Charles V., have since sustained many sieges. The neighboring country is highly fertile. P. in 1874, 5238.

Pesch'el (Oskar Ferdinand), b. at Dresden Mar. 17, 1826; studied law at Leipsic and Heidelberg; was for several years employed on the Augsburg *Allgemeine Zeitung;* became professor of geography at the University of Leipsic in 1871, and wrote *Geschichte des Zeitalters der Entdeckungen* (1858), *Geschichte der Erdkunde bis auf A. von Humboldt und Karl Ritter* (1865), *Neue Probleme der vergleichenden Erdkunde* (1870).

Peschie'ra sul Lago di Garda, an Italian fortress situated at the point where the Mincio issues from the Lake of Garda, and on the railway from Brescia to Verona, about 14 miles W. of the latter city. The circumference of the fortress is about 8000 feet, and it is surrounded by high, strong walls and bastions, and by broad and deep trenches filled with water from the lake. Peschiera, chiefly important as forming a part of the military system known under the name of the "Quadrilateral," commands the approaches by the Mincio and the navigation of the lake. From the natural strength of its position it was occupied during the Middle Ages by a fort held now by one faction now by another. In 1549 the Venetian republic repaired and garrisoned the fortress; in 1796 it was taken by the Austrians, who afterwards enlarged and strengthened the works at immense expense, and who held it (except a brief occupation by the French in the early part of this century, and by the Italians in 1848) until it was ceded to the kingdom of Italy in 1866. P. of v. in 1874, 4218.

Pe'scia, town of Italy, province of Lucca, situated in a most fertile district, 12 miles E. of the city of Lucca. The churches and other public buildings, as well as the private palaces, are very respectable, but without special interest. The inhabitants are active and industrious, the silk, leather, and paper factories are extensive and prosperous, and the fruit-market of Pescia is very famous. This town was a dependency of Lucca during the Middle Ages. P. in 1874, 12,700.

Pesci'na, town of Italy, province of Aquila degli Abruzzi, on the left bank of the Giovenco, near Lake Fucino. The principal buildings are the cathedral and the episcopal palace. It has considerable trade in oil, wine, wax, honey, and hides. Remains of cyclopean walls are to be seen in the neighborhood. P. in 1874, 5156.

Peshaw'er, a territory formerly belonging to Afghanistan, but now annexed to the dominions of Punjaub, British India, comprises an area of 2300 sq. m., with 847,695 inhabitants, of whom 776,063 are Mohammedans and 71,632 Hindoos. The soil of the country is exceedingly fertile, and by artificial irrigation it produces annually two crops of the finest rice in the world. The capital, Peshawer, is situated on the frontier of Afghanistan, at the eastern terminus of the Khyber Pass, which forms the principal road of commerce between India and Persia. It was formerly a very flourishing city, with 100,000 inhabitants, but it was nearly destroyed in the beginning of this century by the Sikhs. Under English rule, strongly fortified and defended by a garrison of 10,000, it is rapidly rising again. P. 53,000.

Peshi'to [Syr. for "simple"], the standard Syriac translation of the Old and a part of the New Testament. It was probably made in the second and third centuries of the Christian era, and is now generally believed to be the work of Christian Jews. It is a generally faithful and scholarly piece of work. The Gospels and Apocalypse are wanting, and are believed not to have been translated into Syriac until much later times.

Peshti'go, p.-v. and tp., Oconto co., Wis., on Peshtigo River, near Green Bay. P. 1749.

Peso'tum, p.-v. and tp., Champaign co., Ill., on Toledo Wabash and Western and Illinois Central R.R. P. 919.

Pestaloz'zi (Johann Heinrich), b. at Zurich, Switzerland, Jan. 12, 1746; studied first theology, then law, but moved by the perusal of Rousseau's *Émile,* and obeying his own inner calling, he burnt his books, settled as a farmer at Neuhof in the canton of Aargau, married, and commenced the development of his educational ideas, theoretically and practically. In 1780 he published (in Iselin's *Ephemeriden*) *The Evening Hours of a Hermit;* in 1781, *Leonard and Gertrude,* a sort of romance; in 1782, *Christoph und Else;* in 1782–83, *Das Schweizerblatt für das Volk;* in 1801, *How Gertrude teaches her Children;* in 1803, *Buch der Mütter;* in 1804, *Anschauungslehre der Zahlenverhältnisse,* etc. The ideas which these books set forth, and most of which seem to us to be mere truisms, because they form the very foundation of our views of education, were at that time new and startling; and the attention which they attracted was very great, and increased by the practical application which the author at the same time gave them. Schools, or rather educational institutions, for children of the lowest classes were established by him at Neuhof, at Stanz, and at Burgdorf in the canton of Berne. This latter, which was afterwards removed to Yverdun, in the canton of Vaud, was at one time very prosperous, and was visited by a number of teachers from other European countries, who came to learn the new method, and brought it back to their native countries. But Pestalozzi lacked financial and disciplinary skill. Harassed by pecuniary difficulties and by dissensions among his co-operators, he retired in 1825 to Neuhof, where he wrote his *Schwanengesang* and *Meine Lebensschicksale.* D. Feb. 17, 1827. There is a collected edition of his works by L. W. Seyffarth (16 vols., 1871–72). (See Biber, *Life and Trials of Henry Pestalozzi* (St. Gallen, 1827), English trans., Philadelphia, 1833; and *Pestalozzi and Pestalozzianism,* by H. Barnard (New York, 1859).)

Pesth, city of Hungary, situated in a sandy plain on the left bank of the Danube, opposite Buda, with which it is connected by a magnificent suspension bridge and several other bridges; originated as a Roman colony (*Transacincum*); was fearfully devastated by the Mongols in 1241; recovered, and rose rapidly into prosperity, especially on account of the elections of the Hungarian kings taking place on the neighboring plain, Rákos, where often armies of 100,000 men were encamped for months; sank again under the Turkish rule (1526–1686) almost into a heap of ruins and rubbish, but recovered once more; was made a free city of the empire, and greatly favored by Maria Theresa and Joseph II., who removed the Hungarian University hither, built a number of great buildings, and made it the seat of the government of the country; and is now the most splendid and populous city of Hungary, the centre of its political and literary life, of its industry and commerce. It consists of five divisions, the old city and four suburbs, of which the Leopoldstadt is the finest. The quays along the Danube and the new boulevards are very elegant, broad, and lined with palatial houses. Among its institutions the most remarkable are—the university, with 140 professors and 2296 students in 1873, a library of 105,000 volumes, a botanical garden, and an observatory; the national library, of 200,000 volumes; the museum, with a complete collection of Hungarian coins; the theatre, the academy of music, the casino, etc. Besides the Roman Catholic cathedral, there are 30 places of worship, among which is a magnificent synagogue; it also has a great number of excellent educational institutions. The principal branches of manufacturing industry are leather, tobacco, brandy, silk, cloth, hats, and shoes. The chief articles of commerce are grain, wine, wool, potash, and soda. P. 200,476, of which 136,890 are Roman Catholics, 22,344 Protestants, and 39,386 Jews.

Pestilence. See Epidemic and Plague.

Petaluma, p.-v. and tp., Sonoma co., Cal., at the head of navigation on Petaluma Creek, on San Francisco and Northern Pacific R. R., 42 miles N. of San Francisco, with which it is connected by a daily line of steamers. Stock-raising, agriculture, and wine-producing are the leading industries, and 4 newspapers are published. P. 4588.

Petard' [Fr. *pétard*], a stout iron or wooden case filled with powder, affixed to the gate or palisades of a beleaguered place, and exploded for the purpose of making a breach. Bags of powder have been found equally effective. The Huguenots first used petards at Cahors (1579).

Petch'ora, a river of European Russia, rises in the Ural Mountains, flows with winding course through wild,

uncultivated regions covered with forests of larch-wood, and enters the Arctic Ocean through a large estuary in lat. 68° N. and lon. 53° E.

Pe'ter, Saint, the first in the list of the twelve apostles, was b. in Galilee, at Bethsaida, on the shore of the Lake of Gennesaret, whence he removed to the adjoining village of Capernaum. He was a fisherman, like his brother Andrew, and, like him, he was probably a disciple of John the Baptist, but he followed Christ immediately when called. His original name was Simon, which Christ changed, declaring, "Thou art Peter, and upon this rock I will build my Church" (Matt. xvi. 18). From his call to the office of apostle, and up to the time of the apostles' council in Jerusalem, the events of his life are told in the Gospels and the Acts, and are familiar to all. His personal character is so distinct and strongly marked that there probably are no readers of the Bible who have not a vivid conception of it, or any two whose conceptions differ very much. But of the facts of his history after the apostles' council in Jerusalem tradition is the only authority, and the circumstance that the papal see rests its whole claim of primacy on events related by this tradition has caused it to be richly elaborated and very much doubted. Jerome and Eusebius relate that Peter was bishop of Antioch for several years, preached in Pontus, Galatia, Bithynia, and Cappadocia, and spent the last twenty-five years of his life in Rome, where he suffered martyrdom. This can hardly be correct. It seems impossible that Peter should have been bishop in Rome for twenty-five years. Paul makes no reference to such a fact in his Epistle to the Romans. At the time of the Reformation it was even contended—for instance, by Spanheim—that Peter never was in Rome; but at present most critics, Protestant as well as Roman Catholic, agree in accepting the tradition in its principal traits—namely, the residence of Peter in Rome and his suffering martyrdom there—though it has not been possible to establish an agreement with respect to the dates of these events. The most probable date is 66 or 67. Of the two Epistles in the New Testament which bear St. Peter's name, the genuineness of the former has commonly not been doubted, while some consider the second, or at least a large part of it, to be spurious.

Peter I., the Great, czar of Russia, b. at Moscow June 12, 1672, son of the czar Alexis Michailowitz; in 1682 succeeded Feodor, his brother, but his brother, Ivan V., being lawful heir, was soon after announced as joint-sovereign under the regency of their sister Sophia; but the energetic Peter, after seven years of tutelage, thrust the princess-regent into a convent, where she died after twenty-two years of confinement, while the inactive Ivan in 1689 abdicated his share of the government. Peter at once reorganized the army; built a small naval force; went to sea in person on several Dutch and English ships, so as to learn the practical part of navigation; took Azof from the Turks 1696; lived abroad (1697–98), chiefly at Saardam in the Netherlands and at Deptford and London, and with his own hands worked as a ship-carpenter and blacksmith, and for some months studied the sciences, so that Oxford gave him the degree of D. C. L. In 1698 he took 500 English mechanics, engineers, etc. to Russia, and in the same year, the Strelitzes having revolted, he ordered them all to be put to death, and assisted the executioners with his own hands; but pardoned a few upon the scaffold, noteworthy among whom was the young Orloff, founder of the princely house of Orloff. Peter spared his life on account of his indifference as he approached the block. In the same year died Le Fort, Peter's wisest counsellor, a Swiss by birth. The czar now reformed the calendar, founded schools, introduced arithmetic (hitherto unknown in Russia), compelled rich merchants to engage in foreign commerce, and enacted rules for dress and deportment; entered upon a war of conquest against Sweden, supported by Denmark and Poland, 1700, and in the same year was badly defeated by Charles XII. at Narva; founded St. Petersburg 1703; invaded Courland 1705; overthrew the Swedes at Pultava 1709; seized the Baltic provinces 1710, and Finland 1713; married Catharine I., his mistress, 1707, and declared her czarina 1711; waged an unfortunate war against the Turks 1711; finally gave up most of Finland in the peace of 1721; made the tour of Europe 1716–17, and returned with many books and works of art; put to death his son Alexei 1718, on the ground of his treasonable conduct; conquered three Caspian provinces from Persia 1722, but in 1730 Persia recovered a great portion of them, after Peter's death, which occurred Feb. 8, 1725. He was succeeded by Catharine I., his wife. Peter was the first Russian to take the title of emperor 1721. The surname "the Great" was assumed by himself.

Peter II., Alexeivitch, b. at St. Petersburg Oct. 23, 1715, a grandson of Peter the Great, a son of Alexei; succeeded Catharine I. on the Russian throne May 17, 1727. D. suddenly Jan. 29, 1730. The most prominent features of his short reign were the desperate intrigues between the families of Mentchikof and Dolgoruki.

Peter III., Feodorovitch, b. at Kiel, in Holstein, Feb. 21, 1728, a son of Peter the Great's daughter Anna, who had married a duke of Holstein; was designated as heir to the Russian crown in 1742 by his aunt, the empress Elizabeth; married, in 1745, Princess Catharine of Anhalt-Zerbst, afterwards Catharine II.; ascended the throne Jan. 5, 1762, and was deposed, arrested, and strangled July 8, same year. He had two very prominent passions—admiration of Frederick II., with whom he immediately made peace, restoring to him the conquered provinces, and hatred to the royal dynasty of Denmark, against which he immediately began war, with the intention of sending it to Tranquebar. He found no time, however, to execute his plans. Just as he had placed himself at the head of an army destined to invade Denmark, a revolution broke out at St. Petersburg. Münich, whom he had recalled from Siberia, advised him to march immediately with the whole army to the capital, but he was taken so completely by surprise that he lost all power of action. At Ropscha he was strangled in his bed by the brothers Orloff. Some years later an impostor, Pugatchew, put himself forward as the murdered emperor, but without success.

Pe'terboro', post-v. of Smithfield tp., Madison co., N. Y. Residence of the late Gerrit Smith. Pop. 368.

Peterborough, town of England, in Northamptonshire, on the New, is celebrated for its beautiful cathedral, built in the twelfth century in Norman style. Its length is 476 feet; the height of the nave to the ceiling 78 feet, and of the lantern-shaped tower 135 feet; its breadth is 78 feet. The town has a large trade in corn. Pop. 17,429.

Peterborough, county of Central Ontario, Canada, is fertile in its southern part, and abounds in lakes and streams. It has 3 ridings. Cap. Peterborough. Pop. 30,473.

Peterborough, a thriving town, the capital of Peterborough co., Ontario, Canada, on the river Otonabee, on the Cobourg Peterborough and Marmora and a branch of the Canada Midland Railway, is handsomely built on a fertile plain, is lighted with gas, has good water-power, manufactures of lumber, leather, machinery, castings, farm-implements. It has a good trade in grain and flour. A handsome bridge connects it with the village of Ashburnham. It has 1 weekly newspaper. Pop. of sub-district, 4611.

Peterborough, p.-v. and tp., Hillsborough co., N. H., on Contoocook River, at the N. terminus of Monadnock R. R., has 1 weekly newspaper and several cotton-mills, foundries, and factories. P. 2236.

Peterborough (Charles **Mordaunt**), Earl of, b. in England about 1658, was a son of Lord Mordaunt of Reygate, Viscount Avalon, to which titles he succeeded 1675; served in boyhood in the navy against the Barbary corsairs in the Mediterranean; was engaged under Admirals Torrington and Narborough in the expedition against Algiers 1678–79; exchanged into the army; took part in the defence of Tangier against the Moors 1680; was an attached friend of Algernon Sydney, whom he attended to the scaffold; was a bitter opponent of the governments of Charles II. and James II. in the House of Lords; indulged in a lavish prodigality, which involved him in debt and made it expedient for him to retire to Holland 1686; used every opportunity of inciting William, prince of Orange, to undertake the overthrow of James; accompanied that prince in his English campaign 1688; became first lord commissioner of the treasury, and was created earl of Monmouth (a title formerly borne by his maternal ancestors) Apr., 1689; soon found himself in conflict with his ministerial colleagues and with the king through his ardent Whiggism; retired from office Jan., 1690; served under William in Flanders 1691; remained several years in unwilling retirement on his estates; was imprisoned in the Tower by order of Parliament on an accusation of complicity in Sir John Fenwick's plot against the king's life 1697; succeeded in the same year to the earldom of Peterborough by the death of an uncle; was restored to favor at court on the accession of Anne; became privy councillor Mar., 1705; obtained through the influence of the duchess of Marlborough the command of the land-forces sent to the aid of the archduke Charles of Austria in asserting his claim to the Spanish crown; sailed with Sir Cloudesley Shovel at the head of 5000 Dutch and English soldiers May, 1705; took on board the archduke at Lisbon and the prince of Hesse-Darmstadt (commander-in-chief of the allied forces) at Gibraltar; occupied Valencia without resistance; proposed an immediate march upon Madrid, but was overruled, and the

siege of Barcelona undertaken against his judgment. Early in September that siege was about to be abandoned as impracticable, when Peterborough obtained leave to undertake a seemingly desperate night-assault upon the citadel of Monjuich, one of the strongest fortresses in the world, which was successfully undertaken (Sept. 6), and led to the capture of Barcelona. Peterborough then began a brilliant campaign, overran Catalonia, Aragon, and Valencia with the greatest rapidity, and successfully defended Barcelona against the formidable army of Philip V. (1706), but resigned in 1707, in consequence of dissensions with his associate commanders. Employed for some years in diplomatic posts, he became governor of Minorca 1713, sided with the Tories during the last years of Anne, lived in retirement during most of the reigns of George I. and George II., was an associate and friend of the chief literary celebrities of the time, and became general of the marine forces of Great Britain 1722. D. at Lisbon Oct. 25, 1735. Peterborough was a chivalrous and eccentric character, of vast military genius, and considerable literary taste, as shown by several occasional publications. He wrote his own *Memoirs*, but they were destroyed by his widow, the celebrated singer, Anastasia Robinson. (See Macaulay's *Essays*, Lord Mahon's *History of England*, and Eliot Warburton's *Memoir* (1853), which contains selections from Peterborough's correspondence.) PORTER C. BLISS.

Peter Creek, tp. of Van Buren co., Ark. Pop. 149.

Peter, Epistle of St., The First, one of the catholic or general Epistles, was written from "Babylon" (perhaps symbolical for Rome) about 64 A. D.—PETER, EPISTLE OF ST., THE SECOND, has suffered more from doubts as to its authenticity than any other book of the New Testament. It is directed against heretics and corrupt men, and the second chapter, in which they are described, bears a striking resemblance to the Epistle of St. Jude.

Pe'terhead, town of Scotland, Aberdeenshire, on a narrow peninsula, with two good harbors on the northern and southern sides of the peninsula, connected with each other by a canal. The herring fisheries along the coast are important; the shipbuilding industry and trade are considerable. P. 8535.

Peter the Hermit, b. at Amiens in the middle of the eleventh century; was educated at Paris and in Italy; served in the army in Flanders, but gave up the military career and married; became a monk after the death of his wife, and finally a hermit; made in 1093 a pilgrimage to Jerusalem, and, deeply impressed by the indignities and cruelties inflicted on the Christian pilgrims by the Mohammedan rulers of the city, he began immediately on his return to Europe, and with the authority of Pope Urban II., to preach a general war for the delivery of the Holy Sepulchre. His preaching in Italy and France stirred up the whole populace, and a crusade was actually determined upon by the Council of Clermont in 1095. Peter himself led the first army towards the Holy Land—an undisciplined and disorderly swarm, containing as many women and children as men. After unspeakable sufferings on their way through Hungary, Bulgaria, and Constantinople to Asia Minor, they were routed and massacred at Nice by Sultan Solyman. Next year a regular and brilliant army, comprising the flower of European chivalry, undertook the second crusade, under the command of Godfrey of Bouillon. Peter accompanied also this expedition, and after the conquest of Jerusalem in 1099 he preached to the crusaders on the Mount of Olives. Shortly after he retired to Huy in Belgium, where he founded a monastery, and d. July 7, 1115.

Pe'terhof, an imperial palace in the government of St. Petersburg, Russia, on the Bay of Kronstadt, was built by Peter the Great, contains a fine collection of pictures, and is surrounded with beautiful parks and gardens. A small town has grown up around it.

Pe'termann (AUGUST), b. at Bleicherode, in Prussian Saxony, Apr. 18, 1822; was educated in the gymnasium of neighboring Nordhausen, and entered in 1839 the geographical institution of Prof. Berghaus at Potsdam, where he stayed for six years, assisting him in the preparation of his *Physical Atlas*, and preparing himself the maps to A. von Humboldt's *Asie Centrale*. In 1845 he went to Edinburgh to superintend the English edition of the *Physical Atlas*, and in 1847 to London, where he became a member of the Royal Geographical Society, and contributed a number of geographical essays and articles to the *Athenæum*, *Encyclopædia Britannica*, etc. In 1854 he returned to Germany as director of Justus Perthes' geographical institution in Gotha, and next year began the publication of his celebrated *Mittheilungen*, a monthly which now has reached 21 vols., and may be considered as the central organ and the highest authority in present geographical literature. Practically, Petermann has interested himself very much in several African and Arctic expeditions, and contributed much to organize them. In 1876 he visited the U. S.

Pe'ters, tp., Franklin co., Pa. P. 2603.

Peters, tp., Washington co., Pa. P. 943.

Peters (ABSALOM), D. D., b. at Wentworth, N. H., Sept. 19, 1793; graduated at Dartmouth College 1816, at Princeton Theological Seminary 1819; was pastor of a Congregational church at Bennington, Vt., from 1820 until 1825, when he accepted the secretaryship of the United Domestic Missionary Society; was the first secretary of the American Home Missionary Society, holding that position until 1837, and editing the *Home Missionary and Pastor's Journal;* became in 1838 editor of the *American Biblical Repository;* was professor of pastoral theology in Union Seminary, N. Y., 1842–44, pastor of a church at Williamstown, Mass., 1844–57, and originated the *American Eclectic Review* and the *American Journal of Education*. D. in New York City May 18, 1869. Author of several theological and polemical treatises, and of a volume of poems.

Peters (CHRISTIAN HENRY FREDERICK), PH. D., b. at Coldenbüttel, Sleswick, Germany, Sept. 19, 1813; graduated at the University of Berlin; travelled extensively for several years in Italy and the East; engaged in scientific researches, after which he settled in the U. S.; was employed upon the Coast Survey; became professor of mathematics and astronomy at Hamilton College 1858, where he took charge of the Litchfield Astronomical Observatory, which he brought to a high state of efficiency; made very extensive investigations concerning comets and asteroids, having discovered more than twenty of the latter bodies; catalogued 16,000 zodiacal stars and recorded over 20,000 solar spots. Under the auspices of the regents of the University of the State of New York, Dr. Peters determined the exact longitude of several points within that State, especially upon the western boundary. He took a prominent part in the observation of the total solar eclipse of Aug. 7, 1869, at Des Moines, Ia.; was chief of the party sent by the U. S. government to New Zealand to observe the transit of Venus of Dec. 9, 1874, and was the only observer on that island who had complete success, having obtained 237 photographs of the transit.—His brother, WILHELM KARL HARTWIG, b. at Coldenbüttel Apr. 22, 1815, took a prominent part in the Prussian survey of Mozambique (1842–47), and is a distinguished professor of zoology at Berlin.

Peters (HUGH), b. at Fowey, Cornwall, in 1599; was educated at Trinity College, Cambridge; became a clergyman in London; was imprisoned for nonconformity; was for some years a preacher at Rotterdam; came to New England in 1635, and succeeded Roger Williams as minister of Salem, Mass.; was influential in public affairs; returned in 1641 to England; became a preacher in Cromwell's army, serving in Ireland with the rank of colonel; filled important civil and ecclesiastical positions, but upon Charles II.'s restoration was shut up in the Tower, and beheaded Oct. 16, 1660, on the charge of having been concerned in the king's death. There have been widely different estimates of his character: the royalist writers of his time bring severe charges against his character, but with very questionable justice. He left some quaint literary remains, now almost forgotten.

Peters (JOHN CHARLES), M. D., b. in New York July 6, 1819; studied homœopathy in Europe, having gone thither in 1842; established himself in New York as a homœopathist, but pursued an independent and novel line of medical theory, and aimed to blend to some extent the scientific methods and results of modern medical practice with those of homœopathy. Edited the *North American Journal of Homœopathy* (1856–61); was chosen president of the American College of Medical Sciences in 1859, and professor of materia medica and therapeutics; author of a series of medical treatises; one of the translators of Rokitansky's *Pathological Anatomy*, etc.

Peters (RICHARD), b. at Blockley (now part of Philadelphia), Pa., Aug. 22, 1744; became a successful lawyer, distinguished for wit and brilliant social qualities; was a captain in the Revolution; secretary to the board of war 1776–81; was in Congress 1782–83; U. S. district judge 1789–1828; was one of the first American farmers to use gypsum, upon the valuable qualities of which he published a memoir 1797; author of 2 vols. of *Admiralty Decisions* (1780, 1807). D. at Blockley, Pa., Aug. 21, 1828.

Peters (SAMUEL ANDREW), D. D., LL.D., b. at Hebron, Conn., Dec. 12, 1735; graduated at Yale in 1757; became Church-of-England minister at Hartford; was compelled to flee to England as a Tory in 1774, and his property was confiscated; published *A General History of Connecticut* (1781), a laughable satire on his native State, probably

not intended to convey any historical information. It was severely denounced in the U. S. Peters was chosen bishop of Vermont in 1794, but the archbishop of Canterbury refused him consecration; returned to the U. S. in 1805, and in 1817 endeavored to get possession of a tract of land in what is now Minnesota. D. in great poverty in New York Apr. 19, 1826.

Peters (THOMAS McCLURE), D. D., b. at Boston, Mass., June 6, 1821; graduated at Yale College 1841; studied theology; took orders in the Episcopal Church: became rector of St. Mary's, of All Angels', and of St. Michael's churches, N. Y.; president of the "Sheltering Arms," and prominently identified with several charitable institutions.

Pe'tersburg, p.-v. and tp., cap. of Menard co., Ill., on Chicago and Alton and Springfield and North-western R. Rs., 20 miles N. W. of Springfield. The town was laid out by Abraham Lincoln (afterward President of the U. S.) in 1835; has fine schools, 7 churches, 2 newspapers, several flouring-mills, good water-power, and extensive timber tracts. Deposits of coal exist here. Pop. of v. 1792; of tp. 2821. JOHN F. MOUNTS, ED. "DEMOCRAT."

Petersburg, v., Venedy tp., Washington co., Ill. P. 35.

Petersburg, p.-v., Washington tp., cap. of Pike co., Ind., situated 1½ miles S. of White River, has an excellent graded school, 4 churches, 1 bank, 1 carriage-factory, 2 flouring-mills, 2 woollen-mills, a brewery, court-house and jail, and stores. Coal is abundant. P. of v. 923.

HARVEY WISHARD, ED. "PRESS."

Petersburg, p.-v. and tp., Boone co., Ky., on Ohio River. P. 400.

Petersburg, p.-v., Summerfield tp., Monroe co., Mich., on Raisin River and Lake Shore and Michigan Southern R. R., has 1 newspaper.

Petersburg, p.-v. and tp., Jackson co., Minn., on Des Moines River. P. 168.

Petersburg, p.-v. and tp., Rensselaer co., N. Y., on Little Hoosick River and Harlem Extension R. R. P. 1732.

Petersburg, p.-v. and tp., Mahoning co., O., on Pittsburg Fort Wayne and Chicago R. R. P. 218.

Petersburg, p.-b., West tp., Huntingdon co., Pa., on Pennsylvania Central R. R. P. 381.

Petersburg, p.-b., Penn tp., Perry co., Pa., on Susquehanna River. P. 960.

Pétersburg, city and port of entry of Dinwiddie co., Va., 23 miles S. of Richmond, on the S. bank of Appomattox River, 12 miles above its mouth, near the falls which constitute the head of tidewater and of navigation for large vessels, and supply abundant water-power for milling and manufacturing purposes. Above the falls the Appomattox is navigable more than 100 miles for flatboats. Petersburg is connected with Richmond, Norfolk, Lynchburg, Weldon, and City Point by means of Atlantic Mississippi and Ohio, Petersburg, and Richmond and Petersburg R. Rs., has 6 banks, 4 savings institutions, 1 weekly and 3 daily newspapers, 24 churches and chapels, 27 public and 21 private schools, 62 manufactories, including many of tobacco, and several of cotton goods, iron and wooden ware, 2 public libraries with an aggregate of 10,000 volumes, several creditable public edifices, including the court-house, the custom-house and post-office, 2 markets, and a theatre, some of which, however, suffered serious damage during the war; is picturesquely situated on the declivities of a hill sloping gradually to the river-bank, affording natural drainage; is well built, lighted with gas, and copiously supplied with pure water from a reservoir; has a beautiful public park called Poplar Lawn; is surrounded by the remains of numerous intrenchments which constituted its defences during the memorable siege of 1864–65, since which period it has rapidly risen in prosperity, doing a heavy shipping business in Southern agricultural staples. In 1874 the exportation of tobacco from the port of Petersburg was 46 per cent., and in 1875 nearly 36 per cent., of the entire freight export of that article from the U. S., the number of pounds exported in the latter year being 3,266,804, and the revenue paid in the city on the manufactured article being $812,345. In 1874, 26,240 barrels of flour were inspected, while 39,648 bales of cotton and 108,000 bushels of peanuts were shipped. It is a place of considerable historic interest, being located on the site of an Indian village burned by Nathaniel Bacon in Aug., 1676; was laid out in 1733, simultaneously with Richmond, by Col. William Byrd; was incorporated 1748, and re-incorporated 1781, and was twice occupied as head-quarters during the Revolutionary war by the British forces, whose commander, Gen. William Phillips (the predecessor of Cornwallis), died here of fever May 13, 1781, shortly after having repulsed an attack by Gen. Steuben. A gallant company of Petersburg volunteers in the war of 1812 earned for it the complimentary title of "Cockade City of the South," attributed to Pres. Madison; and its heroic defence during the closing scenes of the late civil war rendered it memorable as the "last citadel of the Confederacy." The Army of the Potomac, under Gen. Grant, being induced by the result of the second battle of Cold Harbor to abandon its advance upon Richmond by the line of the Chickahominy, crossed the James River below City Point June 12, 1864, and made formidable assaults upon Petersburg June 15 and 16, which were repulsed with a loss, as stated by Gen. Grant, of 10,268 men; after which he proceeded to invest the city. The actual siege began June 19, after which the Weldon railroad was torn up by the Union cavalry under Wilson, and an attempt was made to isolate the city from its supplies. Mines were constructed and exploded on an extensive scale, and the "bloody battle of the crater," July 30, was but one of a series of unsuccessful attempts to take the city by storm. The siege was prolonged, amid long-continued, indecisive operations, until Apr. 3, 1865. when a week of bombardment and active engagements, including Sheridan's success at Five Forks, determined Gen. Lee to evacuate the city, and his surrender at Appomattox six days later terminated the war. The population of Petersburg remained nearly stationary during the decade of the war, having been 18,266 in 1860 and 18,950 in 1870, but since the latter date it has rapidly increased.

ROGER A. PRYOR.

Petersburg, p.-v., cap. of Grant co., West Va., situated on the S. branch of Potomac River, 150 miles S. E. of Wheeling, has good schools and hotels. It is a general dépôt for grain from the neighboring counties. P. about 300. S. D. GORDON, ED. "EXAMINER."

Peters' Comet, so called because the elements of its orbit were first determined by Prof. C. H. F. Peters, director of the Litchfield Observatory at Clinton, N. Y. Of the fourteen ascertained periodic comets whose mean distance from the sun is less than that of Saturn, this has the greatest distance and the longest period, Pigott's comet being the next. Its motion is direct; mean distance from the sun, 6.3206; eccentricity of orbit, 0.8464; inclination of orbit, 13° 2′ 14″; period of revolution, 15.990 years.

Peter's Creek, p.-v. and tp., Stokes co., N. C. P. 1491.

Pe'tersen (CLEMENS), b. in the island of Seeland, Denmark, Oct. 2, 1834; studied theology and philosophy at the University of Copenhagen; had charge of the critical department of the principal Danish paper in that city 1853–69; lectured on literature and art; wrote *On the Performance of the Greek Tragedy* (1861) and *The Contest between the Old and the New in Danish Literature on the Appearance of Œhlenslāger,* published by the Literary Society of Copenhagen (1867); came to New York in 1869, and has been an occasional contributor to the *Atlantic, Galaxy,* and other periodicals.

Petersen (NIELS MATTHIAS), b. at Sanderup, island of Fuhnen, Denmark, Oct. 24, 1791; studied philology and history, and became professor of ancient Scandinavian language and literature in 1845 at the University of Copenhagen, where he occupied a prominent place as one of the earliest and most gifted representatives of modern ideas in philology and history. His works relating to ancient Scandinavian mythology, literature, history, and language (*Det Danske, Norske og Svenske Sprogs Historie* (1829), *Den Nordiske Mythologie* (1849), *Danmarks Historie i Hedenold* (1834), *Haandbok i den oldnordiske Geographie* (1834), etc.) are distinguished both for elevated and comprehensive views and ingenious treatment of details, and his elaborate *History of the Danish Literature* (6 vols., 1853–64) exercised a deep and regenerating influence on Danish taste. As a literary character he was not altogether unlike Thomas Carlyle. He had no system, hardly any tendency. His soul was a deep sea of sentiment, wonderfully pure, but sometimes violently agitated; and now and then he burst out in self-contradictions which astonished the systematic intellect and offended party passion, but behind which were subsequently found the sublimest manifestations of his genius. D. at Copenhagen May 11, 1862. CLEMENS PETERSEN.

Pe'tersham, p.-v. and tp., Worcester co., Mass., noted as the scene of the battle in which the insurrection under Daniel Shays was suppressed by Gen. Benjamin Lincoln, Feb. 4, 1787. P. 1335.

Pe'terson, p.-v., Clay tp., cap. of Clay co., Ia., on Little Sioux River. P. 44.

Peterson, tp., Emmet co., Ia., on W. fork of Des Moines River. P. 153.

Peter's Pence, or **Romescot,** an ancient tax for the benefit of the pope, perhaps first levied as a voluntary tribute from the Anglo-Saxon princes of England to the successor of St. Peter, or more probably at first as a tax for the support of the English school at Rome. (See

Lappenberg's *History of England under the Normans.*) Peter's Pence was paid the pope, with some interruptions, until 1534, when, during the reign of Henry VIII., it was finally abolished. The levy of Peter's Pence was attempted in various other countries at different times. In 1848 the attempt was made to renew the contribution of Peter's Pence in every part of the Church, and since that time the pope has derived a good part of his revenue from this source.

Peter's, St., Church, at Rome, the largest cathedral in the world, consists of a Latin cross 613 feet long and 450 feet across the transept, surmounted by a dome which rises 434¾ feet above the pavement with a diameter of 195½ feet. The façade is 368 feet long and 145 feet high. The building was commenced under Pope Nicholas V., after a plan by Rosselini, in 1450, but the work was neglected for nearly half a century. Under Julius II., Bramante prepared a new plan, which was subsequently followed out in the main. Raphael had charge of the building for some time. Michael Angelo designed the dome and nearly completed its erection. The façade is by Carlo Maderno, the colonnade by Bernini. The church was consecrated by Urban VIII. Nov. 18, 1626, the 1300th anniversary of the day on which St. Sylvester consecrated the basilica which originally occupied the site, and which was built by Constantine the Great on the spot where, according to the tradition of the Roman Catholics, the apostle Peter, whose remains rest under the high altar, suffered martyrdom.

Pe'tersville, p.-v. and tp., Frederick co., Md., on Potomac River. P. 159; of tp. 2574.

Peterwar'dein, town of Austria, the cap. of the Slavono-Servian military frontier, on the Danube, is one of the strongest fortresses of the Austrian empire, with barracks to accommodate 10,000 men. The town itself is insignificant, and has hardly 4000 inhabitants.

Peth'erick (John), a British traveller in Africa; entered the service of the viceroy of Egypt, Mehemet Ali, as a mining engineer 1845; went to Kordofan 1847; became a merchant at Khartoom on the death of the viceroy; received the appointment of British consul at that place, and made extensive explorations of the Upper Nile, of which he gave an account in his work entitled *Egypt, the Soudan, and Central Africa, with Explorations from Khartoom on the White Nile to the Regions of the Equator* (1861).

Petic', or **Pitic,** town of the Mexican confederation, in the state of Sonora, on the river Sonora, near the place where it becomes lost in the sand. Since the exhaustion of the gold-mines it has begun to decline, but it is still an important place, as situated at the entrance into an exceedingly fertile and densely-peopled valley which stretches along the Sonora, and produces wheat, wine, and fruit in large quantities. P. about 14,000.

Pet'igru (James Louis), b. in Abbeville co., S. C., May 10, 1789; graduated at Columbia College, S. C., in 1809; admitted to the bar in 1812; went to Charleston, S. C., and became attorney-general of the State, though he was a very decided adherent to the principles of the Federal party under the elder Adams, in opposition to those taught by the disciples of the school of Mr. Jefferson, which then constituted the general creed of South Carolina. In the days of nullification he was the acknowledged leader of the Union party in the State. But he stood almost solitary and alone of all the men of wealth, position, and high reputation in the State, and with firmness, earnestness, and eloquence opposed the doctrines put forth at that time by Hayne, Hamilton, McDuffie, and Calhoun. In 1860 also he was strongly opposed to the doctrine of secession, but yielded a quiet obedience to the ordinances and laws of his State. The great work of his life was the codification of the laws of South Carolina. This high trust had been confided to him by the legislature notwithstanding his well-known political principles. During the first year of the war he devoted himself almost exclusively to the completion of this work, and he survived his labors on it only a short time. The codification was finished in the fall of 1862. D. in Charleston Mar. 9, 1863. A biographical sketch, by W. J. Grayson, was published in New York in 1866. A. H. Stephens.

Peti'lia [*Policastro*], town of Southern Italy, province of Catanzaro, situated on a hill surrounded by a most fertile country, about 11 miles from the Ionian Sea. Its only remarkable building is the palace of the archbishop of Salerno, who passes his summers here. P. in 1874, 5500.

Pétion' (Anne Alexandre **Sabès**), b. at Port-au-Prince, Hayti, Apr. 2, 1770, was a quadroon, the son of a free mulatto woman by M. Sabès, a wealthy planter; was educated in the military school at Paris; entered the French army; joined the Haytian rebellion, and strove to restrain excesses and to protect the whites of the island. In 1799 he abandoned the cause of Toussaint, whose extreme measures he deplored, and for a time served against him under Rigaud; re-entered the French service as colonel, serving in Hayti, but the cruelties of Leclerc led him in 1802 to head a new revolt against the French. He finally became the leader of the mulatto party against the blacks, who were headed by Christophe, and in 1807, Pétion was declared president of Hayti. Involved in frequent wars with Christophe, and impeded in the execution of his patriotic plans by the almost savage condition of his people, Pétion became insane, and starved himself to death. D. at Port-au-Prince Mar. 29, 1818. He was a man of amiable and philanthropic character and of engaging manners, but was deficient in that firmness and energy required by the circumstances in which he was placed.

Pétion' de Villeneuve' (Jérôme), b. at Chartres, department of Eure-et-Loir, in 1753; studied jurisprudence and practised law in his native city, when in 1789 he was elected a deputy of the States General. He showed himself a thorough republican and a fierce adversary of the court; belonged first to the party of the duke of Orleans, then to that of Robespierre; became a prominent member of the Jacobin Club, and was chosen mayor of the city of Paris Nov. 18, 1791. In this position he at first connived at, perhaps even instigated, the risings of the Parisian mob, but as the Revolution developed he became frightened, separated from the Terrorists, and sided with the Girondists. His popularity was immediately gone, and when he voted for the death of the king on condition of an appeal to the people, he became suspected as a royalist and accomplice of Dumouriez. On June 2, 1793, he was arrested, but escaped, and assembled with the other Girondists at Caen. After the defeat of their army he wandered for some time in the neighborhood of Bordeaux, where his corpse was found, together with that of Buzot, in July, 1793, in a cornfield, half eaten by wolves. His *Œuvres* were published at Paris in 4 vols. (1793), and consist of political speeches and pamphlets. His *Mémoires* were published by Dauban at Paris (1866).

Peti'tion [Lat. *petitio*], a representation of a grievance for which the ordinary judiciary courts can give no redress, accompanied with a supplication for the relief by legislation of said grievance, addressed to an authority capable of granting it. In all free countries the right of petition—that is, the right of the citizen to address petitions to the legislative power of the government—is considered a most valuable right. In the English constitution it is of old standing, and in all younger liberal constitutions it has been claimed most emphatically by the citizens and defined with the greatest precision by the government.

Petition of Right, a celebrated English statute passed early in the reign of Charles I. (3 Car. I. c. 1, A. D. 1627) for the purpose of restraining and limiting the acts and prerogatives of the Crown, and securing the personal and civil liberties of the subject. Although a legislative act, yet, as it does not profess to establish any new rule, but simply to reaffirm those already in existence, it is in the form of a petition, and is entitled, "The Petition exhibited to His Majesty by the Lords and Commons, etc. concerning divers rights and liberties of the subjects, with the King's Majesty's royal answer thereto in full Parliament." After reciting the most important provision of Magna Charta and certain old statutes passed in the reigns of Edward I. and Edward III., which prohibited unlawful taxes and assessments, and forced loans, and illegal arrests and imprisonments, and quartering of soldiers upon private citizens, and a resort to martial law in civil cases; and after reciting in detail the various acts done by or in the name of the king which violated all of these prohibitions—viz. his unwarrantable levies of taxes, his forced loans, his arbitrary arrests and imprisonments, his quartering of soldiers in private houses, and his commissions authorizing the use of martial law—the Parliament prays that all these acts and proceedings should be discontinued and not repeated, recapitulating the violations of law above mentioned in detail, and concluding in the following language: "That you would be pleased to declare your royal will and pleasure that in the things aforesaid all your officers and ministers shall serve you according to the laws and statutes of this realm, as they tender the honor of Your Majesty and the prosperity of this kingdom." The king's assent, given in full Parliament, is indicated by the formula, "*Soit droit fait come est desiré*" ("Let right be done as prayed"). This declaration of the legislature, together with Magna Charta, the Bill of Rights, the Habeas Corpus act, and the Act of Settlement, is justly considered as forming one of the fundamental and constitutional guaranties by which civil and political liberty is secured to the British people. Although it does not contain in express terms the statement of broad principles, but rather deals with particular instances of executive wrongdoing,

yet it is always regarded as actually including and establishing the principles of personal right and liberty in the most comprehensive manner.

The term is also applied to a common-law proceeding by which a subject sought to establish his title to, and recover possession of, real or personal property in the possession and under the control of the Crown. As the king is not liable to be sued in the ordinary manner, a petition setting forth the facts of the case and praying for the proper relief is presented to him; upon this he endorses the words, "*Soit droit fait al partie*" ("Let right be done to the party"), and delivers it to the law-officers of the Crown. The subsequent proceedings resemble those in an ordinary action; the issues are tried before a court, and judgment is rendered for or against the petitioner, as the case may be. JOHN NORTON POMEROY.

Petitcodiac, p.-v. of Westmoreland co., N. B., on European and North American Railway, has 1 weekly newspaper. P. about 400.

Petit Jean, tp., Perry co., Ark. P. 228.

Petitot′ (LOUIS MESSIDOR LEBON), b. at Paris June 23, 1794; studied sculpture under his father at the Academy of Paris and in Rome. D. in Paris June 1, 1862. His most prominent works are *Ulysses visiting Alcinous* (1821) and *The Pilgrim* (1847), which latter was placed in the garden of the Luxembourg in 1874.

Petit-Thouars. See DUPETIT-THOUARS.

Pe′to (Sir SAMUEL MORTON), BART., b. at Woking, Surrey, England, Aug. 4, 1809; became partner in a wealthy building firm, and afterwards engaged extensively in the work of railroad construction in Great Britain, on the Continent, in Africa, Canada, and other regions; was made a baronet in 1855 for patriotic services in the Crimea; was several years in Parliament, and was distinguished for his large charities; is one of the leading Baptists of London. In 1868 his firm failed with $35,000,000 liabilities. Author of a work on *Taxation* (1863) and another on the *Resources of America* (1866).

Pet′öfi (SÁNDOR), b. at Kun-Szent-Miklos, in Little Cumania, Hungary, in humble circumstances; was baptized at Kisköros Jan. 1, 1823, and received a very poor education, growing up as a private soldier and as a strolling actor. Nevertheless, as early as 1843 his numerous songs, published in newspapers and periodicals, had attracted so much attention that he was enabled to take a place in the young literature whose brightest ornament he soon became. In 1848 it was he and his song, "Now or Never," which gave the first impulse to the Hungarian rising. In the following year he fought in the army as aide-de-camp to Gen. Bem, and in the encounter at Szegésvár, July 31, 1849, he fell, or rather disappeared. Between 1843 and 1849 he published a drama, *Tiger and Hyæna*, a translation of Shakspeare's *Coriolanus*, a comic and a serious epic, which latter, *János*, became the national epic of the Hungarians, a large romance, and several short tales or novels—all of which bear the stamp of an original genius of high rank—and at the same time he continued to pour forth his stirring songs, which belong to the most excellent specimens of lyrical poetry. There are many translations of his works into German; several of his poems have been translated into English by Bowring (London, 1866).

Pe′tra [Gr. Πέτρα, "rock"], the Selah of 2 Kings xiv. 7, taken from the Edomites by Amaziah (839–810 B. C.), in the hands of the Moabites about 700 B. C., and the capital of the Nabathæans (descendants of Nebaioth, the eldest son of Ishmael) about 300 B. C., when the Greeks first knew it as Petra. During the reign of Trajan (in 105 A. D.) it was conquered by the Romans, is mentioned several times by Eusebius and Jerome as an ecclesiastical metropolis, but is not heard of after about 536 A. D. Whether destroyed by the Mohammedans in the seventh century, or previously by the hordes of the desert, is not known. Its identification, suggested by Ritter on the basis of facts gathered by Seetzen in 1807, was established by Burckhardt in 1812. A good description of the ruins may be found in Robinson's *Biblical Researches* (1841), as also in Porter's *Handbook for Syria and Palestine* (1875). The present name of the little valley is *Wady Musa*, about 28 hours N. E. of Akabah, the E. head of the Red Sea. The city, shut in by cliffs from 150 to 300 feet high, occupied an area of about half a mile square. A stream still flows through the valley. The ruins of tombs, a theatre, and perhaps a temple are exceedingly picturesque.
R. D. HITCHCOCK.

Petra′lia Sopra′na, town of Sicily, province of Palermo, 22 miles from Cefalù. It stands on a very high hill, and contains pictures and other works of art. P. in 1874, 6600.

Petra′lia Sotta′na [anc. *Petrapolis*], town of Sicily, province of Palermo, very near Petralia Soprana, though on a lower spur of the Madonie. It is still nearly 3000 feet above the sea-level. The churches are interesting—some of them very old, others containing good pictures. The town is well supplied with charitable institutions and is increasing in prosperity. About 3 miles N. of Petralia on one of the highest crests of the chain, 4000 feet above the sea, stands the Santuario della Madonna dell' Alto, erected in 1328. P. in 1874, 7374.

Pe′trarch [It. *Petrarca*], (FRANCESCO), b. at Arezzo July 20, 1304, of an exiled Florentine family; educated at Pisa 1312, Avignon 1313, and Carpentras 1315, and studied law at Montpellier 1319–23, and Bologna 1323–26, but returned after the death of his father to Avignon, and devoted himself exclusively to literary pursuits, to poetry, and the study of the Latin authors. From 1327 to 1353 his residence was principally at Avignon and in the neighboring valley of Vaucluse, though he made numerous journeys in Spain, France, Germany, and Italy, both for literary purposes and on diplomatic missions. In 1353 he returned to Italy, where he resided first at Venice to 1370, and then at Arqua, near Padua, where he d. July 18, 1374. But long before he left Avignon he had acquired great fame as the first poet and scholar of the age. Apr. 18, 1341, he was crowned as *poeta laureatus* at the Capitol in Rome; and that movement in European civilization which is characterized as the revival of letters received one of its noblest and most powerful impulses from Petrarch. He was a zealous collector of manuscripts, and the preservation of several interesting classical works, such as Cicero's letters and Quintilian's book, is due to him. He copied several manuscripts with his own hand, and he was evidently as passionate and enthusiastic in his studies as in his writings; he was found dead in his library with his head gently bent over the book. But it is a curious fact that of his poetical works those which made him famous in his own time are now hardly known at all, while those which have brought his name down to our time, and still charm the world, were treated with comparatively little respect by himself and his friends. He wrote both Latin and Italian poetry; all his prose writings are in Latin. But it was his *Africa*, a Latin epic on the Punic war, which procured for him the laurel crown, while it is his *Rime*, his sonnets to Laura, which in our time make him admired as one of the greatest lyric poets that ever lived. His Latin works appeared at Bâle in 1496, and again in 1581. His Italian poems were published at Venice in 1470, and have subsequently passed through a great number of editions. Biographies, reviews, and sketches concerning his writings and life, especially concerning his relation to Laura, are also very numerous. The most prominent are—Jacques de Sade, *Mémoires pour la Vie de Pétrarque* (Amsterdam, 3 vols., 1767); Ugo Foscolo, *Essay on Petrarch* (London, 1825); Thomas Campbell, *Life of Petrarch* (2 vols., 1841); Alfred Mézières, *Pétrarque, Étude après de Nouveaux Documents* (1857); Ludwig Geiger, *Petrarka* (Leipsic, 1874).

Pet′rel [from *Peter*, because they were believed to walk, like St. Peter, on the waves], a name applied to various species of the family Procellariidæ, and to some extent conflicting with the names fulmar and Mother Carey's Chickens. (See PROCELLARIIDÆ.)

Pe′trie (GEORGE), LL.D., b. at Dublin, Ireland, in 1790, son of a portrait-painter; became early noted for his skill as a draughtsman in water-colors; was employed to illustrate many works of travel or topography; obtained an intimate knowledge of the archæology of Ireland; became librarian of the Royal Hibernian Academy 1830; was associate editor of the *Dublin Penny Journal* (1832–33); founded the *Irish Penny Journal* (1842); originated the fine museum and library of the Royal Irish Academy, for which he collected more than 400 volumes of Irish MS. documents; took an active part in the ordnance survey of Ireland 1833–46 as director of its historical and antiquarian sections; was secretary, and afterwards president, of the Royal Irish Academy; procured the autograph originals of the *Annals of the Four Masters*; published in 1832 a prize essay on *The Round Towers of Ireland*, expanded in 1845 into *The Ecclesiastical Architecture of Ireland*; and was author of many other antiquarian publications. D. at Dublin Jan. 18, 1866.

Petrifactions. See PALÆONTOLOGY.

Petro′leum, Naphtha, Mineral Oil, Kerosene, Coal Oil, Shale Oil, Photogen, Solar Oil, etc. The word "petroleum" is from πέτρος, "rock," and *oleum*, "oil" (the latter from the Greek ἔλαιον, "oil"), dating only from the Middle Ages. "Naphtha" is from the Persian *nafata*, to "exude." Petroleum is an inflammable

liquid which exudes from the earth in various parts of the world.

History.—Although petroleum has been known from time immemorial, and has been collected in considerable quantities in various parts of the world for ages, it was not until American enterprise in 1859 successfully bored an artesian well for the express purpose of procuring oil from the rocky strata below, that this cheap and beautiful illuminating oil became an important article of commerce. The previous introduction of an oil very similar to petroleum in composition, but which was obtained by the destructive distillation of various bituminous substances, such as cannel coals, asphalts, and shales, had paved the way for petroleum, which came in at once as a cheaper and purer substitute for the artificial oils. In this country, at least, the manufacture of coal and shale oil is a thing of the past. It is impossible to go back to the time when petroleum was first discovered; its occurrence in abundance in the form of springs of oil in many localities makes it evident that it has always been known—certainly more than 4000 years. The earliest evidence of the use of petroleum is found in the ruins of Nineveh and Babylon. In building both of those cities an asphaltic mortar ("slime" of the Old Testament) was employed, the asphalt for which was a partially evaporated petroleum. That used at Babylon was obtained from the springs of Is, on the Euphrates, which at a later date attracted the attention of Alexander, of Trajan, and of Julian; they even to this day supply the neighboring villages with oil. Herodotus, 500 years before Christ, spoke of the oil-wells of Zante; and Pliny and Dioscorides described the oil of Agrigentum, which was used in lamps under the name of "Sicilian oil." In one of the Ionian Islands there is a spring which has yielded petroleum more than 2000 years. The wells of Amiano, on the banks of the Taro, formerly supplied oil for lighting the city of Genoa. In Persia, near the Caspian Sea at Baku, numerous springs of petroleum have been known from the earliest times. The springs of Rangoon, on the Irrawaddi, have been worked for ages; before the general introduction of petroleum among civilized nations the yield of the wells in this district is said to have been 400,000 hogsheads of oil per annum. The perpetual fires burned at pagan shrines are supposed to have been caused by springs of petroleum, ignited at the surface. The American Indians collected petroleum, which was sold for various purposes under the name of Seneca oil. But it seems probable now that, before the Indians, the race of people who worked the copper deposits of Lake Superior and lead ores of Lexington, Ky., and built the mounds in the Western States, also dug numerous wells in Pennsylvania, Ohio, and Canada to collect the oil which flowed into them. These wells are known, from the trees now growing upon the earth thrown out in making them or growing in the wells themselves, to be from 500 to 1000 years old. One of these, at Titusville, was found after it was cleared out to have been 27 feet deep and 5 or 6 feet in diameter, and to be cribbed up with logs to the top. In another a notched tree was found still standing in the position in which it had been used as a ladder. In 1819 oil was accidentally obtained in boring two salt-wells on Muskingum River, O. It was used to a limited extent in workshops in the neighborhood, but did not prove a satisfactory substitute for the animal and vegetable oils in use, as the lamps suitable for burning it had not yet been invented. The oil was considered a great evil on account of its interference with the manufacture of good salt. In 1829 a flowing well was accidentally obtained at Burkesville, Ky., and for two or three weeks the oil flowed over the surface of Cumberland River, and, becoming ignited, caused some apprehension of a general conflagration among the inhabitants of the towns and villages lower down on the river. As early as 1836 from 50 to 100 barrels of petroleum were collected annually in the valley of the Kanawha and sold as a medicine.

It was not, however, till oil from coal and shale had been successfully introduced, with lamps specially adapted for this class of oils, that attention was directed to the petroleum springs as likely to furnish a cheap supply of material. From the time of Eele, Hancock, and Portlock, who in 1694 made "pitch, tar, and oils" of a kind of stone, various persons have made investigations in coal and shale oil. Selligue in France was the first to manufacture an oil (shale oil) on a large scale and introduce it for lighting. He began his experiments as early as 1834, erecting three factories. He manufactured in the six years between 1838 and 1843 about 15,000 barrels (40 gallons each) of shale oil. Still, the industry did not extend. Abraham Gesner made oil from coal in Prince Edward's Island in 1846, and obtained patents which were sold to the New York Kerosene Co. In 1850, James Young of Glasgow, Scotland, introduced paraffine oils, made from the Torbane Hill mineral, commonly called *boghead coal.* This industry was very profitable and rapidly extended. It was introduced into Germany, the material being either the boghead coal from Scotland or the bituminous shales which abounded in the country.

In the U. S., as early as 1850, Luther Atwood experimented on this class of oils, and succeeded in perfecting his "coup oil," made from coal-tar. This was manufactured as a lubricating oil in considerable quantities by Samuel Downer of Boston. The first factory established in the U. S. was that of the Kerosene Oil Co., built at Newtown Creek in 1854. In 1855 or 1856 the Breckenridge coal of Kentucky was used as a material for making oil. Trinidad pitch, chapopoti from Cuba, candle-tar, menhaden oil, and various other materials were used for making this oil, but it was found to be more economical to import the boghead coal from Scotland than to use the cheaper but poorer materials found in this country. The only exception to this statement is the albertite of Nova Scotia, which yielded larger quantities of oil than any other material; this was, however, monopolized by a single company. The grahamite of West Virginia was also used to a limited extent. The industry rapidly expanded, and on Jan. 1, 1860, there were 40 coal-oil factories on the Atlantic border, all of which used the Scotch boghead coal, with the exception of two, where albertite was employed. The total yield of the works amounted to 500 barrels per day, or 200,000 barrels per annum. Besides these there were 25 factories in Ohio. This industry was doomed to be very short-lived in the U. S., although it still flourishes in Europe, for the wells of Pennsylvania in 1860 yielded 650,000 barrels of petroleum; in 1861, 2,000,000; and in 1862, 3,000,000 barrels. Not only were the coal-oil works at once changed to petroleum refineries, but new refineries were erected all over the country. In 1854 the Pennsylvania Rock Oil Co. had been formed for the purpose of collecting oil at Oil Creek, Pa., but collecting the oil from the surface of ditches with blankets and squeezing it into tubs was found too expensive a process to compete with the coal-oil manufacture. The elaborate report of Prof. B. Silliman, Jr., on the petroleum of Venango co., made to this company in Apr., 1855, is extremely interesting, especially now that the industry has grown to such magnitude and importance. It was reprinted in full in the *American Chemist* (vol. ii., p. 18, July, 1871).

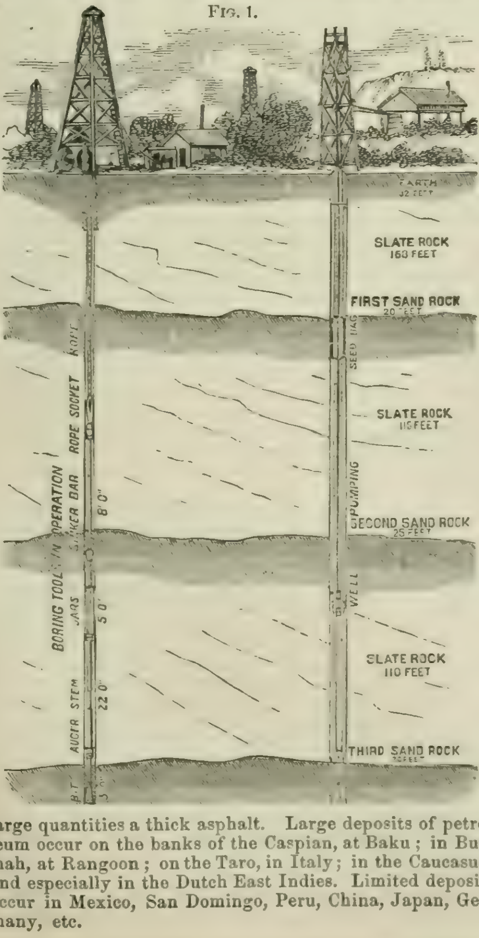
In 1858, however, Col. G. L. Drake, the superintendent of the company, began to bore, on Oil Creek, Venango co., Pa., an artesian well for oil, much to the amusement of his friends and neighbors, who considered the project most absurd. When, however, on Aug. 28, 1859, he "struck oil" at a depth of 71 feet, and obtained 400 gallons of oil a day, which sold for 55 cents per gallon, there was a great excitement. Every one who could leave his home rushed to the oil-region, a forest of derricks soon appeared in the valley, and numerous wells were bored. Wells were also bored in West Virginia, Ohio, etc. No mining enterprise had ever offered such sudden fortunes. A well costing a few thousand dollars might yield, if successful, from 100 to 2000 barrels of oil daily, with no expense for pumping. The Noble well yielded, in a little more than one year, 500,000 barrels of oil. The Sherman flowed 450,000 barrels in about two years. The poor farmers on Oil Creek, who could not previously have realized more than a few dollars per acre, suddenly found themselves wealthy. Single farms brought their owners from $500,000 to $1,000,000, with, in some cases, a royalty on the wells in addition. One man received $3000 per day royalty from the wells on his farm, and thus accumulated $600,000, all of which was soon squandered. After a time, however, the novelty of the oil-wells wore off somewhat, and a steady, permanent industry was established. As wells failed new ones were bored to take their place. In some cases old wells were made to renew their yield by the explosion in them of torpedoes charged with nitro-glycerine.

When the petroleum of Southern California first attracted attention, it was thought that the deposit would far exceed in quantity that of Pennsylvania. Before the wells were bored on Oil Creek there was very little oil to be seen; here and there a little scum on the pools of water was the only indication of oil. Prof. Silliman went to California for the purpose of exploring the oil-district. He was familiar from its very inception with the development of the oil industry of Pennsylvania. He was the first to investigate the nature and properties of the raw material as first found in the trenches and shallow pits of Oil Creek, as we have already shown, and he knew how trifling were the surface-indications which in Pennsylvania had led to such surprising discoveries by artesian borings. When, therefore, he saw the remarkable extent and accumulation of the heavy hydrocarbons in Santa Barbara co., Cal.—phenomena which have struck all observers with

wonder—and found that the thin oil which oozed from the broken and upturned edges of the rocks was soon converted into pools of tough maltha, in which cattle and even wild animals were mired to their destruction, it certainly required no effort of the imagination to infer that explorations by boring, if judiciously undertaken and pushed, would become fruitful in wells from which an ample supply of thin oil might be expected. A few artesian borings were made, but it appears that this research was not wisely conducted. Several tunnels run into the hills across the broken and upturned strata of Tertiary rocks were, however, fruitful of considerable quantities of oil of a quality which warranted its manufacture, and for a time excellent oil of California manufacture was produced and sold in San Francisco in successful competition with the Pennsylvania petroleum. But the price of the raw material fell at the Pennsylvania wells from \$8, and even \$12, per barrel (40 gallons) in 1863, to a merely nominal price in 1865; and this fact, taken in consideration with the high price of labor in California, the absence of casks and of means of transportation, rendered these explorations unprofitable, and has suspended indefinitely the time when the oil-producing regions of California can be successfully developed. Subsequent research demonstrated that the California oil does not belong to the same class as the Pennsylvania petroleum; that it is devoid of the lighter naphthas and yields no paraffine; that the burning oil made from it has a higher density than the Pennsylvania kerosene, but is an excellent illuminant. Prof. Silliman also demonstrated by later researches that even the densest malthas of the surface-pools of California are capable of being *cracked* into light naphthas, burning oil, and heavy oil, but without developing any paraffine.

Geographical Distribution.—By far the most extensive deposits of petroleum occur in the N. W. corner of Pennsylvania, on and near Oil Creek. This locality furnishes more than three-fourths of all the petroleum of commerce. Other districts are the Mecca, Grafton, Vermilion, and Mapen Valley in Ohio; Smith's Ferry, on the boundary between Ohio, West Virginia, and Pennsylvania; Parkersburg, West Va.; Glasgow and Burkesville, Ky.; Enniskillen and Gaspé, Canada; Santa Barbara and Humboldt cos. in California. The island of Trinidad furnishes in

Fig. 1.



large quantities a thick asphalt. Large deposits of petroleum occur on the banks of the Caspian, at Baku; in Burmah, at Rangoon; on the Taro, in Italy; in the Caucasus; and especially in the Dutch East Indies. Limited deposits occur in Mexico, San Domingo, Peru, China, Japan, Germany, etc.

Geological Position.—Petroleum occurs in rocks of nearly all geological ages, from the Lower Silurian to the present epoch. It is associated with shales and sandstones, and often permeates limestones. It often collects in cavities along gentle anticlinals, whence it issues in jets when an outlet is made by boring. (1) Lower Silurian petroleum is found at Manitoulin in Hudson and Utica shales, and at Burkesville, Ky., in Trenton limestone. (2) The Devonian rocks furnish the great supplies of petroleum at present, the Oil Creek wells being in the Portage and Chemung deposits. The oil of Vermilion, O., and of Enniskillen and Gaspé, Canada, are also Devonian. (3) Lower Carboniferous oil occurs at Mecca, Mapen Valley, and Grafton, O., and at Glasgow, Ky. (4) The coal-measures yield oil at Parkersburg in West Virginia and S. E. Ohio, and at Smith's Ferry in Pennsylvania and Ohio. (5) Oil is found in the Triassic formation of North Carolina. (6) Tertiary deposits yield oil in Los Angeles and Santa Barbara cos., and Humboldt Bay, Cal., in Italy, Trinidad, and on the Caspian. (See PETROLEUM, GEOLOGY OF, by PROF. J. S. NEWBERRY.)

Oil-wells are drilled to the proper depth with the aid of the derrick and the same drilling-tools which are used in boring for water. (See ARTESIAN WELLS.) Often a cavity is struck by the drill which may deliver gas, oil, or water first, according as it was penetrated at the upper, middle, or lower part. In some instances the well is a flowing one, but in most cases the oil must be pumped. It is received in large wrought-iron tanks, which are often sunk in the ground and covered with gravel to diminish the danger from fire. The oil is then transported to the refiner's in barrels, glued to make them tight, in tank-barges, tank-cars, or through lines of iron pipe laid underground, often for miles, by the pipe companies. In California the side-hill was tunneled to reach the oil.

The properties of petroleum vary at different localities. Pennsylvania petroleum is generally of a dark greenish-brown color; thin, of a somewhat offensive odor, varying in specific gravity from 0.820 to 0.782, or from 40° to 48° Baumé. Oils, differing from that which occurs so abundantly at Oil Creek, Pa., are obtained in more limited quantities at various localities, some of which are given in the following table:

Locality.	Gravity, Baumé.	Color.
Oil Creek, Pa	43 to 47°	Greenish-brown.
Pit Hole Creek, Pa	49 to 57°	"
Allegheny River, Pa	34 to 39°	"
French Creek, Pa	28 to 31°	"
Burning Spring, West Va	42 to 43°	
Enniskillen, Canada	42 to 43°	Blackish-brown.
Mecca, O	26 to 28°	Yellow.
Amiano, Italy	25 to 50°	Red to straw.

The oil passes by insensible gradations into thick maltha, and then into semi-solid or solid asphalt, which is an oxidized compound.

Composition.—Petroleum is a mixture of a great number of hydrocarbons, compounds of carbon and hydrogen, the average proportion of the two elements in the mixture being—

Carbon	85
Hydrogen	15
	100

These hydrocarbons differ from each other in volatility. Some are so volatile as to evaporate rapidly at ordinary temperatures, making it dangerous to approach an open tank of petroleum with a flame; others are much less volatile, some requiring a temperature of 700° to 800° F. to vaporize them. The volatility of these component hydrocarbons is intimately related to their specific gravity or weight, the lightest ones being the most volatile, while the heavier oils possess the higher boiling-points. The inflammability of the oils is also intimately connected with their volatility and specific gravity. The light volatile oils ignite on the approach of a burning match, no matter how cold they may be, while the heavy, less volatile oils can only be ignited when they are heated above the ordinary temperature of the air. The lighter oils in petroleum belong mostly to the group of hydrocarbons known as the hydrides of the alcohol radicals, paraffines, or marsh-gas series; the heavier oils are believed to belong to the olefines, or ethylene series. Neither of the groups has been fully studied, and the exact constitution of the heavier portions of petroleum has yet to be determined. Table I. shows the composition, boiling-points, and gravities of some of the members of the first group, or marsh-gas series. Table II. shows the composition, boiling-points, and gravities of the members of the olefine or ethylene series. The first or lowest members of each series are gases at ordinary temperatures; the intermediate members, liquids; the highest members, solids.

I. *The Paraffines, or Marsh-gas Series of Hydrocarbons.*

Names.	Formulæ, C_nH_{2n+2}	Carbon.	Hydrogen.	Boiling-points.	Specific gravity.	Density, Baumé.
Methane, m'sh-gas.	CH_4	75.00	25.00	A gas.		
Ethane	C_2H_6	80.00	20.00	A gas.		
Propane	C_3H_8	81.81	18.19	A gas.		
Butane, quartane	C_4H_{10}	82.80	17.20	34° F.	0.600	106°
Quintane	C_5H_{12}	83.33	16.67	86°	0.628	98°
Hexane	C_6H_{14}	83.72	16.28	154°	0.669	86.5°
Heptane	C_7H_{16}	84.00	16.00	200°	0.699	72°
Octane	C_8H_{18}	84.21	15.79	242°	0.726	64.5°
Nonane	C_9H_{20}	84.38	15.62	278°	0.741	60.5°
Decane	$C_{10}H_{22}$	84.51	15.49	321°	0.757	56.5°
Endecane	$C_{11}H_{24}$	84.61	15.39	360°	0.765	54.5°
Dodecane	$C_{12}H_{26}$	84.70	15.30	388°	0.776	52.5°
Tridecane	$C_{13}H_{28}$	84.78	15.22	422°	0.792	48°
Tetradecane	$C_{14}H_{30}$	84.85	15.15	460°		
Pentadecane	$C_{15}H_{32}$	84.90	15.10	496°		
	* *					
	$C_{18}H_{38}$	85.04	14.96			
	* *					
	$C_{20}H_{42}$	85.11	14.89			
	* *					
	$C_{23}H_{48}$	85.18	14.82			
	* *					
	$C_{25}H_{52}$	85.23	14.77			
	* *					
Paraffine	$C_{27}H_{56}$	85.26	14.74	Solid.	......	31.5°
	* *					
Paraffine	$C_{30}H_{62}$	85.31	14.69	698°F.		

II. *The Olefines, or Ethylene Series of Hydrocarbons.*

Composition: carbon, 85.71 per cent.; hydrogen, 14.29 per cent.

Names.	Formulæ.	Boiling-points.	Specific gravity.	Density, Baumé.
Ethylene	C_2H_4	Gas.		
Propylene	C_3H_6	0° F.		
Butylene	C_4H_8	37.4°		
Amylene	C_5H_{10}	95.°		
Hexylene	C_6H_{12}	156.°		
Heptylene	C_7H_{14}	203.°		
Octylene	C_8H_{16}	240.°		
Nonylene	C_9H_{18}	284°		
Dicatylene	$C_{10}H_{20}$	343°		
Endecatylene	$C_{11}H_{22}$	384°	.782	50.°
Dodecatylene	$C_{12}H_{24}$	321°		
Decatriylene	$C_{13}H_{26}$	455°	.791	48.°
	* *			
Cetene	$C_{16}H_{32}$	527°		
	* *			
	$C_{20}H_{40}$			
	* *			
Cerotene	$C_{27}H_{54}$	......	Solid.	Solid.
	* *			
Melene	$C_{30}H_{60}$	707°	Solid.	Solid.

Pelouze and Cahours think they find in petroleum members of the marsh-gas series as high as $C_{15}H_{32}$, and probably higher. Warren believes that this series terminates with C_9H_{20}, and that the oils of higher density and atomic numbers belong to the ethylene series. Warren found that there was a second isomeric marsh-gas series, which he called the beta-naphtha group. The boiling points of the members of this group are 8° C. higher than their isomeres.

The Beta-Naphtha Group.

Formulæ.	Boiling-point.	Gravity.
C_4H_{10}	8–9° C.	0.611
C_5H_{12}	37	0.645
C_6H_{14}	68.5	0.689
C_7H_{16}	98.1	0.730
C_8H_{18}	127.6	0.752

The benzol group of hydrocarbons is represented in some varieties of petroleum, the first three members in Rangoon tar, xylol in the petroleum of Schude in Hanover, and all the members in the petroleum of Boroslaw in Galicia. None of these have been found in Pennsylvania petroleum.

The Benzol or Aromatic Series of Hydrocarbons.

Name.	Formulæ.	Carbon.	Hydrogen.	Sp. gravity.	Boiling-point.
Benzol	C_6H_6	92.31	7.69	0.85	82° C.
Toluol	C_7H_8	91.30	8.70	0.88	111°
Xylol	C_8H_{10}	90.57	9.43	0.86	139°
Cumol	C_9H_{12}	90.00	10.00	0.87	148°
Cymol	$C_{10}H_{14}$	89.55	10.45	0.86	175°

Naphthalene, $C_{10}H_8$, has been observed in Rangoon tar.

Alteration of petroleum occurs in two ways: (1) by the evaporation of the lighter portions, by which the heavier, thicker constituents alone are left; (2) by oxidation, by which asphalts and bitumens are produced. Generally, both operations occur simultaneously, the various malthas, asphalts, albertite, grahamite, bitumen, etc., being the final results. (See article on the "Oxidation of Petroleum," by W. P. Jenney, *Amer. Chemist*, v. 359.) Besides these hydrocarbons there are always present small quantities of oxidized bodies, acids, bases, sulphur compounds, etc.

The origin of petroleum is generally attributed to the decomposition of vegetable and animal remains, diffused in a finely-divided condition in fine mud or clay. The theory which attributed petroleum to a process of distillation from coal, etc. is untenable, as there is no evidence of heat to be found in the oil-bearing strata. (See PETROLEUM, GEOLOGY OF, by PROF. J. S. NEWBERRY.)

Refining Petroleum.—The dark, offensive crude petroleum is subjected to a process of refining in order to separate from the portion designed for burning in lamps—(1) the lighter oils, naphthas, which are very inflammable, and, owing to their volatility, evolve vapors at ordinary temperatures, which, when mixed with the proper proportions of air, constitute explosive mixtures; (2) the heavier oils, which do not burn well in lamps, but are excellent lubricators. From these oils is obtained by chilling and pressing the solid paraffine, which is used for candles, for water-proofing cloth, etc. (see PARAFFINE); (3) the tarry matter, which would crust the wicks of the lamps; (4) the coloring-matters; (5) the compounds which cause the offensive odors of the crude oil.

Refining, as usually practised, involves three successive operations: (1) fractional distillation; (2) agitation with sulphuric acid; (3) agitation with hydrate of soda or ammonia. A few refiners improve the quality of their refined oil by redistilling it after the treatment with acid and alkali.

Fractional Distillation.—The apparatus employed consists of an iron still, connected with a coil or worm of wrought-iron pipe, which is submerged in a tank of water for the purpose of cooling it. When the still has been filled with crude oil the fire is lighted beneath it, and soon the oil begins to boil. The first products of distillation are gases; at ordinary temperatures they pass through the coil and escape without being condensed. Soon the vapors begin to condense in the worm, and a stream of oil trickles from the far end of the coil into the receiving-tank. The first oils obtained have a gravity of about 95° Baumé; as the distillation proceeds the product becomes heavier, 90° B., 85° B., 80° B., 75° B., 70° B., and so on. In most establishments it is customary to run the product into one tank till the gravity reaches 65° B. to 59° B.; the product, known as *crude naphtha*, being subsequently separated by redistillation into (1) *gasolene*, the lightest, condensed in worm by cold water, used in "air-gas machines" and gas "carbonizers;" (2) *naphtha*, for *oil-cloths*, cleaning, etc., so-called "safety oil," "Danforth's oil," "American safety gas," etc., for adulterating kerosene, cleaning oil-wells, etc.; (3) *benzine*, for paints and varnishes. By cooling the condensing-worm with ice and salt, the very volatile liquid "rhigolene" is obtained, which is used as an anæsthetic. By the use of a condensing-pump a still more volatile liquid, "cymogene," is obtained, which has been used in ice-machines. When the stream of oil runs from the coil with a gravity from 65° to 59° B., it is diverted into the *kerosene*-tank, and continues to run into this receiver till the gravity reaches about 38° B., or until the color deepens to a yellow. This second fraction is the burning oil or *kerosene*, and is subsequently purified by sulphuric acid and alkali. After taking off the burning oil the stream is directed to the *paraffine* oil tanks, and continues to run there till nothing remains in the still save coke. The last products have a gravity of about 25° B. This oil is chilled to crystallize the paraffine, and is then folded in cloths and exposed to pressure to squeeze out the oil. The solid paraffine is purified by repeatedly melting it in naphtha, chilling, and pressing; the oil separated from it is purified with sulphuric acid and alkali, and used for lubricating purposes. While this is a general outline of the process of distillation, it should be remarked that refiners differ in the details of the operation.

When very large stills are employed, of a capacity of from 1000 to 3500 barrels, the distillation is not continued till coke is formed, but is interrupted when there remains in the still a thick tarry residuum amounting to from 5 to 10 per cent. of the original oil. This residuum is afterward distilled to coke in smaller stills. By slow distillation in high stills the heavier oils are "cracked" into lighter oils, so that the refiner need not produce any heavy oil. In many of the largest establishments only three products are obtained from crude oil: (1) crude naphtha, (2) burning oil, (3) residuum. The *burning oil* is deodorized and bleached for market with sulphuric acid and alkali; the *crude naphtha* is sold for from 3 to 5 cents per gallon, and poured down the oil-wells, nominally *to clean them*, but practically to be sold to the refiner again in the crude oil, or it is sold to be redistilled for gasolene, refined naphtha, and benzine. The well-owners are many of them dishonest enough to pour the naphtha into the crude-oil tank. This adulteration averages 15 per cent. The residuum is sold to be distilled for paraffine and lubricating oil, or it is cracked in high stills, and the product put into the large stills with the crude oil. In this

case no lubricating oil or paraffine is manufactured. This is the practice at Cleveland and Pittsburg. Some redistill the last 10 per cent., the colored portions of the burning oil, with the crude oil. Some place the crude petroleum in large stills and blow steam through it, and thus take off the crude naphtha before the oil is run into the fire-still. Some manufacturers, who pride themselves upon the superior quality of their special brands of oil, separate certain portions of the distillate and send them to market as unusually safe oils. The "*astral oil*" is probably the oil which runs from about 54° to 44° B.; in other words, the "heart" of the burning oil. As it does not contain the lighter portions of the ordinary oil, its flashing-point is 125° F., or 25° above the standard of safety, although its average gravity is 49° B. The "mineral sperm" and "neutral lubricating oil," made by the Downer Kerosene Oil Co. under the patents of Joshua Merrill, are among the most remarkable products of petroleum. The "mineral sperm" is a heavy oil, which probably runs between 40° B. and 32° B., averaging 36° B., sp. gr. 0.847. This is so heavy (it boils at 425° F.), and requires so high a temperature to volatilize it, that it does not evolve an inflammable vapor below 262° F. nor take fire below 300° F. Practically, it is as safe as whale oil. "The neutral heavy lubricating oil" is made from the heavy paraffine oil which is distilled off last, after the burning oil. Owing to the cracking which takes place during the distillation the crude distillate contains a large percentage of light offensive oils, which are too thin for lubricators. These cannot be separated by ordinary distillation without producing a new quantity by cracking the heavier oils. Merrill found that by placing the crude distillate in a still, heating it to near boiling, and blowing superheated steam through it, he could remove all the light offensive oils without cracking, and leave in the still a neutral, odorless heavy oil from 26° to 29° Baumé, or sp. gr. 0.883, with a boiling-point of 575° F. Many hundred thousand gallons of this neutral heavy hydrocarbon oil, which has frequently perplexed the most expert judges and dealers in oils, have been made by Mr. Merrill. It is almost odorless and tasteless, and cannot be easily distinguished when mixed with one-fifth part of its volume of the best bleached animal, sperm, or other fat oil. No better estimate of its valuable qualities can be given than the statement that in the year 1871, 50,000 gallons of this oil were sent to England alone, where it was used for lubricating spindles, oiling wool, and other purposes.

Treatment with Acid.—After the oil has been fractioned it is subjected to the action of sulphuric acid to remove a little color, but more particularly to *sweeten* it—*i. e.* to remove the disagreeable odor which it still retains. About 2 per cent., by measure, of acid, is poured into the oil, the mixture is thoroughly agitated, and on standing a dark, tarry sediment separates; this is removed, and the clear oil is then agitated with water, then with alkali, either caustic soda or ammonia. This neutralizes the last traces of acid, and, after removal by water, leaves the oil "sweet." Some of the more careful refiners then subject it to a somewhat elevated temperature to expel a small percentage of naphtha or benzine which it still contains, while a few subject it to redistillation.

The following table will give a clear idea of the fractional distillation and its various products:

Products of the Distillation of Crude Petroleum.

	Limits of gravity, Baumé.	Average gravity, Baumé.	Sp. gr.	Boiling-point.
1. Gases, uncondensed....				
2. Cymogene..................	115° to 105°	110°	.600	32° F.
3. Rhigolene..................	105° to 95°	100°	.625	65°
4. Gasolene	95° to 80°	87°	.664	120°
5. Naphtha (refined).......	80° to 65°	73°	.700	175°
6. Benzine....................	65° to 60°	63°	.750	250°
7. Kerosene, burning oil.	60° to 38°	46°	.807	340°
8. Lubricating oil (com'n)	38° to 25°	30°	.885	425°
9. Paraffine	....	....	......	
Special Products, Downer Kerosene Oil Co.				
10. C, naphtha..............	....	70°	.706	180°
11. B, naphtha..............	....	67°	.724	220°
12. A, naphtha..............	....	65°	.742	300°
13. Mineral sperm oil........	....	36°	.847	425°
14. Neutral lubricating oil	....	29°	.883	575°

Prof. Henry Morton has discovered a very interesting solid hydrocarbon, *thallene*, in the last distillate of petroleum, which is a product of destructive distillation. It is probably $C_{14}H_{10}$. It is one of the most beautifully fluorescing bodies known.

The Yield of Different Products.—The yield of the different products from crude petroleum varies greatly in different refineries. The following is a fair average for Pennsylvania oil of about 45° B.:

Gasolene	1½
Refined naphtha..................	10
Benzine..................	4
Refined petroleum or kerosene..................	55
Lubricating oil..................	17½
Paraffine..................	2
Loss, gas, and coke	10
	100

By cracking, the same oil could be made to yield—

Crude naphtha	20
Burning oil..................	66
Coke and loss..................	14
	100

The following is the usual yield from the distillation of residuum in small stills for lubricating oil and paraffine; 30 barrels yield—

1. Light oil for gas,	35° B.,	2 bbls.	.... 6.50	per cent.
2. First run,	29° B.,	8 "	.... 26.50	"
3. Second run,	35° B.,	12 "	 40	"
4. Coke and gases..............			 27	"
		22 bbls.	100	per cent.

The first and second runs are treated with oil of vitriol and soda, chilled and pressed to separate the paraffine. The heavy petroleum of West Virginia and Ohio, varying from 32° B. to 27° B., is stored in tanks to settle out the gritty impurities, and then used directly as a lubricator, or is mixed with animal or vegetable oils. Sometimes it is filtered over charcoal to remove color. The same is true of the Tidioute oil, though some of it is mixed with "residuum" and "still bottoms," and fractioned into lubricating oil, etc.

The kerosene or burning oil is the most important product of petroleum. It is a mixture of many hydrocarbons. It has the consistency of the essential oils, a burning taste, and aromatic odor. When properly refined it is nearly colorless by transmitted light, and slightly fluorescent by reflected light. Its density should be about 43° B., or 0.810. At ordinary temperatures it should extinguish a match as readily as water. When heated it should not evolve an inflammable vapor below 110°, or, better, 120° F., and should not take fire below 125° to 140° F. As the temperature in a burning lamp rarely exceeds 100° F., such an oil would be safe. It would produce no vapors to mix with the air in the lamp and make an explosive mixture; and if the lamp should be overturned or broken, the oil would not take fire.

Why most of the Kerosene in the Market is unsafe.—The crude naphtha sells at from 2 to 5 cents per gallon, while the refined petroleum or kerosene sells for 20 to 25 cents. As great competition exists among the refiners, there is a strong inducement to turn the heavier portions of the naphtha into the kerosene-tank, so as to get for it the price of kerosene. They change the direction of the stream from the coil of the still when it reaches 65° to 63° B., instead of waiting till it reaches 58°. Thus the inflammable volatile naphtha or benzine is allowed to run into the kerosene, rendering the whole highly dangerous. Dr. D. B. White, president of the board of health of New Orleans, found that, experimenting on an oil which flashed at 113° F., an addition of

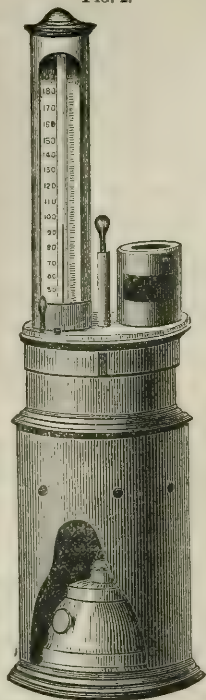
1	per cent. of	naphtha	caused it	to flash	at	103° F.
2	"	"	"	"	"	92°
5	"	"	"	"	"	83°
10	"	"	"	"	"	59°
20	"	"	"	"	"	40°

After the addition of 20 per cent. of naphtha the oil *burned* at 50° F. It is, therefore, the cupidity of the refiner that leads him to run as much benzine as possible into the kerosene, regardless of the frightful consequences which result from the frequent explosions. It must not be supposed that the specific gravity of the oil can be considered a safe index of its quality; on the contrary, the specific gravity gives very little idea of the quality, for while naphtha tends to render the oil lighter, the average gravity of good oil is maintained by the heavier oils present. A poor, dangerous oil may be heavier than a safe oil. The *astral oil* illustrates this fact; while it does not flash below 125° F., its gravity is 49° B. Ordinary kerosene flashes at 86° F., but has a gravity of 47° B.

Testing kerosene is a very simple operation. It is merely ascertaining the temperature at which the oil evolves an inflammable vapor, the "flashing-point," and the temperature at which the oil takes fire, the "burning-point." Although the operation is simple, results may yet in ignorant hands deviate 20° or 30° from the truth, while in skilful hands 4° or 5° will cover the most divergent results. (1) A suitable apparatus is required, consisting of a cup to hold the oil, surrounded by a vessel of water, which is heated by a small spirit-lamp: the bulb of a thermometer

is immersed in the oil. The tester legalized in the schedule of the English Petroleum act (Fig. 4) is a very good one. The open tester of Tagliabue (Fig. 3) is a very good instrument, but should be protected from currents of air, when in use, by a screen. The closed tester, or "pyrometer" (Fig. 2), I consider very unreliable, at least for determining the burning-point, as the mass of metal (brass) over the oil is very liable to become heated by the burning vapor after the flashing-point has been reached. (2) The oil should be heated very slowly; the temperature should not rise faster than 2° per minute. Whenever the test is to be used in a prosecution against the dealer, it should be duplicated with special care. The length of time occupied depends, of course, on the size of the flame beneath the tester. (3) The thermometer should not descend far below the surface of the oil; if the bulb is well covered it is sufficient. There is often a difference of a number of degrees in the temperature of the oil at different depths; it is well, therefore, to stir the oil before applying the flame. (4) Care should be taken, in making the test, to use a very small flame for trying the oil. I have used, with entire satisfaction, a minute gas-flame, burning from a glass tube drawn to a fine point; this is attached to a burner by a flexible rubber tube. This flame should not be thrust against the surface of the oil in making the flashing-test, as it might, by heating the oil, cause it to flash a number of degrees below the temperature recorded. It should merely be flitted quickly across the surface after noting the thermometer.

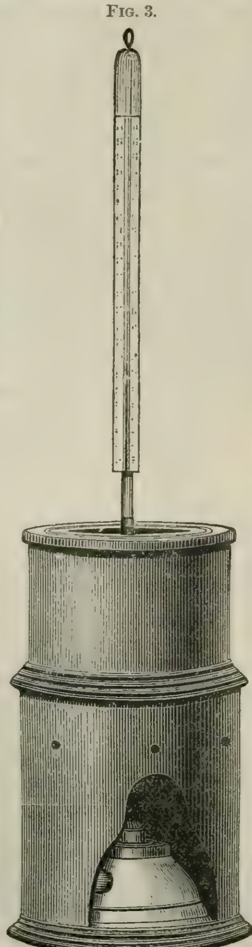
Fig. 2.



Tagliabue's Closed Tester, or "Pyrometer."

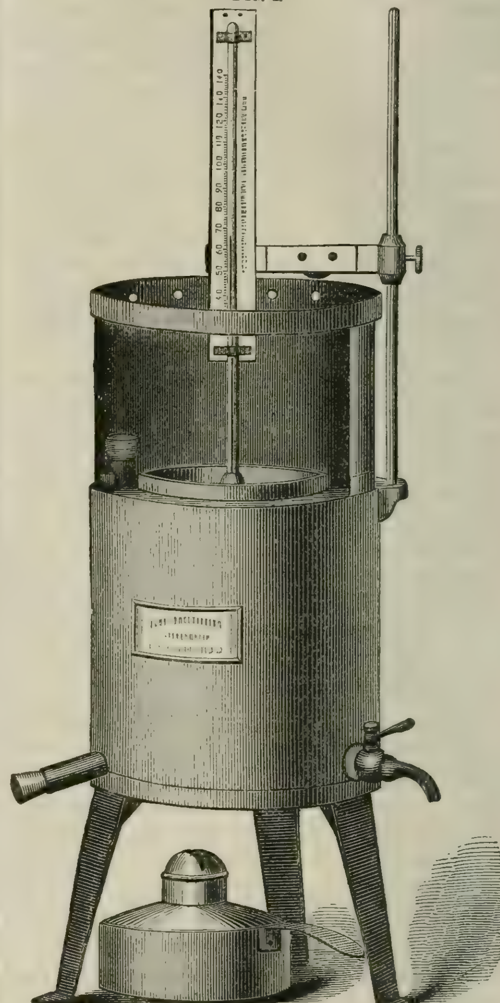
The Standard of Quality.—There are two distinct tests for oil—(1) *the flashing test,* (2) *the burning test,* which are often confounded, and when the law or ordinance specifies *the fire test,* there is a doubt as to which of the two tests is intended. *The flashing test* determines *the flashing-point* of the oil, or the lowest temperature at which it gives off an inflammable vapor. This is by far the most important test, as it is the inflammable vapor, evolved at atmospheric temperatures, that causes most of the accidents. Moreover, an oil which has a high flashing test is sure to have a high burning test, while the reverse is not true. *The burning test* fixes the burning-point of the oil, or the lowest temperature at which it takes fire. The burning-point of an oil is from 10° to 50° F. higher than the flashing-point. The two points are quite independent of each other; the flashing-point depends upon the amount of the most volatile constituents present—naphtha, etc.—while the burning-point depends upon the general character of the whole oil. One per cent. of naphtha will lower the flashing-point of an oil 10° without materially affecting the burning test. The burning test does not determine the real safety of the oil—that is, the absence of naphtha. The standard which has been generally adopted as a safe one fixes the flashing-point at 100° F. or higher, and the burning-point at 110° or higher. In the English act and some of the more recent laws of the States of the American Union the burning test has been very judiciously omitted, as two distinct tests are often confusing, and moreover, the burning test or point is not an index of the safety of the oil. More than half of all the samples of oil which have been tested by the writer did not take fire below 110° F., consequently they were safe according to the burning test, but only 28 of 736 samples were really safe, all the rest evolving inflammable vapors below 100° F. The *flashing test* should therefore be the only test mentioned in laws framed to prevent the sale of dangerous oils.

Fig. 3.



Tagliabue's Open Tester.

Fig. 4.



English Standard Tester.

What flashing-point should be selected as a standard of safety is a question on which there is some difference of opinion. The higher the flashing-point the safer the oil. Animal and vegetable oils do not flash below 500° to 600° F., hence it is impossible to have an explosion or any burning accident with a lamp or can filled with them. The flashing-point should be somewhat higher than the highest temperature the oil ever reaches in the lamps or cans. Our highest summer temperature does not far exceed 90° F., though a can of oil placed in the sun or near a fire might become much hotter. The point of 100° F. does not seem to be high enough to secure immunity from danger, though it may be said very few, if any, accidents occur with oil which does not flash below this temperature. In some of the laws 110° is fixed as the flashing-point, and in one of them 120° F. With a desire to throw some light on this question, an investigation was made of the temperature of the oil in burning lamps. (See *Am. Chemist*, Aug., 1872, p. 43, for results in detail.) By these results it ap-

pears that the temperature of the oil in lamps often rises much above 100° F., thus reaching a temperature at which oil *which does not emit a combustible vapor below 100° F.* would be dangerous. It is apparent that 100° F. is too low a standard for safety; 120° F. would not be too high a standard, and its adoption would add but a few cents per gallon to the cost of the oil.

Advantages of Petroleum.—The great advantages of petroleum, which led to so sudden a revolution in the system of artificial illumination all over the world, causing the old lamps designed for whale, sperm, and vegetable oils and for camphene to be thrown aside and to be replaced by the new lamps, are the cheapness of this oil, the brilliancy of the light, and the freedom of the flame from smoke. Although the first oil was struck in Col. Drake's well on Oil Creek as recently as Aug. 28, 1859, or only seventeen years ago, the average *daily* production in the U. S. has now reached the enormous amount of 25,000 barrels of 42 gallons each. The wells on Oil Creek now run more oil in a fortnight than was captured per annum by the entire fleet of 600 vessels which sailed from Nantucket, New Bedford, Stonington, New London, and Providence in the palmiest days of the whale fishery.

The Economy of Kerosene.—The following results show the wonderful cheapness of the light from kerosene oil. They were calculated when the oil was much higher in price than at present. The standard of comparison is a sperm candle which burns 2 grains per minute, or 120 grains per hour. (For details of the experiments see *Am. Chemist*, iii. 20.) It was found that in lamps of the sizes generally used the illuminating power of the kerosene flame is equal to from 8 to 9 sperm candles with the flat wick, to from 11 to 15 candles with the round wick, and to from 9 to 17 with the "dual" burner, and that a gallon of oil lasts from 59 to 109 hours in such lamps, and gives an amount of light equivalent to that which is afforded by from 14½ to 20 pounds of sperm candles. The heavy mineral sperm oil adds to the advantage of a degree of safety almost equal—in fact, practically equal—to whale oil, that of giving an amount of light equal to from 18 to 21½ pounds of sperm candles. The ordinary gas-burner, burning 5 feet of gas per hour, gives, if the gas is of good quality, a light equal to from 16 to 18 candles.

One thousand feet of 16-candle gas, costing $3, is equivalent to

3.25 gallons common kerosene, flashing at 86° F., costing, at 30 cts. per gallon	$0.97
3.15 gallons standard kerosene, flashing at 115° F., costing, at 40 cts. per gallon	1.26
3.27 gallons astral oil, flashing at 125° F., costing, at 50 cts. per gallon	1.64
2.87 gallons mineral sperm, flashing at 262° F., costing, at 75 cts. per gallon	2.15

The average cost per hour of light equal to eight sperm candles is—

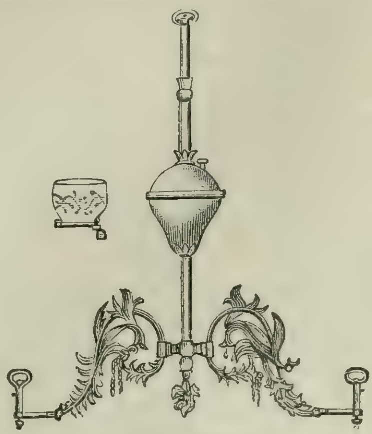
From sperm candles, at 42 cts. per pound	$5\frac{76}{100}$ cts.
Gas, at $3 per 1000 feet	$0\frac{75}{100}$ "
Mineral sperm oil, in German student lamp, at 75 cts. per gallon	$0\frac{57}{100}$ "
Mineral sperm oil, in Merrill's lamp, at 75 cts. per gallon	$0\frac{48}{100}$ "
Mineral sperm oil, in dual-wick lamp ⅝ in	$0\frac{56}{100}$ "
" " " " ⅞ in	$0\frac{54}{100}$ "
Astral oil, flat-wick lamp, at 50 cts. per gallon	$0\frac{46}{100}$ "
Astral oil, German student lamp, at 50 cts. per gallon	$0\frac{44}{100}$ "
Astral oil in Merrill's lamp, at 50 cts. per gallon	$0\frac{34}{100}$ "
Standard kerosene, in flat-wick lamp, at 40 cts. per gallon	$0\frac{33}{100}$ "
Standard kerosene, in German student lamp, at 40 cts. per gallon	$0\frac{31}{100}$ "
Standard kerosene, in dual-wick lamp, ⅝ in	$\frac{35}{100}$ "
" " " ⅞ in	$\frac{31}{100}$ "
Standard kerosene, in Merrill's lamp, at 40 cts. per gallon	$0\frac{28}{100}$ "
Common kerosene, unsafe, in flat-wick lamp, at 30 cts. per gallon	$0\frac{27}{100}$ "

In addition to the advantages of economy, brilliancy, cleanliness, and absence of smoke, it should be mentioned that kerosene never freezes and never becomes rancid. The only real objection—but, nevertheless, a most serious objection—raised against kerosene is the danger arising from its inflammability and the combustible vapors which are evolved at ordinary temperatures by most of the oils in common use. The oils used in the experiments above narrated do not belong to this class; they are perfectly safe, and every refiner has it in his power to manufacture a safe oil at an expense of not over 3 to 5 cents per gallon more than it costs him to make the dangerous oil now generally sold. It is moreover shown in the last table that the difference in the cost of the same amount of light when obtained from safe or unsafe oils, burned in flat-wick lamps, between "standard kerosene," which flashes at 115° F. and is safe, and common oil, which flashes at 86° F. (the average of the unsafe oils sold in New York), is only $\frac{6}{100}$ths of a cent per hour, or 1 cent for 16 hours. Certainly, an illuminating material which gives, in a cheap lamp, an amount of light equal to that of eight sperm candles at a cost of one-third of a cent an hour is an inestimable boon to the world. It adds several hours to the day, and enables the workingman to devote the long evenings to the improvement of his mind by reading; or where the labors of the day must be prolonged into the night, it saves the eyes from the inevitable ruin which would follow the use of insufficient light. The sanitary advantages of a clear, smokeless light are inestimable.

Naphtha and Benzine under False Names.—Processes have been patented and venders have sold rights throughout the country for patented and secret processes for rendering gasolene, naphtha, and benzine non-explosive. Thus treated, these explosive oils, just as explosive as before the treatment, are sold throughout the country under trade names, such as "liquid gas," "aurora oil," "safety gas," "petroline," "puroline," "black diamond," "septoline," "anchor oil," "sunlight non-explosive burning fluid," etc. These processes are not only totally ineffective, but they are ridiculous; roots, gums, barks, and salts are turned indiscriminately into the benzine, to leave it just as explosive as before. In the patent-office report for 1866 are fourteen such patents for "burning fluids," a few of which are quoted by way of illustration: No. 57,095. Gasolene, 40 gallons; gum olibanum, 1 pound; cascarilla bark, ½ pound; lichen, ½ pound. No. 57,390. White-oak bark, 2 pounds; alkanet root, 2 pounds; salt, 2 pounds; alcohol, 1 pint; cyanide of potassium, 1 ounce; to be added to 3 gallons naphtha to make it non-explosive. No. 57,749. Naphtha, 40 gallons; carbonate of soda, 3 pounds; alum, 2 pounds; hydrate of lime, 2 pounds; slippery elm, 2 pounds; gum camphor, ½ pound; oil of sassafras, 4 ounces; essence of tar, 1 ounce. No. 58,180. Naphtha, 40 gallons; potatoes, 50 pounds; lime, 4 pounds; sal soda, 4 pounds; curcuma, 3 pounds. No wonder we have kerosene accidents, with agents scattered through the country selling county rights and teaching retail dealers how to make these murderous "non-explosive" oils. The experiments these venders make to deceive their dupes are very convincing. None of the petroleum products are explosive *per se*, nor are their vapors explosive under all circumstances when mixed with air. A certain ratio of air to vapor is necessary to make an explosive mixture. That this is true is proved by the air-gas machines, which are simply contrivances designed to saturate air with gasolene or benzine vapor, when it burns like ordinary coal-gas. Equal volumes of vapor and air will not explode; 3 parts of air and 1 of vapor give a vigorous puff when ignited in a vessel; 5 volumes of air to 1 of vapor give a loud report. The maximum degree of violence results from the explosion of 8 or 9 parts of air mixed with 1 of vapor. It requires considerable skill to make *at will* an explosive mixture with air and naphtha, and it is consequently very easy for the vender *not to make one.* In most cases the proportion of vapor is too great, and on bringing a flame in contact with the mixture it burns quietly. The vender, to make his oil appear non-explosive, unscrews the wick-tube and applies a match, when the vapor in the lamp quietly takes fire and burns without explosion. Or he pours some of the "safety oil" into a saucer and lights it. There is no explosion, and ignorant persons, biassed by the saving of a few cents per gallon, purchase the most dangerous oils in the market. *It is not possible to make gasolene, naphtha, or benzine safe by any addition that can be made to it. Nor is any oil safe that can be set on fire at the ordinary temperature of the air.*

Special lamps, some of them of very elegant design, have been introduced for burning the liquid gas (naphtha). They are all provided with a reservoir for the dangerous fluid, and a burner by which it is vaporized and burns like gas. The cuts represent some of these dangerous contrivances. The apathy of the public in regard to this matter is beyond comprehension. These facts are well known in almost every community, and yet, although it is now twenty years since this class of oils came into general use, we have as yet no adequate legislation for the protection of life or property. Nothing but the most stringent laws, making it a State-prison offence to mix naphtha and illuminating oil, or to sell any product of petroleum as an illuminating oil or fluid to be used in lamps, or to be burned except in air-gas machines, that will evolve an inflammable vapor below 100° F., or better, 120° F., will be effectual in remedying the evil. In case of an accident from the sale of oil below the standard, the seller should be compelled to pay all damage to property, and if a life is

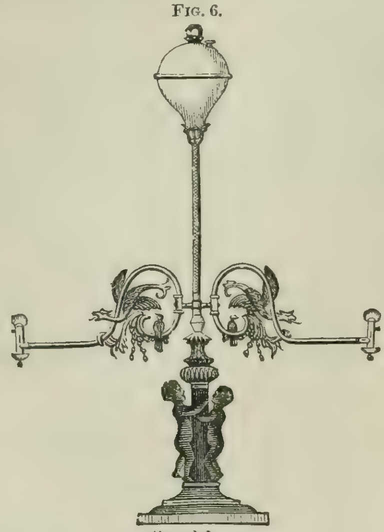
Fig. 5.



Hanging Lamp.

sacrificed should be punished for manslaughter. It should be made extremely hazardous to sell such oils.

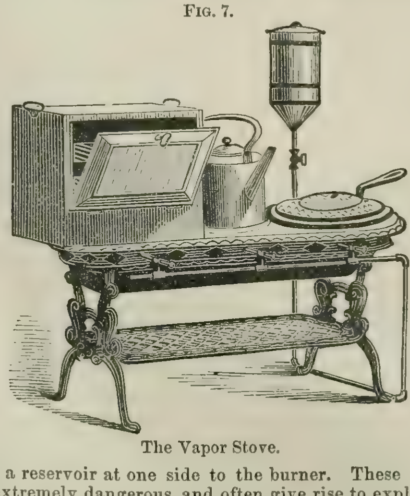
Fig. 6.



Stand Lamp.

"Vapor" and other Naphtha Stoves are contrivances for burning the cheap naphtha for warming and cooking. The naphtha, sold under various names for the purpose, flows

Fig. 7.

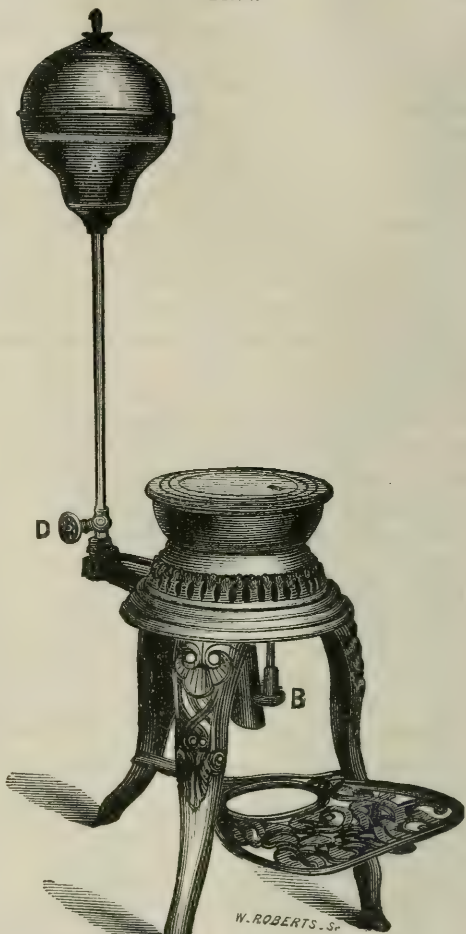


The Vapor Stove.

from a reservoir at one side to the burner. These stoves are extremely dangerous, and often give rise to explosions and conflagrations. Several serious accidents, involving loss of life and destruction of property, have already occurred with them in New York.

The So-called Safety Lamps.—An indefinite number of safety lamps have been patented with a view to make it possible to burn the explosive, inflammable naphthas without danger. No matter how well they realize the idea of protecting the oil they contain from explosion, they are treacherous friends. They allay one's fears of

Fig. 8.



explosive oils, and the accident, which is always much more likely to occur outside than within the lamp, is just as likely to take place. The lamp is dropped and broken; it is filled while burning; the servant neglects to screw in the wick-tube; the oil-can is upset or left uncorked, or the servant uses the oil to kindle the fire. In some way fire gets to the vapor of oil and an explosion occurs. Even when the "safety lamp" has an ally in the form of a "safety can," it fails to make naphtha safe. It is an axiom that *no lamp is safe with dangerous oil, and every lamp is safe with safe oil.*

Petroleum as Fuel.—Numerous efforts have been made to employ petroleum and the crude oils from coal, shale, etc. as fuel. The heating power of these oils is two or three times that of coal, and furnaces have been invented in which they can be readily and completely consumed under steam-boilers. But the practical difficulty is, after all, the cost of the petroleum. A gallon of petroleum weighs about 7 pounds, a barrel of 42 gallons 294 pounds, or $7\frac{1}{2}$ barrels make a ton of 2240 pounds. At the wells, at \$1.40 per barrel, the oil costs \$10.50 per ton, and if we add \$2.50 per barrel for transportation, we have \$18.75, which makes the total cost of a ton of petroleum \$29.25, at which it cannot compete with coal. (See *Petroleum versus Coal,* report by Prof. R. A. Fisher (New York, 1864); *Petroleum and Shale Oil, Report of Experiments at Woolwich* (House of Commons, Aug. 10, 1866); *Hydrocarbons as Fuel, Address of Francis H. Thomson, Phil. Soc. Glasgow* (Nov. 6, 1867); *On Liquid Fuel,* Benj. H. Paul, Ph. D., *J. Soc. Arts* (Apr. 17, 1868); *Papers by H. Sainte-Claire Deville, Comptes Rendus* (1871); *The Eames System of Furnace-working with Petroleum, Am. Chem.* (Sept., 1875, 94).)

Statistics.—The following figures have been selected from the report of the second geological survey of Pennsylvania and the circulars of Tetens & Beling and Beling, Niemeyer & Wessels of New York, and of G. R. Babbitt of Petrolia, Pa.:

Pennsylvania Petroleum.

Year.	Production in barrels.	Average price for year at wells.	Total value at wells.	Exported, crude or its equivalent, barrels.	Value of exported at wells.
1859	3,200	$13.00	$41,664		
1860	650,000	6.72	4,368,000		
1861	2,113,600	2.73	5,770,128	27,812	$75,926
1862	3,056,606	1.68	1,135,098	272,192	457,282
1863	2,611,359	3.99	10,419,322	706,268	2,818,009
1864	2,116,182	9.66	20,442,318	796,824	7,697,319
1865	3,497,712	6.57	22,979,967	745,138	4,895,556
1866	3,597,527	3.73	13,418,775	1,685,761	6,287,888
1867	3,347,306	3.18	10,644,443	1,676,300	5,330,634
1868	3,715,741	4.15	15,420,325	2,429,498	10,082,416
1869	4,215,010	5.85	24,657,750	2,568,713	15,026,971
1870	5,659,000	3.80	21,504,200	3,530,068	13,414,258
1871	5,795,000	4.35	25,208,250	3,890,326	16,922,918
1872	6,539,103	3.75	24,521,636	4,276,660	16,037,475
1873	9,879,455	1.84	18,178,197	4,981,441	9,165,851
1874	10,910,303	1.17	12,765,054	4,903,970	5,737,644
1875	8,619,639	1.21	10.429,763	5,200,000	6,292,000
Tot.	76,326,733	....	$245,904,880	37,690,971	$120,242,147

The Export for 1874 and 1875.

	1874.	1875.
Crude oil, barrels (42 gals.)	299,008	386,664
Refined oil " "	3,463,128	3,549,532
Lubricating oil "	....	2,584
Naphtha "	199,660	283,676
Residuum "	....	47,316
Refined oil, cases (10 gals.)	2,738,595	2,621,507
Naphtha " "	1,550	19,100
Equivalent of above in crude oil, barrels,	4,903,970	5,200,000

As nearly all the oil exported is refined in this country, we may add $2 per barrel for refining, and also $2.50 per barrel for transportation to the seaboard, when we shall have—

	For 1875.	Total to end of 1875.
Oil at wells	$6,292,000	$120,242,147
Cost of refining	10,400,000	75,381,942
Cost of transportation	12,500,000	94,227,427
Total	$29,192,000	$289,851,516

The wells drilled in Pennsylvania to end of 1868 were 5560, yielding 27,700,000 barrels of oil, the average being 4600 barrels per well; at the average price of $4.06 per barrel, yielding $18,700 per well. From 1869 to 1874, inclusive, 4939 wells were drilled, yielding 42,000,000 barrels of oil, or 8400 barrels per well, which at $2.90 per barrel, the average price, has been $24,500. Of the entire 10,499 wells drilled to the end of 1874 (in oil-producing territory only), 3250 were pumping at the beginning of 1875. The daily yield during Nov., 1875, was in—

Butler and Armstrong counties	15,017	barrels.
Clarion district	4,890	"
Upper oil-country	3,350	"
Bradford district	195	"
Total	23,452	barrels.

No data are at hand for West Virginia, Ohio, Canada, etc., but the amount is comparatively small.

Literature.—Naphtha in Asia (*Am. J. Sci.*, 1839, xxxvii. 353); *Report on the Nature and Products of Distillation of Peat*, by the director of the Museum of Irish Industry (London, 1851); *Asphaltes et Naphtes*, par Isidore Huguenet (2d ed., Paris, 1852); *Report on the Rock Oil or Petroleum from Venango Co., Pa.*, B. Silliman, Jr. (1855; reprinted in *Am. Chemist*, July, 1871, i. 18); *Petroleum*, Greville Williams (*Phil. Trans.*, 1857); *Handbuch der Photogen u. Paraffin Fabrikation*, Ullenhuth (Quedlinburg, 1858); *Die trockne Distillation, etc.*, Mueller (Leipzig, 1858); *The Rock Oils of Ohio*, J. S. Newberry (*Ohio Ag. Rep.*, 1859); *The Manufacture of Photogenic or Hydrocarbon Oils, etc.*, T. Antisell (New York, 1859); *Review of Dr. Antisell's Book*, F. H. Storer (*Am. J. Sci.*, 1860, xxx. 112, 254); *Notes on the History of Petroleum or Rock Oil*, T. S. Hunt (*Canadian Naturalist*, July, 1861); *Petroleum or Rock Oil*, T. S. Hunt (*Smithsonian Report*, 1861, 319); *Handbuch d. Ch. Tech.*, Bolley (Bd. i. G. 2, Braunschweig, 1862); *Handbuch d. Fab. Min. Oele*, Theo. Oppler (Berlin, 1862); *Petroleum and its Products*, A. Norman Tate (London, 1863); *Die Mineraloele*, Otto Buchner (Weimar, 1864); *Coal Oil and Petroleum*, H. Erni (Phil., 1865); *Geol. Survey of California*, "Geology" (vol. i., 1865); *Lehrbuch d. Chem. Tech.*, 3te Auf., Dr. F. Knapp (Braunschweig, 1865); *Le Pétrole*, E. Soulié et H. Handoüin (Paris, 1865); *A Practical Treatise on Coal, Petroleum, and other Oils*, 2d ed., Abraham Gesner (New York, 1865); *Researches on the Volatile Hydrocarbons*, C. M. Warren (*Mem. Am. Acad.*, new series, ix. 1865, 1866); *Petroleum*, report of S. S. Hayes (39th Congress, Ex. Doc. 51, 1866); *I Petrolii in Italia*, A. Stoppani (Milano, 1866); *Nouveau Manuel complet de la Fabrication et de l'Emploi des Huiles Min.*, D. Maguier, Manuels Roret (Paris, 1866); *Des Huiles Min.*, Ch. Cogniet (Paris, 1868); *Mineral Oils of the Netherlands' East Indian Possessions*, E. H. v. Baumhauer (*Archives Néerlandaises des Sciences, etc.*, xiv. 1869); *Notice sur l'Éclairage aux Huiles Min.*, Ed. Colin (Paris, 1870); *Petrolia, a Brief History of the Pennsylvania Petroleum Region*, A. Cone and W. R. Jones (New York, 1870); *Report on Petroleum as an Illuminator, etc.*, C. F. Chandler (Report Health Dept. New York, 1870; reprinted in part in *Am. Chemist*, ii. 409–446; iii. 20, 41); *The Oil-bearing Limestones of Chicago*, T. S. Hunt (*Am. Chemist*, ii. 27); *Report from the Select Committee of the House of Lords on the Petroleum Bill* (London, 1872); *Das Paraffin u. die Mineralöle*, M. Albrecht (Stohmann-Engler's Payen's *Tech. Chemie*, Stuttgart, 1874); *The Paraffine Industry*, F. Field (*Am. Chemist*, v. 169); *Second Geol. Survey of Pennsylvania*, appendix to Minerals of Pennsylvania, S. P. Sadttler, and *Special Report on the Petroleum of Pennsylvania*, H. E. Wrigley (Harrisburg, 1875); *Extinction of Petroleum by Chloroform*, Ommeganck (*Am. Chemist*, v. 292); *Wagner's Jahresb. d. Chem. Tech.* (i. to xx., 1855–74); Watt's *Dict.*, "Naphtha, Paraffine, Petroleum;" *Muspratt's Technische Chemie* (2te Auf. iii. 1381; v. 181). C. F. Chandler.

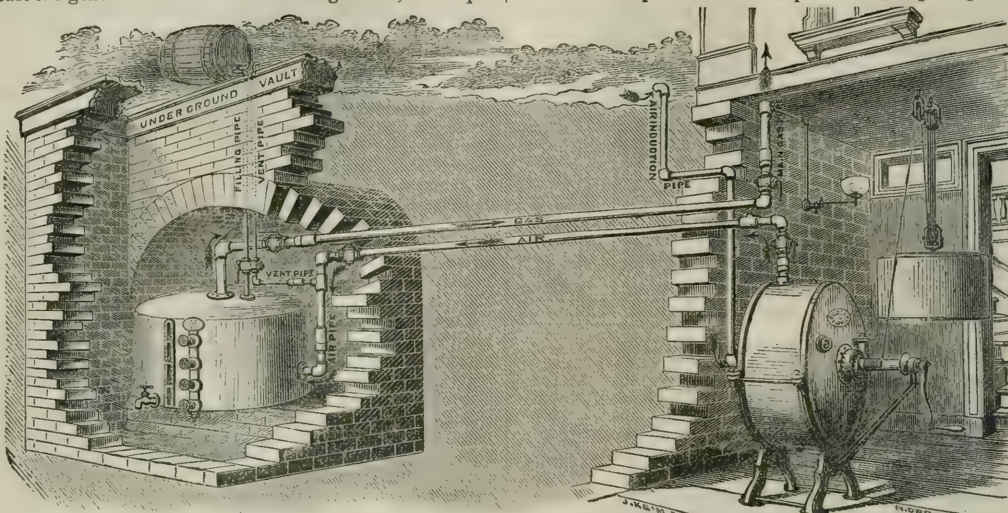
Petroleum and **Naphtha Gas.** Many processes have been patented, and put in practice to a greater or less extent, for the preparation of illuminating gas from petroleum and its products, as well as from coal and shale oils. These processes involve either (1) simply charging atmospheric air with the vapors of the lighter portions of petroleum, etc., gasolene, and using the mixture, *air-gas;* or (2) subjecting either of the above-mentioned materials to destructive distillation at or above a red heat, and thus converting them into permanent gases of high illuminating power, to be used either (*a*) alone, or (*b*) mixed with air or other gases. *Air-gas* is now extensively manufactured, generally on a small scale, for the lighting of dwellings, hotels, factories, etc. Air-gas was first made by passing air over benzol from coal-tar. Beel patented a machine for carburetting air with benzol in 1836; Paine in Worcester, Mass., experimented on an air-light about 1850; O. P. Drake of Boston brought out a machine in 1852; Jesse Carpenter patented a machine soon after this date. (For details with regard to early patents see *Wagner's Jahresb.;* Longbottom's, 1856, p. 422; Mongruel, 1863, p. 727; Well and Meyers, 1864, p. 700; S. Marcus, 1866, p. 701; Pond, Richardson, and Morse, 1866, p. 703; Friedleben, 1868, p. 763; and Müller and Methei, 1868, p. 765.) The cost of benzol was an obstacle which for a long time prevented the introduction of the air-light. It was obtained in limited quantities, and sold for $1 to $1.50 per gallon. The introduction of petroleum gave a new impetus to this system of illumination by supplying gasolene in large quantities at about 25 cents per gallon. Inventors at once turned their attention to the subject, and a great variety of "gas-machines" were soon patented. All consist, however, of at least (1) a contrivance for securing a current of air, "the blower," and (2) a vessel to hold the gasolene, "the generator," more or less complicated, so as to expose a very large quantity of liquid, either in shallow trays or on cotton wicking, shavings, etc. Some have in addition (3) arrangements for warming the generator to increase the evaporation. The evaporation of the gasolene lowers the temperature of the generator very rapidly if it is small, and the low temperature retards the evaporation. This difficulty is met by warming or by increasing the size and capacity of the generator. Dr. A. A. Hayes tested the gas from one of these machines, and found that the evaporation and subsequent condensation in the pipes of the gasolene was controlled by the temperature to a marked degree: at 60° F. five feet of the air-gas gave a light varying from 17 to 19 candle-power (sperm candles, burning 2 grains each per minute); at 38° F., 11 to 12 candles; at 27° F., $9\frac{1}{2}$ candles; and at 14° F., 3 candles. At 60° F., $3\frac{1}{2}$ pounds of gasolene, or $\frac{7}{10}$ths of a gallon, furnished 100 cubic feet of gas, equal to a consumption of 7 gallons per 1000 feet.

Air-gas requires burners with large openings specially constructed for it, and must be burned under a low pressure. If the current is too rapid, the flame is cooled too much and is readily extinguished. A few years since the writer tested the gas from a number of different machines at the American Institute Fair, and found it to vary from $10\frac{1}{2}$ to 30 candles. Some of these machines are provided with a retort which is sufficiently heated to actually decompose at least a portion of the gasolene passing through it into permanent gases. These are afterward diluted with air. This is not properly "air-gas," in the sense to which the term is usually restricted. A. S. Kimball has analyzed the gas from such a machine, and found it to contain—air, 70 per cent.; fixed gas, 27; olefiant gas, 1; hydrogen (?), 2. (See *Am. Chemist*, vi. 11.)

Special precautions are necessary to make the use of these machines safe. Gasolene is such an inflammable liquid that it will take fire at any temperature, and is so

volatile that it evolves a combustible vapor at all temperatures, which, mingling with the air, forms an explosive mixture. Several serious accidents have already occurred. All danger can be obviated by placing the machine, or at least the generator which contains the gasoline, in a separate and carefully-locked building or vault at a considerable distance (100 feet) from the building to be lighted.

Gas from Petroleum, etc. by Destructive Distillation.—Permanent gas of high illuminating power can be readily obtained from petroleum and its products by exposing them



Gas-Generator in vault, distant from house 50 feet or more. Air-Pump, in cellar of house.

Springfield Gas-machine.

to a red heat. This was at first doubted by many, who believed that the only effect of heat would be the vaporization of the volatile hydrocarbon oils and the production of a mere vapor, which would condense in the cool pipes. The "cracking" or splitting of complex hydrocarbon oils into simpler, lighter, and more volatile oils has been discussed in the article Petroleum, and the conversion of such oils into permanent gases in the article Gas-Lighting. There is but one condition necessary to accomplish the latter result; that is, the actual exposure of the oily vapors to a full red heat for a sufficient length of time, a few seconds only. The product may contain some condensable vapors, but after the separation of these there will remain a large percentage of rich permanent gases, consisting of marsh-gas (CH_4), ethane (C_2H_6), butane (C_3H_8), etc., with olefines (C_2H_4,C_3H_6), acetylene (C_2H_2), etc. The higher the temperature and the longer the exposure the simpler the products and the lower the illuminating power. The real difficulty is in regulating the temperature so as to secure a constant product. A deposit of carbon will be found in the retort, but this should not be so abundant as to cause inconvenience. Much fear was expressed lest the gas should "stratify" in the holders. Stratification could result in only two ways: (1) either by the heavier, richer gases settling from the lighter ones, or (2) from an irregular production due to variations in the heat, by which heavy gas is produced at one time and light gas at another. The first way is impossible, as gases never separate after they have once mixed (The popular idea that carbonic acid accumulates near the floor in our rooms is entirely fallacious.) By the second method *temporary* stratification may occur, but a uniform mixture will be sure to result finally, as gases diffuse into each other, no matter how great the difference in their densities. (See article Gas.)

Crude petroleum is readily converted into gas by causing it to pass through a red-hot retort filled with fragments of coke, fire-brick, or similar porous body to increase surface, or fitted with tray-like iron plates. The material being free from sulphur, the gas requires little purification. Ten gallons of crude petroleum yield 1000 feet of gas, samples of which, analyzed by Bolley (Wagner's *Technology*), were found to contain—

	I.	II.
Heavy hydrocarbons	31.6	33.4
Light hydrocarbons	35.7	40.6
Hydrogen	32.7	26.0
	100.	100.

According to Wagner, the petroleum gas made in Hirzel's apparatus consists chiefly of acetylene (C_2H_2), and has a specific gravity of 0.69.

Petroleum residuum may be used in place of crude petroleum. F. A. Sabatton found that 6¼ gallons could be made to yield 1000 feet of rich gas. *Crude shale and coal oils* give results similar to those obtained with petroleum. (See Wagner's *Technology*.) *Creosote soda*, the refuse product obtained in purifying coal and shale oil with caustic soda, has been suggested by L. Ramdohr as a cheap material for the manufacture of a rich gas. *Naphtha*, the cheapest and most volatile available product from petroleum, is, however, the material which has found most favor as a substitute for coal. Numerous processes have been patented in the U. S., and some of them are now in use on a considerable scale. (1) The naphtha is passed alone, generally in vapor, through a red-hot retort, and converted into gas which is (*a*) used alone, (*b*) diluted with air, (*c*) added to pure coal-gas as an enricher, (*d*) diluted with both air and coal-gas (Rand & Gale process, used at N. Y. Mutual works and elsewhere), (*e*) diluted with water-gas, a mixture of hydrogen and carbonic oxide, produced by passing steam over red-hot charcoal, coke, or anthracite, or by passing a mixture of naphtha-gas and steam through a red-hot retort (Spencer process; see Water-Gas); or (2) a portion of the coal-gas made in the ordinary way is passed through heated naphtha, and when loaded with its vapors is sent through a red-hot retort (Olney's process, Harlem gas-works, Citizens' G. L. Co.'s and People's Gas L. Co.'s works, Brooklyn). All of these methods may be made to yield permanent gases of high illuminating power. Some can, however, be carried out with much more regularity and certainty than others. Some result in the rapid destruction of the retorts; others do not. It is a mistake to suppose that the higher illuminating power of the naphtha-gas is a special reason why it should be substituted for coal-gas. Seventeen candle-gas, such as is furnished from coal by all our city companies, is as rich as is desirable. Gas much richer is liable to smoke, at least at times, and the products from partially-burned gas not only discolor fixtures, walls, and houses, but they are very oppressive to the lungs. The real questions are (1) whether naphtha is cheaper than caking coals for supplying the entire volume of gas, or (2) whether it is cheaper than cannel, albertite, grahamite, etc. as an enricher for coal-gas of low illuminating power. Naphtha with a specific gravity of 0.700 or 72° B. weighs 5.8 pounds to the gallon, equivalent to 386 gallons to the ton of 2240 pounds. This at 5 cents per gallon is $19.30 per ton; at 6 cents, $23.16; 7 cents, $27.02; 10 cents, $38.60. Further, naphtha yields neither coke nor tar, both of which are important items in the accounts of coal-gas works, especially as coke or other fuel must be provided to make the naphtha-gas. A further and most important element in the calculation is the fluctuation in the price of naphtha, even now when but little is used for gas. Should the large works create a new demand, the price would undoubtedly advance to double or treble the present rate. It is not probable that naphtha-gas can ever come into general use, even in this country, near the source of supply, except as an enricher of coal-gas.

C. F. Chandler.

Petroleum, Geology of. Petroleum is the common name for mineral oil, whatever its physical characters or chemical composition. These vary greatly, some kinds being dark, viscid, and tar-like, others almost transparent, very fluid, and volatile. More generally petroleum has an oily consistence, is brown, green, or yellowish by reflected,

often red by transmitted light, and has a strong, characteristic odor. It cannot be regarded as a mineral species, as it has no fixed formula of composition, but is a variable mixture of several substances, which differ much in their physical characters and in the ratios of their constituents. The different varieties of petroleum form a continuous series of hydrocarbons, which begins with asphaltum, a hard, black solid, and ends with naphtha, an ethereal fluid. These, with water, carbonic acid, marsh-gas, etc., are the evolved products of a natural or spontaneous decomposition of organic tissue, lignite, peat, coal, anthracite, and graphite being the residual products. The diversity observable in petroleums is probably due in part to differences in the vegetable and animal matters from which they have been produced, and in part to changes they have suffered through evaporation and oxidation. As originally formed, probably most petroleums were very light, but have been evaporated and sometimes oxidized by exposure. Petroleum distilled artificially becomes more and more dense by the loss of its lighter parts until it is reduced to a tar or pitch. In nature essentially the same changes take place, and the final residuum is asphalt. This is formed about oil-springs, often in large quantities, as in Canada, at the "tar-springs" of Colorado, in Southern California, the island of Trinidad, etc. Asphalt in its turn also suffers distillation, and the older asphalts, like grahamite and albertite, though derived from petroleum and filling fissures once reservoirs for oil have become so hard and dry as to be classed as "asphaltic coals."

The theory of the genesis of petroleum held by the writer of this article is briefly as follows: It is well known that in the growth of plants the mysterious principle called life produces the dissociation of the elements composing carbonic acid and water, breaking the strongest bonds of inorganic chemistry. Under this influence structures of hundreds of feet in height and many tons in weight are piled up in antagonism to the force of gravitation and the affinities of inorganic chemistry. When the life-spark leaves this structure, and its creative and conservative power is no longer exerted, the mass stands as an unstable compound, and the oxygen which has been divorced from its carbon by the intrusive life-force now hastens to reclaim its own. This reunion may take place slowly and quietly, and is then named "decay," but under favoring circumstances with heat and fury, which is called "combustion." The result in each case is the same: the organic tissue is oxidized; the affinities of inorganic chemistry reassert themselves; the stable compounds carbonic acid and water are formed and pass away; hydrocarbons are evolved and oxidized; and in place of the great mass of organic tissue a handful of ashes is left, which represents the mineral matter woven by life into its ephemeral fabric. This process of the decomposition of organic tissue may be hastened or retarded, but it can hardly be permanently arrested. By excluding oxygen and applying heat the constituents of the mass react upon themselves, forming new compounds—solids, liquids, and gases—several of which possess properties which make them useful to man during their existence, or in the development of usable force in the act of passing to their inevitable destiny, oxidation.

The chemical composition of wood-tissue varies somewhat in different kinds of wood, but a typical example chosen by Bischof gave carbon 49.1, hydrogen 6.3, oxygen 44.6. When this is placed in a retort and subjected to destructive distillation, there are evolved from it watery vapor (hygroscopic), acetic acid, condensable vapors of naphtha, and, as the heat is increased, uncondensable gases (carburetted hydrogen, etc.), water from the combination of hydrogen and oxygen, free nitrogen, ammonia, and carbonic acid, the latter from a combination of the oxygen and carbon of the wood. The ultimate residual product is charcoal, consisting of carbon and the ash of the plant, in all, perhaps, one-quarter of the original mass. A similar round of changes may take place in nature spontaneously and at a low temperature. When buried under water or wet earth, vegetable tissue is still slowly oxidized, since water absorbs some air; but apart from this, the original tissue is greatly modified by the reaction of its constituents upon themselves. The carbon, hydrogen, and oxygen combine in part to form carbonic acid, water, carburetted hydrogen, and naphtha (petroleum), which escape, in part remaining temporarily as a solid residuum, which becomes at first brown and ultimately black from its free carbon, and is known first as lignite, and subsequently, as it progressively changes, as coal, anthracite, etc. The escape of gases from vegetable matter decaying in shallow water has been seen by almost every one. The evolution of liquid hydrocarbons has also been observed, and would be more frequently noticed if carefully looked for. The process of subterranean or subaqueous distillation of vegetable tissue is called bituminization, because one of its temporary products is bitumen, which saturates or invests the residual carbon, giving it a pitchy appearance. This process goes on as long as there is any organic compound left in the mass; the final residuum being graphite, the intermediate stages represented by peat, lignite, bituminous coal, anthracite, etc. Some of its phenomena may be observed in the evolution of carburetted hydrogen and carbonic acid ("fire-damp" and "choke-damp") from beds of lignite and coal, and by a constant flow of inflammable gas and petroleum from strata of bituminous shale. The spontaneous distillation and oxidation of the organic constituents of beds of lignite, coal, and carbonaceous shale may be seen along their lines of outcrop, where even the carbon of the most exposed portions is altogether burnt off, leaving an ash or clay behind. As the strata are penetrated the percentage of carbon and hydrogen constantly increases, until, having passed beyond the reach of atmospheric influences, the mass is found presenting its normal physical and chemical characters. A similar series of facts may be observed in a comparison of the carbonaceous deposits of different geological ages, as, except where local causes like volcanic outbursts and elevation of mountain-chains have produced metamorphism of all rocks, and perhaps complete destructive distillation of organic matter, the oldest deposits exhibit the most complete result of this process, and the more recent beds of carbonaceous matter approach more and more nearly to the composition of cellulose.

It has been claimed by some chemists that in the decomposition of vegetable tissue it is resolved primarily into coal, carbonic acid, carburetted hydrogen, etc., and that the escape of gases from coal is simply their liberation from imprisonment in its interstices. This theory is disproved, however, not only by the facts that have been cited, but by observations made on the changes which take place in coal itself when long exposed—observations which show a progressive and spontaneous distillation of this substance. If any further evidence of the validity of this view is required, it is furnished by the fact that from peat, lignite, bituminous shale and coal, hydrocarbon gases and liquids can be and are produced on a grand scale by artificial distillation. All our cities are lighted with illuminating gas distilled from coal, and it is well known that previous to the discovery of abundant supplies of petroleum, oils were distilled from coal and carbonaceous shale to supply wants since more cheaply met by the natural oils. Even now in some countries the manufacture of artificial oil is a great and well-sustained industry. In all their essential characters the artificial agree with the natural oils, the most important difference being that the former contain benzole, naphthalene, anthracene, etc., and hence supplying the materials for the coal-tar colors, while they are found in but few "rock oils." This difference is probably due to the fact that in one case the distillation is effected at a high temperature, which results in the formation of certain organic compounds not often produced in the natural distillation.

If the theory given above be the true one, petroleum where it occurs in nature should be associated with carburetted hydrogen, and be traceable to some deposit of organic matter; and such may probably be always found to be the case. Petroleum shows itself at the surface flowing out, usually with water, from some subterranean source, and all *copious* springs of this description are found to be located at no great distance above some considerable mass of bituminous material. Where obtained in large quantities it is found in reservoirs of broken or porous strata, which overlie carbonaceous deposits. Much confusion has been produced in the minds of those who have not thoroughly investigated this subject by the fact that coarse sandstones and conglomerates form the reservoirs which hold the oil of Western Pennsylvania; but it needs no argument to prove that petroleum is not indigenous in a mass of comminuted quartz, and that it must have been derived from some other source and from organic material. It is inevitable also that when flowing out of the rock where it is produced, it should rise and occupy any reservoir open to receive it; and that where the channels through which it flows are continuous to the surface, the current production should pass off with the water and be evaporated, oxidized, and dispersed, or leave only an asphaltic residuum. When petroleum is stored it is placed in capacious tanks, where it is hermetically sealed up; and in nature we find it stored in the same way. Porous and jointed strata of conglomerate and sandstone often lie conveniently above some mass of carbonaceous material undergoing decomposition. These open strata form great reservoirs that are filled with water, gas, and oil, and above this is sometimes spread a sheet of impervious matter that serves as a cover. When by boring through this cover the reservoirs are tapped, either water,

oil, or gas is forced out, according as the bottom, middle, or top of the reservoir is pierced. What are called fountain or flowing wells must be connected with subterranean reservoirs in such a way that the elasticity of the gas in some upper chambers forces out the oil. This is the structure of our most productive oil-districts; and something similar must exist wherever great accumulations of petroleum appear and where flowing wells are attainable.

If the facts reported above are accurately stated, and the explanation of them is the true one, it follows that petroleum is being constantly produced, and that the oil in any oil-district will not be exhausted until all the hydrocarbonaceous matter from which it comes is distilled. But it has been learned by experience that the enormous productiveness of some oil-wells (1000 to 2000 barrels per day) is short-lived, and also that the supply from any one oil-district may be so nearly exhausted that the current production will not pay its cost. Hence we may expect that at no distant day all the now productive and the yet-to-be-discovered oil-districts—of which the number is unknown, but is probably small—will be practically, though not perfectly, worked out, and petroleum cease to be one of the great staple products of the country. Fortunately, it has been demonstrated that the work nature is doing so slowly can be taken out of her hands, and be done artificially far more rapidly than, and almost as cheaply as, she does it. The Huron shale and other oil-producing rocks can be distilled so as to furnish oil at a cost not greater than double that now paid, and the supply obtainable from this source is practically inexhaustible. We may therefore congratulate ourselves that the present over-stimulated production and wasteful use of this valuable portion of our national estate is not so ruinous an extravagance as it at first sight would seem; for after this stock of the manufactured article shall be squandered by the heirs there will still remain a vast amount of raw material from which industry, and not speculation, will supply the wants of the people, and for ever maintain a legitimate and flourishing business.

Distribution of Petroleum.—Petroleum occurs at all geological horizons above the Eozoic system. The metamorphic rocks of this series and the later ones of New England contain graphite and anthracite, but the hydrocarbons have been entirely expelled from the vegetable tissue of which these are residues. In the later and unchanged sedimentary rocks petroleum is usually to be found flowing in greater or less quantity from every considerable mass of carbonaceous material. It seems, however, to be produced in the greatest abundance from bituminous shale, and it is probable that all the great accumulations of rock-oil are derived from strata of this character. This is doubtless due in part to the great thickness and extent of deposits of this class, since they contain in the aggregate a far greater amount of bituminized organic tissue than beds of coal, lignite, or peat. It is also probable that the carbonaceous matter of bituminous shales is peculiarly prone to this kind of decomposition. It is derived very largely from marine vegetation, and has always been submerged in water; and perhaps for this reason is richer in hydrogen, and in spontaneous distillation furnishes a larger quantity of oil and gas, than any other form of mineralized organic tissue.

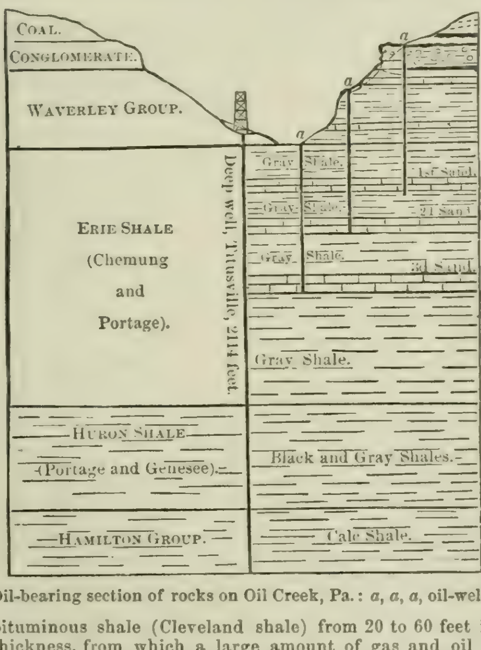
In ascending the geological scale, the first oil-horizon is found in the upper part of the Lower Silurian series. Here the Utica shale is highly bituminous, and is the source of oil and gas springs over a large area. In the State of New York oil and gas issue from the Utica shale in many places, and they are here probably derived from sea-weeds and graptolites. At Collingwood, Canada, this formation is saturated with petroleum, but it is here a bituminous, earthy limestone, filled with the remains of trilobites, and it doubtless owes much of its carbonaceous impregnation to the animal matter of these crustaceans. In the region about Burkesville, Ky., famous for its oil-springs and flowing wells, the oil apparently emanates from strata of the age of the Utica shale, and is confined by sheets of impervious limestone which represent the Hudson River group. These strata are exposed by the deep erosion of the valley of the Cumberland, and the accumulation of gas under the flaggy limestones is such as in some instances to cause violent explosions, in which many hundred tons of rock and water are thrown out. These *gas volcanoes*, as they are called in this region, afford positive proof of the *gradual* production of marsh-gas from bituminized organic tissue, since if the animal and vegetable matter buried in the mud at the bottom of the Silurian sea had in its primary decomposition produced all the gas it was capable of yielding, this would have all bubbled out ages ago. Though now "landlocked," and from its isolation neglected, the Cumberland oil-region is probably capable of producing a large amount of petroleum. In Western Canada, between Lake Erie and Lake Huron, is a district which from the quantity of oil it has produced is generally known as the Canada oil-region. The country is here low and level, and is underlaid by a thick sheet of clay. Beneath that, the surface-rocks are the Hamilton limestones and shales, smoothly planed off by glacial action. The oil obtained here has been mainly derived from the line of junction between the clay and rock, and so much had accumulated there that when the clay was pierced many thousand barrels of oil flowed from a single orifice. When these reservoirs were emptied the oil was found to issue in relatively small quantity from fissures in the rock below. The current supply in the shafts sunk was too small to be remunerative, and the wells bored, though yielding considerable oil, were on the whole not successful; and this oil-region has been practically abandoned. The Canadian geologists have considered the Corniferous limestone as the source of oil in Western Canada, and have gone so far as to represent this as the great source of petroleum in the country. There are serious difficulties, however, in the way of this theory. Though the Corniferous limestone is undoubtedly an organic deposit, it nowhere contains more than a small percentage of hydrocarbons; very little oil can be produced from it, and oil and gas springs are very rare where it underlies the surface. No considerable quantity of petroleum is derived from wells in the Corniferous or any other limestone, either because of the absence of petroleum or the closeness of the rock. Cells filled with oil are frequently met with in many limestones, but they are generally closed cavities. The oil of Canada is probably derived from two horizons—the Marcellus and Hamilton shales, and the underlying Collingwood shales, to which reference has already been made. This district lies in the line of the Cincinnati axis, and it is highly probable that the strata are slightly disturbed or broken in such a way as to favor the emission of oil, even from deep sources. The Canadian petroleum is nearly black in color, has a gravity of 26° to 42° Beaumé, and a peculiar acrid and nauseous smell, probably in virtue of a small amount of sulphur it contains.

The next higher oil-horizon is by far the most productive one in this country. It lies in the Upper Devonian rocks, and is that in which all the oil-wells of Pennsylvania are located. The geological structure of this district is as follows: The hills and table-lands are formed of carboniferous rocks, patches of coal-measures, the conglomerate, and 300 to 400 feet of Lower Carboniferous or Waverley shales. The draining streams generally cut through these strata and expose the Chemung. The wells bored in the valleys begin in the shales of the Chemung; those of the table-lands pass through the Waverley. The underlying Chemung and Upper Portage rocks are here composed of alternations of clay shale, with three or four bands of sandstone and conglomerate. The oil is found in the latter, saturating the porous material and filling an extensive system of fissures which traverses them. These are records of slight disturbances which have affected the region, and which have shattered and opened the harder strata, while the shales—as is the constant habit of such rocks—have settled back into compact masses. That the petroleum of Western Pennsylvania has not originated in the mechanical strata just mentioned is certain, as there neither is nor has been any constituent of this rock which could be transformed into it. And, as intimated in a preceding paragraph, we must look below the reservoirs that contain it for its place of origin. We there find a great thickness of bituminous shales, which furnish all the conditions necessary for the solution of the problem. The carbonaceous beds referred to consist of the Marcellus, Genesee, and Gardeau black shales, of which the upper ones combine toward the W. and form in Ohio the Huron shale. This has the thickness of over 300 feet, all colored black by carbon, and containing 10 to 20 per cent. of combustible matter. In Central Pennsylvania the representatives of the Huron shales form portions of what Rogers called the Cadent group, in which the bituminous layers at their outcrops in Huntingdon county have a thickness of 800 feet. This formation is very widely spread, and contains a larger aggregate amount of combustible matter than all our coal-measures. That these black shales can and do produce petroleum is demonstrated by the facts that they have been extensively and successfully used in the artificial manufacture of oil, and that a series of gas and oil springs mark their line of outcrop all the way from Central New York to Alabama. While the quantity of oil which they furnish is relatively small where the current production has free escape, in N. W. Pennsylvania, where nature has prepared great reservoirs for its reception, and closed these above with nearly impervious covers, it has accumulated for ages, and forms the most important deposits of petroleum known

in the world. It may also be said that all the most important gas springs and wells of the country are located in strata immediately overlying this great black shale formation, and from these in New York, Pennsylvania, and Ohio sufficient inflammable gas is daily escaping to light all our cities.

The view here presented of the genesis of petroleum is not accepted by the Pennsylvania geologists, but it is the result of careful study on the spot of the phenomena presented in all our oil-regions, and of many months devoted to practical well boring and pumping in Pennsylvania and Ohio. One feature which it presents, however, demands a passing notice. Within the limits of the large area over which oil is found, productive wells are limited to certain "oil-centres." The reason of this localization of the flow of oil has not been demonstrated, but it may be conjectured that those districts where the oil is found in greatest abundance have suffered more disturbance than the surrounding barren areas. None of this region is much disturbed, the horizontality of the rocks being unchanged, so far as can be judged by the eye; but it is certain that the waves of strata which form the Alleghanies and the series of coal-basins which border them on the N. W. reached far beyond the limits of the State of Pennsylvania, as even in Ohio they are distinctly perceptible. In confirmation of this view it may be said that all the other productive oil-regions of the country afford unmistakable evidence of disturbance; and it is difficult to conceive any reason why so much of the country W. of Oil Creek, which is underlaid by the same geological formations, should yield oil in almost every well, but nowhere in considerable quantities, unless it be because—what is known to be true—the sandstones and conglomerates wedge out and disappear—the reservoirs are wanting: the rocks are all compact and impervious, and the sources of the oil are hermetically sealed up.

In N. E. Ohio, the Waverley series contains a sheet of



Oil-bearing section of rocks on Oil Creek, Pa.: *a*, *a*, *a*, oil-wells.

bituminous shale (Cleveland shale) from 20 to 60 feet in thickness, from which a large amount of gas and oil is constantly escaping. These show themselves in gas and oil springs along its lines of outcrop, and in the complete saturation of the overlying Berea sandstone in several localities. Two of these—Mecca, Trumbull co., and Grafton, Lorain co.—are local oil-districts. At Mecca at least 1000 wells have been bored from 60 to 100 feet deep, many of which have at times yielded considerable oil; but as the reservoir-rock had no impervious cover over it, no great accumulation of oil had taken place in it, and the supply was soon exhausted. It has been discovered, however, that a slow but constant reproduction of petroleum is going on, and many of the wells have been successfully pumped for a few days each year for the last ten years. The oil of this horizon is thick and heavy, and is used for lubricating machinery—a character which it probably owes to the fact that it has been exposed to evaporation, by which the lighter portions have been lost.

The oil-district which is next in importance to that of Pennsylvania is that of West Virginia and S. E. Ohio, in the vicinity of Parkersburg and Marietta. There the surface-rocks are the coal-measures, but a marked line of disturbance passes through this region, and there is very little doubt that the petroleum comes from a deeper source. The oil of West Virginia is generally green in color and of excellent quality. It is heavier than that of N. W. Pennsylvania, and much of it is used for lubricating purposes. Though the production of this district has greatly diminished, it still yields a large quantity of oil. Among the interesting features of the West Virginia oil-field the famous grahamite deposit deserves mention, as it is undoubtedly one of the oil phenomena. This is a nearly vertical fissure broken through the shales and sandstone of the coal-measures in the disturbed area to which reference has been made. In the shales this fissure has closed again, as it would in clay or putty, but in the sandstone it has stood open, and has been filled with asphalt. This asphalt (grahamite), like the albertite, was long ago asserted by the writer to be the residual product of the evaporation and oxidation of petroleum; and this view has been fully confirmed by the artificial preparation of grahamite from petroleum by Mr. W. P. Jenney.

At Smith's Ferry, where the Ohio crosses the Pennsylvania line, large quantities of petroleum have been noticed rising to the surface of the water in the river ever since the occupation of this region by the whites. After the breaking out of the oil excitement on Oil Creek many wells were bored at Smith's Ferry and on Island Run, a few miles N. These have furnished a large quantity of oil, but most of them have now failed, and the present yield of this district is small. The valley of the Ohio at Smith's Ferry is cut down nearly to the base of the coal-measures, but the source of the oil is in the Lower Carboniferous or Upper Devonian rocks.

In the preceding notes the more important oil-regions of the valley of the Mississippi have been enumerated, but there are others in the far West which demand a passing notice. The Palæozoic rocks W. of the Mississippi contain little carbonaceous matter, and so far as known no petroleum flows from them. In the Cretaceous and Tertiary formations, however, are beds of lignite which rival in extent and thickness our carboniferous coal-seams, and we also find there numerous springs of petroleum. In Western Colorado, on White River, is a region where petroleum, mineral tar, and asphalt are said to occur in considerable quantities, but no detailed description of this region has ever been given. Some petroleum is also obtained on the upper Arkansas, S. of Denver, Col. In Southern California the Cretaceous and Tertiary rocks are very extensively saturated with oil, tar, and pitch, but no great quantity of oil has been obtained there, as the structure of the region has not been favorable to its accumulation. The asphalt derived from it exists in enormous quantities and has considerable economic value.

Although the oil-wells of America have had no rival in productiveness, they are not so entirely without parallel in the history of the world as has been stated, nor was the oil of this country discovered and used as recently as is generally supposed. It has been ascertained that the oil of Oil Creek was extensively collected, and wells were dug to obtain it, by the ancient inhabitants of our country, the "Mound-builders," those who also worked the copper-mines of Lake Superior, the lead-mines of Kentucky, and the mica-mines of North Carolina. In the Old World petroleum has been known and used for ages. The Chinese have obtained it from wells bored much like ours. On the banks of the Irrawaddi in India a large number of oil-wells have yielded petroleum for several hundred years, and it was sold in the markets of Europe under the name of "Rangoon petroleum" long before it was known that any such thing existed on this continent. At Baku on the shores of the Caspian innumerable gas and oil springs exist, and oil has been collected in large quantities from pits dug for the purpose during many centuries. The formation in which the oil occurs on the plain and promontory of Baku is Miocene-Tertiary, but this is underlaid by Jurassic rocks which contain beds of coal; and these are now regarded as the source of the oil. At various localities in Italy oil has been found in Tertiary strata, and the towns of Parma and Amiano were lighted with it long before it was used in America. Perhaps the most remarkable oil-spring known is the "Pitch Lake" on the island of Trinidad. This is really a petroleum lake, of which the shores are formed by the asphalt produced by its evaporation and oxidation. J. S. NEWBERRY.

Petroleum Centre, p.-v., Cornplanter tp., Venango co., Pa., on Oil Creek and on Oil Creek and Allegheny River R. R., is in the midst of the petroleum region.

Petro'lia, p.-v. of Lambton co., Ont., Canada, has numerous oil-wells and refineries, from which several thousands of barrels of crude and refined oil are shipped weekly

by the Great Western Railway, a branch of which extends to this place, which is 51 miles E. of Sarnia. It has 1 weekly newspaper. P. of sub-district, 2651.

Petromyzont'idæ [*Petromyzon*, from πέτρος, "a stone," and μύζειν, to "suck"], the only recognized family of the order Hyperoartii. The form is eel-like; the skin naked; in the adult the head is elongated, with branchial and antebranchial regions nearly equal; eyes well developed, not far in front of the first branchial aperture; mouth with a subcircular suctorial disk armed with teeth which are horny, severally sessile on soft papillæ, and simple or multicuspid; they are distinguished into maxillary, mandibulary, lingual, and suctorial, although with little reason; the branchial apertures are always seven in number and lateral; dorsal, anal, and caudal fins represented to a greater or less extent by a continuous or interrupted membrane; pectorals and ventrals not developed; the intestine has a spiral valve. Such are the characters of the adults, but all the species undergo a metamorphosis, and a very different form is possessed by the young or larvæ. This stage was formerly regarded as representing a peculiar mature form, and described under the name *Ammocœtes*; in this stage the antebranchial region of the head is little developed, the eyes are wanting, and the mouth is represented by a longitudinal slit, and is without teeth. Representatives of the family are found in the temperate regions of both the northern and southern hemispheres; these are represented by the generic forms *Petromyzon* and *Ammocœtes* (= *Lampetra*) in the northern hemisphere generally; *Entosphenus* in Western America; *Geotria* in Australia; *Velasia* in Chili, New Zealand, and Australia; and *Mordacia* in Chili and Tasmania. The species are, to some extent, parasitic, and fasten themselves by their suckers to fish, whose flesh they consume by abrasion.

THEODORE GILL.

Petro'nius Ar'biter, the author of a Latin romance, *Satyricon*, which in a half-comical manner gives a description of the vices and debauchery of Roman society under the first emperors, now in prose, now in verse, sometimes witty, generally obscene. Of the work, which seems to have been very large, only fragments are still extant. One of these, well known under the name of the *Supper of Trimalchio*, was first discovered in the middle of the seventeenth century, and published at Paris in 1664. Several attempts have been made to deceive the public by spurious manuscripts of the lacking portions of the book; thus, in 1693, Francis Nodot published a complete *Satyricon* from a manuscript which he pretended to have found in Belgrade. The best editions of the true fragments are that by Burmann (Amsterdam, 1743) and that by Bücheler (Berlin, 1862). A most minute and thorough collation of the MSS. was made by Charles Beck (Cambridge, 1863). Of the author of this book nothing is known. In former days he was thought to be the Petronius of whose character and life Tacitus gives an amusing sketch, the *maître de plaisir, elegantiæ arbiter*, at the court of Nero, the authority and model in matters of taste and fashion in dress, manners, and sensual enjoyment. But Beck ("The Age of Petronius Arbiter," *Proc. Amer. Academy*, 1856) puts the work, on historical and linguistic grounds, considerably earlier—between 6 and 34 A. D.

Petropaulov'ski, the official Russian name of the peninsula of KAMTCHATKA (which see), and the name of its capital, a village of only 479 inhabitants, exclusive of the garrison.

Petropaulovski, town of Siberia, province of Akmolinsk, on the river Ishim, is situated on the great Siberian post-road, has a garrison and a cannon-foundry, and is an important station for caravans from Khiva and Turkistan. P. 8220.

Petrovsk', town of Russia, government of Saratov, on the Medvieditza, an affluent of the Don, has 7 churches, 1 monastery, an ecclesiastical seminary, and several educational and benevolent institutions. Bees are extensively reared in the vicinity. P. 7631.

Petrozavodsk', town of European Russia, capital of the government of Olonets, on the Onega Lake, was founded in 1703 by Peter the Great, who discovered the rich iron ore which the vicinity contains. It is the see of an archbishop, and has many educational institutions, a good harbor, and a large cannon-foundry. P. 10,910.

Petrus Lombardus. See LOMBARD (PETER).

Petsh, or **Ipek,** town of European Turkey, eyalet of Room-Elee, on the Bistritza, with fine and substantial houses surrounded with orchards and mulberry plantations, has large manufactures of silk and arms. P. 8000.

Pets'worth, tp., Gloucester co., Va. P. 2692.

Pet'tenkofer, von (MAX), b. at Lichtenheim, Bavaria, Dec. 3, 1818; studied medicine, pharmacy, and chemistry at the University of Munich, and was appointed professor of medicine there in 1847. Besides a number of minor essays on practical chemistry in *Zeitschrift für Biologie*, of which he became editor in 1865, and in other scientific periodicals, he wrote a valuable work on ventilation, *Die atmosphärische Luft in Wohngebäuden* (1858), two on the manner in which cholera spreads (1855 and 1871), and *Ueber Oehlfarbe und Conservirung der Gemäldegalerien* (1870).

Pet'tigrew (CHARLES), D. D., b. probably in Pennsylvania about 1750; removed with his family to North Carolina; became a teacher at Edenton 1773; was ordained in the Protestant Episcopal Church at London 1775; was chosen first bishop of North Carolina 1794; took a leading part in establishing the University of North Carolina. D. at Bonarva, on Lake Scuppernong, in 1807.

Pettigrew (THOMAS J.), M. D., F. R. S., b. at London, England, Oct. 28, 1791; was admitted to the Medical Society of London 1808, becoming successively their secretary and registrar; was an early friend of Coleridge and other eminent thinkers; founded the Philosophical Society of London 1810; was secretary to the Royal Humane Society 1813–20; became surgeon-in-ordinary to the dukes of Kent and Sussex and librarian to the latter, for whom he drew up the splendid bibliographical work entitled *Bibliotheca Sussexiana* (1827–39); took part in founding Charing Cross Hospital 1820; was one of the founders of the British Archæological Association, of which he was long treasurer, vice-president, and editor of the *Journal*; was intimate with Young, Wilkinson, Belzoni, and other antiquaries; devoted much study to Egyptian archæology, on which subject he published several curious works, and was author of various professional books, especially *Superstitions connected with Medicine and Surgery* (1843) and *The Medical Portrait-Gallery* (4 vols., 1840). D. at South Kensington Nov. 23, 1865.

Pet'tis, county of Central Missouri. Area, 670 sq. m. It is somewhat uneven, fertile, well timbered, and contains beds of coal. It is traversed by Missouri Pacific and Missouri Kansas and Texas R. Rs. Live-stock, grain, and wool are leading products. Cap. Sedalia. P. 18,706.

Pettis, tp., Adair co., Mo. P. 1041.

Pettis, tp., Platte co., Mo. P. 3943.

Pet'trich (FERDINAND), b. at Dresden in 1798; studied sculpture at the academy of his native city and under Thorwaldsen in Rome; lived for some time in the U. S. as director of the Academy of Art in Pennsylvania, afterward in Brazil. D. at Rome Feb. 14, 1872. The most prominent of his works are his statues of Belisarius and Christ, and his bas-relief, *Day and Night*.

Pettusville, p.-v. and tp., Limestone co., Ala. P. 1659.

Pet'ty, tp., Lawrence co., Ill. P. 1591.

Petty (Sir WILLIAM), b. at Romsey, Hampshire, England, May 16, 1623, was the son of a clothier; educated in the school of his native town and at Caen in France; was for a time an officer in the English navy; afterward studied medicine at Paris; obtained from Parliament in 1647 a patent for his invention of a "pentagraph" or copying-machine; practised medicine at Oxford, where he became assistant to the professor of anatomy; obtained a fellowship at Brasenose College 1648; chosen professor of anatomy in the University of Oxford 1650, professor of medicine in Gresham College 1651; became physician to the army in Ireland and secretary to Henry Cromwell 1652; was made surveyor of forfeited lands in Ireland; entered Parliament 1658, and at the Restoration was knighted and made surveyor-general of Ireland. He was one of the founders of the Royal Society; made several curious inventions and discoveries in physics; lost much by the fire of London, but afterwards acquired a large fortune by successful speculations, and was author, among other works, of *The Political Anatomy of Ireland* (1691), *Taxes and Contributions* (1667), *Political Arithmetic* (1676), a treatise on money entitled *Quantulumcunque* (1660), which have procured him the reputation of being the principal founder in England of the science of political economy. He was ancestor of the noble house of Landsowne. D. at Westminster Dec. 16, 1687.

Petu'nia [from the Brazilian name of tobacco, *petun*], a genus of annual, biennial, or perennial plants of the order Solanaceæ, natives of the hot regions of America. The *Petunia nyctaginiflora* and *violacea* have been for fifty years cultivated in European and North American gardens, and have afforded numerous hybrid and other varieties, some of which are very beautiful.

Peu'tinger (KONRAD), b. at Augsburg Oct. 14, 1465; d. Dec. 24, 1547; wrote several works on antiquities, and

was the possessor of the so-called *Tabula Peutingeriana*, a map of the military roads of the West Roman empire from the fourth century. It was first discovered in a Benedictine monastery at Tegernsee, and remained there for nearly two centuries in the family of Peutinger, but was bought by Prince Eugene, who presented it to the imperial library of Vienna, where it is now preserved. A part of it was published by Marcus Welser (Venice, 1591); the whole by Scheyb (Vienna, 1753), by Mannert (Leipsic, 1824), who also gives an interesting account of the vicissitudes which this unique monument of ancient literature has gone through from the fourth to the nineteenth century; and in *Recueil d'Itinéraires anciens*, by Fortia d'Urban (Paris, 1845).

Peutingerian Table. See PEUTINGER.

Pevera'gno, town of Northern Italy, province of Cuneo. The ruins of only two of its four mediæval castles remain, and the feudal palace is now a private dwelling. P. in 1874, 6887.

Pew [Old Fr. *pui*], a seat in a church enclosed and separated from others. In England the exclusive and perpetual right to a particular pew in the parish church may be held by a parishioner as an appurtenant to his mansion-house, such ownership arising either from prescription—that is, long-continued use—or from a grant by the ordinary or bishop. All the other pews not so claimed are under the control of the churchwardens, acting on behalf of the ordinary. In the U. S. different customs prevail in different churches and States. Occasionally, the trustees or vestry, or other officers of the corporation, retain the entire custody of the church edifice, and the seats are free to all comers during divine service. Sometimes the pews are leased for a year only at a specified rent; on the other hand, they are often conveyed by an instrument in the form of a perpetual lease, reserving an annual rent. In the latter case the right of the pewholder is peculiar; it is property, and may be transferred, but is generally exempt from sale on execution; in some States it descends to the heirs as real estate, and in others it passes to the administrator as personal estate. It is, however, limited, and subject to the ultimate control of the trustees or vestry, who may, under restrictions not affecting the pewholder, convey the church edifice, rebuild it, repair it, or remodel it at their discretion. JOHN NORTON POMEROY.

Pewa'mo, p.-v., Lyons tp., Ionia co., Mich., on Detroit and Milwaukee R. R.

Pewau'kee, p.-v. and tp., Waukesha co., Wis., on Pewaukee Lake and Chicago Milwaukee and St. Paul R. R.

Pewee. See PHŒBE-BIRD.

Pewee Valley, p.-v., Oldham co., Ky., on Louisville Cincinnati and Lexington R. R.

Pew'ter [O. Fr. *peutre*], an alloy of lead and tin of extremely variable proportions. Bismuth, antimony, copper, and other metals are sometimes introduced for special purposes into the metal.

Peyer's Glands, small sacculi peculiar to the mucous membrane of the small intestine, termed *glandulæ solitariæ* when scattered singly, and *glandulæ agminatæ* when collected in groups, or *Peyer's patches*, so named from Peyer (1653–1712), who first described them. (See HISTOLOGY.)

Peyron' (AMEDEO), ABBÉ, b. at Turin in 1785; d. 1869. He was a pupil of Tommaso Valperga di Caluso, and succeeded him in the chair of Oriental languages. He was a member of the Turin Academy of Sciences, foreign member of the French Institute, and senator of the kingdom of Italy. He rendered important services to the study of Greek and of Coptic. Many of his memoirs are in the publications of the Academy of Turin; he translated Thucydides anew into Italian, published a profound work of historical criticism upon the Hellenic constitution, prefixed to the *Scene Elleniche* of Brofferio; discovered and published several Greek texts (Empedocles, Parmenides, Theodosianus), fragments of the *Orations* of Cicero for Scaurus and Tullius and against Clodius. He has, besides, the merit of having founded the study of Coptic by his *Lexicon Linguæ Copticæ* and his *Grammatica Linguæ Copticæ*.

Peyronnet', de (CHARLES IGNACE), COUNT, b. Oct. 9, 1778, at Bordeaux; studied law, and practised as an advocate in his native city; became very conspicuous during the first and second restorations as an ultra-royalist and staunch adherent of the Bourbons, and was minister of justice in the cabinet of Villèle from Dec. 14, 1821, to Apr. 17, 1827. In 1822 he carried a law by which all press cases were deprived of trial by jury and referred immediately to the royal courts, which were empowered to suspend and suppress any publication which seemed hostile to the public peace, the established Church, and the royal authority. In 1825 he carried another law by which profanation of any object consecrated to the public worship was punished by forced labor for life. In 1822 he was created a count; May 16, 1830, again entered the government as minister of the interior in the cabinet of Polignac, and as such he signed the notorious ordonnances of July 25, 1830, which occasioned the revolution of 1830 and the fall of the elder line of the house of Bourbon. Arraigned before the House of Peers for high treason, he was sentenced to imprisonment for life, and confined in the fortress of Ham, but Oct. 17, 1836, he was pardoned. D. Jan. 2, 1854, at his estates in the Gironde. He wrote a *Histoire des Francs* (2d ed. 1846) and *Satires* (2d ed. 1854).

Peyto'na, p.-v. and tp., Boone co., West Va., on Coal River. P. 1166.

Pézénas', town of France, department of Hérault, is beautifully situated at the confluence of the Peine and the Hérault, and has large manufactures of chemicals, brandy and liqueurs, and a brisk trade in wine, olives, and almonds, which are produced in its vicinity. P. 7375.

Pfäfers, a watering-place of Switzerland, canton of St. Gall, near Ragatz. Its waters have a temperature of 100° F., and enjoy a high reputation for their curative qualities; they are used both for drinking and bathing.

Pfeif'fer (IDA), b. at Vienna Oct. 15, 1797; d. there Oct. 27, 1858; became widely known by her journeys to the Holy Land, the Scandinavian countries, round the world twice over different routes, and to Madagascar, which she described in *Journey to Iceland, Sweden, and Norway* (Pesth, 1846; London, 1852), *A Woman's Journey Round the World* (Vienna, 1850; London, 1854), *Second Journey Round the World* (Vienna, 1856; London, 1857). (See *The Last Travels of Ida Pfeiffer, with a Biography*. Lond., 1861.)

Pforz'heim, town of Germany, grand duchy of Baden, at the confluence of the Nagold, Ens, and Würm, has large manufactures of jewelry, chemicals, and linens, ironworks, tanneries, and oil-mills; and an active trade in timber, which is cut in the neighboring Black Forest. P. 19,801.

Phacochœr'idæ [*Phacochœrus*, from φακός, "a wart," and χοῖρος, "a hog"], a family of hog-like ungulates very closely related to the Suidæ, or true hogs. They are distinguished by the following characters: the skull has the palato-maxillary axis extremely deflected, and forming an angle with the occipito-sphenoidal axis; the basi-sphenoid is reflected, with the crest uniting with the presphenoid, and forming two deep pocket-like cavities; the orbits are directed upward and backward, and the induced position of the eyes gives to the animal a peculiar physiognomy; the malar bones are very deep, and have short inferior processes; the teeth are very aberrant in the adult; the molar series is reduced to the true molars, or even the last true molar; this last is elongated, and composed of three longitudinal rows of columnar tubercles, presenting when worn simple oval, insular areas; the incisors in the adults are reduced to two, or even entirely lost in the upper jaw, and sometimes entirely wanting also in the lower one. Of this type only a single genus (*Phacochœrus*) is known; this is represented by two species—(1) *Phacochœrus Africanus*, which is common to several parts of Africa; and (2) *P. Æthiopicus*, confined to South-eastern Africa. These are popularly known under the name of "wart hogs." The snout, as in the true hogs, is disciform, and the nostrils open forward from it. THEODORE GILL.

Phæ'dra, in Greek legend, the wife of Theseus and the stepmother of Hippolytus, with whom she fell desperately in love. When he refused to comply with her wishes, she accused him to his father of an attempt upon her honor, but when she heard that he had perished in consequence of his father's wrath, she confessed her guilt and committed suicide. The tragedies on this subject by Sophocles and Euripides are lost, but there is a celebrated one by Racine.

Phæ'drus, b. in Thracia or Macedonia; was brought to Rome as a slave, but was made free by Augustus, and became famous by his five books of fables, containing 97 fables, most of which, however, are only versifications of the fables of Æsop. The style is easy and fluent, and the book often very pleasant to read. There are editions by Orelli (Zürich, 1831), L. Müller (Leipsic, 1868), and others.

Pha'ethon, in Greek mythology, the son of Helios, obtained one day permission of his father to drive the chariot of the sun across the heavens, but the horses ran off, and the chariot was just about setting the earth on fire when Zeus struck down the unfortunate driver with a thunderbolt. He fell into the river Eridanus (Po), and his sisters, the Heliades, who stood mourning by his corpse, were transformed into poplars and their tears into amber.

Phaëton'idæ [*Phaëton*, in allusion to the tropical habitat of the species], a family of large swimming birds, familiarly known as "tropic-birds." The form is somewhat ternlike; neck rather short; the bill about as long as the head, compressed, with the culmen slightly elevated and

curved; the gonys long and ascending; the nostrils near the base, linear and exposed; the wings long and pointed; the tail rather large, and with the two median feathers prolonged in a linear form; the legs originating rather more forward than usual, with the tarsi short, and the toes all connected together by a broad membrane, the hind one being deflected upward and forward; the claws are small, compressed, and acute; the skull belongs to the "desmognathous" type of Huxley; the sternum is very short and co-ordinate with the anterior position of the legs. The family is composed of but a single genus (*Phaëton*), in which four species are generally recognized; these are all found generally in the tropical seas, and often observed at great distances from land. They seek the shore for rest, however, and build their nests in hollow trees or in rocks, in which they lay generally two eggs. THEODORE GILL.

Phalan'ger, the anglicized form of the name Phalangista. (See PHALANGISTIDÆ.)

Phalangist'idæ, or **Phalangers** [*Phalangista*, a name having reference to the manner in which two of the toes are joined together as far as the last phalanges], a family of the order Marsupials and sub-order Syndactyles, adapted for herbivorous diet. They are of moderate or small size, with a moderate head, of which the facial portion is rather short; with the muffle naked, and with the upper lip cleft; the teeth are in moderate number—viz. I. $\frac{3}{1}$, C. $\frac{1}{1}$ or $\frac{1}{0}$, P. M. $\frac{1-3}{1-3}$, M. $\frac{4-3}{4-3} \times 2$; the limbs are equal, the fore feet provided with five well-developed toes, armed with compressed and curved claws, the hind ones with five toes, the first or internal of which is large, thumb-like, and opposable to the others; the second and third smaller than the rest, and, as in the Syndactyles generally, united by a common integument nearly to their extremities, and furnished with curved hollow nails; fourth and fifth with curved and compressed claws; tail generally long and more or less prehensile, sometimes rudimentary; a well-developed pouch is present, and opens downward; at the bottom are four (or two?) mammæ; the stomach is simple, and sometimes provided with a cardiac gland; a cæcum present, and in most species very large. The family was thus essentially divided by Waterhouse, but the genus *Tarsipes* at least included by him therein is entitled to separate family rank. The species of the family are distributed throughout almost every part of Australia and the Papuan Archipelago. They are nocturnal in their habits, and feed upon grass and other herbage. By Krefft eight genera are admitted, exclusive of *Tarsipes*—viz. (1) *Phascolarctos*, (2) *Cuscus*, (3) *Phalangista*, (4) *Petaurista*, (5) *Belideus*, (6) *Dactylopsila*, (7) *Acrobates*, and (8) *Dromicia;* these include fourteen species. By some these have been combined in several sub-families, the first being the type of the Phascolarctinæ, which is by some elevated to family rank, and the rest distributed among the sub-families Phalangistinæ and Petaurinæ. THEO. GILL.

Pha'lanx [Gr. φάλαγξ], in the military organization of ancient Greece, the tactical unit of the heavy-armed troops, a body of foot soldiers armed with spears and shields. The number of men was various. They were arranged from four to sixteen men deep. In later times the great phalanx under the Macedonians comprised 16,384 men, and was composed of four minor phalanges, each of which had two *merarchies*, or halves. Each merarchy was composed of two *chiliarchies*, each of these of four *syntagmata*, and each syntagma of sixteen men. The phalanx was, when compared with the Roman legion, a cumbrous arrangement of men.

Phal'aris, proverbially the most cruel tyrant known to antiquity, was the ruler of Agrigentum in Sicily for about sixteen years, in the middle of the sixth century B. C. Of his history hardly anything is known with certainty, most of it being enveloped in fables. A prominent feature in these fables is the brazen bull, invented by one Perillus, in which Phalaris roasted his enemies, inaugurating the ingenious instrument of torture by the roasting of its inventor. The famous *Epistles of Phalaris*, 148 in number, first printed at Venice in 1498, and afterwards often reprinted and translated, give quite another picture of the man's character, and were read through many centuries with great edification, until Bentley proved that they were spurious, a product of a much later time.

Phalarope, the anglicized form of *Phalaropus*. (See PHALAROPIDIDÆ.)

Phalaropid'idæ [*Phalaropus*, from φαλαρίς, "coot," and πούς, "foot"], a family of aquatic birds. They have some resemblance to the plover in form; the bill as long as, or longer than, the head, nearly straight, more or less slender, with the culmen decurved toward the tip, and with the sides of the upper mandible grooved for nearly the whole length; nostrils near the base, linear, and in the lateral groove of the mandible; wings long and pointed; tail short and rounded; legs rather posterior, with the tarsi moderate, the anterior toes united at the base and with lobate sides, and the hind toe elevated and with a narrow membrane; the skull is of the "schizognathous" type of Huxley. The family is one of several associated together by Huxley under the common name Charadriomorphæ. "The species," according to G. R. Gray, "are inhabitants of the northern regions, but migrating to the more temperate climes during severe winters. They are usually observed in pairs or in small parties, swimming about on the sea or on lakes, ponds, and streams of fresh water, generally near the margins, moving quickly in search of floating seeds, aquatic insects, and small crustaceous animals, on which they subsist. They swim with the greatest facility and swiftness, and their flight is rapid and elevated in the air. The female deposits four eggs among a tuft of herbage in the marshes." Only one genus, with three species, is recognized; these species are all inhabitants of the northern hemisphere; two of them belong more especially to Europe, and one to America.

THEODORE GILL.

Phal'lic Wor'ship, originally seems to have been the adoration of the reproductive and regenerative powers of nature, represented after a time by the phallus, or male generative organ, or in some instances by a straight column or by the pistil of a flower, as in India at the present day. This worship, whatever of symbolism it may have had at first, rapidly became a most corrupt and intolerable practice. It prevailed in India (as at present), in Chaldæa, Egypt, Syria, Phrygia, Greece, and Rome, as in later days among some of the American savages, notably the Seminoles of Florida. The forms which this abomination assumed were innumerable. Dionysus, Hermes, Venus, Priapus, Pan, Isis, and other gods were worshipped at Rome by phallic symbolism.

Phanerog'amous [Gr. φανερός, "evident," and γάμος, "marriage"] and **Phænog'amous** [φαίνειν, to "show," and γάμος] are synonymous terms, applied to those plants which have stamens and pistils, or perfect and evident reproductive organs. All other plants are cryptogamous. Phanerogamous plants, then, are flowering plants. (See BOTANY.)

Pha'raoh, the term applied in the Bible to the kings of Egypt, of which many explanations have been proposed, as *pa-ra*, "the sun;" *pi-ouro*, "the king;" *per-aa*, "the great house," "court," a phrase explained by Horapollo as "emperor of the world;" *pa-ra-anh*, or "the living sun." None of these etymologies are altogether satisfactory, some not being found at an early period. It is still less possible to connect it with the name of any Egyptian monarch, and it must have been a common appellation like *khan*, *cæsar*, or *czar*. Many Pharaohs are mentioned in the Bible, but in the present state of Egyptian chronology it is not possible to certainly determine the monarchs of Egypt they represented. The first known is the Pharaoh reigning in the days of Abraham, but he cannot be identified with any Egyptian monarch or "shepherd king," and the account given of him applies rather to some conterminous ruler or vassal of Egypt, for the camels which he is said to have given to the patriarch were never used by the Egyptians or seen on any monument, although at the time of the nineteenth dynasty they are mentioned in papyri as existing in Palestine. The next Pharaoh is the one of the time of Joseph (Gen. i. 4–6), whose court appears to have been at Heliopolis, and in whose reign Joseph was elevated to the post of governor of Egypt. According to Eusebius, he was the monarch Apepi or Apophis, of the sixteenth or Shepherd dynasty, and it is probable that the conditions of the history of Joseph coincide with the events of such a period, although other inquirers would place the arrival of Joseph in the days of the twelfth dynasty, when it is known Egypt was afflicted with a famine. The next Pharaoh is the one under whom the Israelites were in bondage, and who compelled them to build the treasure-cities of Pithom and Rameses of bricks; and it was under him or his successor that Egypt was afflicted with the ten plagues, and that Moses and Aaron led the Israelites out of Egypt, and the Egyptian army in its pursuit of the retreating Israelites was drowned in the sea, although it is doubtful if the Pharaoh perished with them. The identical Egyptian monarch who was the Pharaoh of the Exodus has been a subject of dispute, but it is principally confined to the period of the eighteenth and nineteenth dynasties. According to the old classical chronologers, the Exodus happened at the beginning of the eighteenth dynasty, and coincided with the expulsion of the Hyk-shos, with whom the Hebrews were confounded. Some would therefore consider that Thothmes II. was the Pharaoh of the period. The Egyptologists, however, generally consider Meri-en-ptah (or

Menephtah) to have been the king in whose reign the event took place, and that the name Ramses or Rameses of the treasure-city was given after Rameses II., his father and predecessor, who reduced the Hebrews to bondage. The name of Raamses is, however, said to be that of the land given to Jacob and his family, which it could not have had at the time, but by which it might have been known in the time of Moses or the writer of the book of Genesis. This *migdol* or tower of Rameses is represented in the wars of Rameses III., and is supposed to be the Pa-ramessu or Tanis from which the Hebrews departed in the direction of Canaan—according to the theory of Brugsch by the road across the spit of land between the Sirbonian Bog, or Lake Serbonis, and the Mediterranean. The other Pharaohs mentioned in the Bible are the father of Hadad the Edomite, supposed to be a king of the twenty-second dynasty; the father-in-law of Solomon; one of the predecessors of Sheshanka or Shishak; that monarch himself, who overran the Holy Land and pillaged Jerusalem; Tirhakah the Ethiopian, who for a time wrested Egypt from the Assyrians; Nekau or Necho II., who invaded Palestine to reduce to subjection, then in alliance with the Assyrians, but was finally defeated at Carchemish by Nebuchadnezzar, then at a youthful age, B. C. 605; and Uah-pa-ra, Hophra, or Apries, of the twenty-sixth dynasty, who marched to relieve the siege of Jerusalem, causing the Babylonians to retire for a while, although it was finally taken by Nebuchadnezzar, B. C. 588. It is remarkable that the Ethiopian kings Zerah and So mentioned in the Bible are not styled Pharaohs, like the Egyptian rulers, as if for some reason they had not the same title or were recognized as lawful rulers of the country. A person named Pharaoh is said to be the father-in-law of Mered, and by the rabbis supposed to have been a king. SAMUEL BIRCH.

Phar′isees [generally derived from the Hebrew *perushim*, "the separated"] originated as a political and religious party among the Jews during the time of the Maccabees in opposition to the invasion of Greek ideas and Greek customs which took place especially during the reign of Antiochus Epiphanes. While the Sadducees and the ruling aristocracy had yielded to the idea of a distinction between religion and politics, between Church and State, the Pharisees still maintained the old and genuinely Jewish view of a theocracy; and while the Sadducees adhered rigorously to the literal conception of the words of the sacred books, the Pharisees adopted the tradition as a means by which to interpret Scripture. Thus, the Pharisees stood at the time of Christ at once as the national party in politics and as the progressive school in theology, and their influence with the mass of the people seems to have been very great. The sources of our knowledge of them are the New Testament, Josephus, and the Mishna. Modern scholars seem inclined, however, to look at them under a milder view than that in which they appear in the New Testament, though it is only natural when the importance which they ascribed to the observation of all minutiæ of the Law led to hypocrisy and falsity. (See JEWISH SECTS.)

Pharmacopœ′ia [Gr. φάρμακον, "a medicine," and ποιεῖν, to "make"], a dispensatory or book of directions for the composition of medicine, approved by medical practitioners or published by authority. Recently-discovered manuscript—the *Papyrus Ebers*—establishes the existence of books of formulæ among the iatro physicians, the medical priesthood of Egypt, as far back as the sixteenth century before the Christian era. Of the later Alexandrian school many articles and formulæ attributed to Isis and Osiris, and the *Simples* of Serapion, were transmitted and employed during the Greek and Roman periods. The remedials advised by Galen, and by those who expounded and practised his exclusive teachings, may be considered the only code of therapeutics until the origin of the Arabian school. The first systematic attempt at methodical collection and classification of recognized formulæ was made by Sabor ebn Sahel in the latter part of the ninth century. The Italian school of the twelfth to the fifteenth centuries produced the extensive work of Nicolaus de Salerno. Many of the early pharmacopœias of the sixteenth and seventeenth centuries contain preparations of the older Arabian and Italian works. The first pharmacopœia issued by authority was compiled by Valerius Cordus in 1542, under sanction of the senate of Nuremberg. Other German pharmacopœias are those of Brandenburg and Ratisbon, and the *Pharmacopœia Germanica*, authorized May, 1872, is to-day employed throughout Germany and in Russia. The pharmacopœias of Amsterdam and Brussels are celebrated. That of Paris is authority in France and Switzerland. The first edition of the *London Pharmacopœia* was issued in 1618; that of Edinburgh in 1699; that of Dublin appeared first in 1807. These three have passed through several editions, and had material differences. They were employed in the U. S. until the second quarter of this century. In 1864 the issues of London, Edinburgh, and Dublin were merged into one work, official for the United Kingdom and its colonies—the *British Pharmacopœia*. In the U. S. the first effort to secure an official pharmacopœia was made in 1818 by the New York County and New York State Medical societies. Other State societies united, and a convention of delegates from State medical societies and medical colleges met in Washington Jan. 1, 1820. The result was the issue in 1820 of the first *Pharmacopœia of the U. S. of America*, a volume of 272 pages. Its adoption was not general. The convention provided for further conventions every ten years to revise the work. Such conventions were held in 1830, 1840, 1850, and the revised editions issued in the following years. The convention of 1860 had delegates from colleges of pharmacy and pharmaceutical societies and from the medical corps of the army and navy. In 1831 appeared the first edition of the *U. S. Dispensatory*. It is a most extensive work—an encyclopædia of materia medica, therapeutics, and pharmacy, and contains full descriptions of many drugs which are not officinal. This work is chiefly employed by apothecaries, but the *Pharmacopœia*, which is brief and concise, is in use with physicians who prepare their own medicines, and with druggists, as a convenient handbook in preparing officinal formulæ. The pharmacopœias of Europe were published only in Latin. The American was published both in Latin and English until the edition of 1840, when and since the Latin has been omitted. The Latin names of medicines and preparations alone were retained, as essential to correspond with terms employed in prescription-writing by physicians, and to maintain a degree of uniformity with the nomenclatures of foreign countries. In the original and subsequent editions many processes are identical with, and derived from, the *British Pharmacopœia*, a correspondence between it and the American being desirable, as the former was long in use in this country, and also as a step towards the future issue of a universal pharmacopœia. The convention for the fifth decennial revision of the work met in Washington in 1870. It made two essential modifications of the previous general plan—first, to substitute for measures of capacity expressions of weight for the quantities in all formulæ; secondly, to extend the scope of the work by adding articles with reference to the local peculiarities of the population and climate. Twenty-seven new articles were added, five were dropped as obsolete. Eighty-seven new preparations were added, seven dismissed. Many entirely new medicines were designated for the first time in this edition, as the benzoate, bromide and iodide of ammonium, digitalinum, extract of American hemp, extract of Calabar bean, citrate of iron and strychnia, yellow oxide of mercury, arseniate of sodium, etc. The terminations of chemical medicines have been changed to correspond with the new nomenclature and terminology of chemistry. The *Pharmacopœia Germanica* of 1872 has been translated into English by C. L. Lochman. As much of the recent literature of therapeutics comes from abroad, and many of our physicians are foreign-born, educated in Europe, or apply the formulæ advised by foreign authors, the apothecary of our larger cities has to employ the British, French, and German pharmacopœias in addition to that of the U. S.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Phar′macy [Gr. φάρμακον, "a medicine"], the art of preparing, compounding, and dispensing medicines with reference to their physical properties, their compatibilities, and chemical combinations. It includes a knowledge of the different parts of plants, the method and season of their collection, their desiccation and preservation; a knowledge of the chemical structure of mineral and artificial inorganic drugs, as well as of their crystalline and other obvious physical appearances. The pharmaceutist employs a scale of weights and measures especially adapted for his art. The "apothecaries' weight" of the U. S. corresponds with the troy weight in its pound, ounce, and grain, having additional definite terms of weight—the scruple and drachm. *Apothecaries' Weight.*—20 grains = 1 scruple (abbreviated ℈j.); 60 grains, or 3 scruples = 1 drachm (ʒj.); 480 grains, or 8 drachms = 1 ounce (℥j.); 12 ounces = 1 pound (℔j.). An earnest effort has been repeatedly made to secure a uniform scale of weights for pharmacy in all countries, the French decimal system being the one preferred. The unit of French weight, the gramme, is equal to 15.4340 grains. The great diversity in official weights will be seen by comparing the equivalent in grammes of the pound of several countries. The pound of England and the U. S. equals 373.246 grammes; Germany, 500 grammes; Austria, 720.009; Holland, Belgium, and Switzerland, 375; Russia and Norway, 357.854; Rome, 339.161; Spain, 345.072; Portugal, 344.190, etc. The measure of liquids employed in pharmacy is wine

measure. The unit of this system is a minim, or .95 of a grain of pure water at a temperature of 60° F.: 60 minims = 1 fluid-drachm (fʒj.); 8 fluid-drachms = 1 fluid-ounce (f℥j.); 16 fluid-ounces = 1 pint; 2 pints = 1 quart; 4 quarts = 1 gallon.

Crude drugs are reduced to a powdered state by various methods. Having been previously dried, they are ground in the drug-mill, triturated by hand with mortar and pestle, or, in the case of soluble saline substances, obtained by the process of granulation, constantly stirring the solution, while evaporated by heat, to prevent recrystallization. Various organic and inorganic drugs are dispensed in powders; there are also several officinal compound powders—the aromatic powder, powder of aloes and canella, Dover powder, compound jalap and compound rhubarb powders. Drugs in their powdered state, unchanged by chemical combinations, are incorporated in the form of pills, suppositories, ointments, and plasters. Only such drugs are dispensed in form of powders as are soluble in water or the gastric juice, or intended to act locally, either chemically or mechanically, upon the parts they affect. The preparation of pills consists in incorporating either crude powdered drugs or their inspissated extracts and active principles with some inert soluble substance to make the pill-mass. More recently, by machine-power, the active ingredients are compressed into very small bulk, being retained in pill form by gelatine or mucilage, with which the articles are saturated. Pills are dusted with aromatic powders to prevent exposure to the air and disguise taste; they are also coated with sugar, gelatine, and tin-foil. Cerates and ointments are made of variable consistency by employing separately or in combination simple cerate or purified fat and wax, in which the active ingredients are disseminated by fusion or trituration. Plasters may consist of the inspissated extracts spread for use, or of medicinal substances added to emplastrum plumbi (lead plaster), which is the base of many officinal plasters. Of liquid preparations or solutions there are, first, *liquores* and *aquæ*, containing medicines soluble in waters; secondly, *spirits* and *tinctures*, solutions in alcohol; thirdly, *vini*, solutions in wine; and, fourthly, ethereal solutions. The simplest solution is an infusion, by pouring on of cold or hot water; next, the decoction, the product of boiling. Tinctures, wines, and ethers may be produced at once when their medicinal contents are soluble in them, but more often are the result of admixture and maceration with the drug and separation by gradual percolation or by displacement.

In continental Europe and Great Britain the standard of scientific qualification to practise pharmacy is high and enforced by law. In the U. S., until recently, there were no restrictions, and in many parts of the country medicines are prepared and dispensed and prescriptions compounded by the ignorant and unskilled. Schools of pharmacy have, however, been established in New York, Philadelphia, and other large cities, and an earnest effort made by the medical profession and American Pharmaceutical Association to secure an enforced standard. In New York City, since June, 1872, all persons not graduated from recognized colleges of pharmacy in this country or abroad, before practising as pharmaceutists or dispensing chemists, are required to appear and pass a satisfactory examination before the board of pharmacy. This board is to be composed of five competent pharmacists, three of whom shall be graduates in medicine, and two graduates in pharmacy. During the brief period of its enforcement this law has developed accuracy and skill in place of error, and fatal accidents no longer occur.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Pharos. See LIGHTHOUSE CONSTRUCTION.

Pharsa'lia, p.-v. and tp., Chenango co., N. Y., on Otselic River. P. 1141.

Pharsa'lus, an ancient city of Thessaly, on the Enipeus, became famous for the battle which was fought here Aug. 9, 48 B. C., between Cæsar and Pompey, and in which Pompey was utterly defeated.

Phar'ynx [Gr. φάρυγξ], a musculo-membranous sac situated at the base of the skull, immediately behind the mouth, nose, and larynx, and in front of the cervical vertebræ, extending as far down as the fifth, where it is continuous with the œsophagus. It has the following openings into it: two from the nose, the posterior nares; two Eustachian tubes, which communicate with the middle ear; the mouth, larynx, and œsophagus. It is lined by mucous membrane, which is continuous with that lining the various cavities opening into it. Beneath this mucous coat is a fibrous layer known as the pharyngeal aponeurosis; and beneath this, again, is a muscular layer, composed of the superior, middle, and inferior constrictor muscles; they diminish the capacity of the pharynx, and by their successive contraction from above downward the food is carried along into the œsophagus. The pharynx is freely supplied with glands, which are situated beneath the mucous membrane. The function of the pharynx is to give passage to the food in deglutition and to the air in respiration. The pharynx is subject to the following diseases: catarrhal, croupous, and diphtheritic inflammation of its mucous membrane, phlegmonous inflammation, syphilitic affections, retro-pharyngeal abscess, polypi.

EDWARD J. BERMINGHAM. REVISED BY WILLARD PARKER.

Pharyngobran'chii [from φάρυγξ, φάρυγος, the "throat," and βραγχία, "gills"], an order of fishes, represented by a single known genera (*Branchiostoma* or *Amphioxus*), which is at the same time the type of a peculiar sub-class, the LEPTOCARDII (which see). THEODORE GILL.

Pharyngogna'thi [Gr. φάρυγξ, φάρυγος, the "throat," γνάθος, the "jaw"], an artificial combination of fishes originally established by Johannes Müller for the reception of those teleosts in which the two lower pharyngeal bones are united together and form a single solid piece. The group thus distinguished was elevated to ordinal rank by Müller, and to it were referred some of Cuvier's acanthopterygians (Labridæ, Cichlidæ, Embioticidæ), as well as some malacopterygians (Scomberesocidæ). These forms have, however, on the one side no close affinity with each other, and on the other side they are severally related to other types in which the lower pharyngeals are separated; again, there are fishes of other families (*e. g.* some Pleuronectidæ and the Sciænidæ hoploidonotinæ—*e. g. drum*) which have the lower pharyngeals as much united as in the typical Pharyngognathi of Müller; therefore, the order, though formerly generally adopted, is now discarded by the best ichthyologists. THEODORE GILL.

Phascolomy'idæ [*Phascolomys*, φάσκωλος, a "pouch," and μῦς, a "mouse"], or **Wombats,** a family of marsupial mammals distinguished by their rodent-like dentition. The body is stout and large; the head large, with full cheeks, flattened above, with an obtuse muzzle and a more or less naked muffle; nostrils widely separated behind, but converging forward; upper lip cleft; teeth twenty-four in number—viz. I. $\frac{1}{1}$, P. M. $\frac{1}{1}$, M. $\frac{4}{4} \times 2$, all of which are rootless, more or less incurved, and grow upward, like the incisors of the placental rodents; the limbs are nearly equal, short and stout; anterior feet with five short, stout toes, severally flattened, with broad and little-curved nails; hind ones with five toes, the innermost of which is small, at nearly right angles with the rest, and destitute of a nail; the second, third, and fourth toes are connected, and they, as well as the fifth, have long curved nails; the tail is rudimentary; the stomach simple, with a special gland situated to the left of the cardiac orifice; the cæcum is short and wide, and has a vermiform appendage. The species, as indicated by their dentition, are addicted to gnawing; they feed chiefly upon grass, roots, twigs, and other vegetable products. They form extensive burrows, and in them remain for the most part of the day; in the night they leave to seek their food. The female generally has only one young at a birth. Four living species are found in various parts of Australia—viz. (1) *Phascolomys wombat* in Tasmania; (2) *P. platyrrhinus* in Victoria, Australia; (3) *P. lasiorhinus* in South Australia; and (4) *P. niger* in the neighborhood of Port Lincoln in South Australia. In former geological times large species flourished in the same countries. THEODORE GILL.

Phase. See MOON.

Phasian'idæ [*Phasianus*, the Latin name of the common pheasant], a family of birds including most of the gallinaceous fowls. They all have the bill moderate, with the sides compressed, and with the culmen arched towards the tip, which is decurved over the lower mandible; the wings are moderate and more or less rounded; the tail variable in development, in some (Phasianinæ) compressed, in others (Pavoninæ) depressed; the tarsi are robust, and covered with transverse scales in front, smaller ones behind, and still smaller ones on the sides, and in the cock are generally armed with one or more spurs; the toes are moderate, three in front united at base by a slight membrane, and a hinder one short and elevated. The sternum has its lateral elements (pleurostea) separated by a very deep notch from the median one (lophosteon). The family includes two sub-families—viz. (1) Phasianinæ, sometimes divided into Phasianinæ and Gallinæ; and (2) PAVONINÆ (which see). The family has recently (1870–72) been made the subject of a monograph by Mr. D. G. Elliot, the plates of which are in imperial folio and prepared by Wolf. This work has been pronounced by an eminent authority (A. Newton) to be "the most gorgeous ornithological work yet published." THEODORE GILL.

Phasian'inæ [from *Phasianus*], the principal sub-

family of the Phasianidæ, distinguished by the compression of the tail and the greater or less extension, at least in the males, of the median ones. To this group belong the numerous species of pheasants, the barn-door fowl, and related types. Recent authors, as Gray and Elliot, admit in the sub-family fifty-one species, distributed under the genera *Phasianus*, *Thaumalea* or *Chrysolophus*, *Pucrasia*, *Crossoptilon*, *Euplocomus*, *Gallus*, *Ceriornis*, and, according to some, *Lophophorus*. Several of these have been divided into sub-genera. THEODORE GILL.

Pha'sis, the ancient name of the *Rion* or Faz River, in the Russian province of Transcaucasia, considered by the classical geographers as the boundary between Europe and Asia. The Argonauts were fabled to have landed at its mouth. The name of the pheasant (Lat. *Avis Phasiana*) is derived from a supposed origin in the region of Colchis traversed by this river.

Pheas'ant [from the Lat. *Phasianus*, itself derived with reference to *Phasis*, a river of Colchis, now called *Rion*, from whose neighborhood it was carried to Greece], a name originally belonging to the *Phasianus Colchicus*, a gallinaceous bird of the family Phasianidæ. It is now naturalized throughout a great part of Europe. It is very beautifully marked with a great variety of changing colors. In England it exists in a half-domesticated state, and is fattened with grain, attaining sometimes a weight of five pounds. Pheasants are collected at the proper time in large numbers, and slaughtered by so-called sportsmen *en battue*. The flesh is very excellent food. This bird hybridizes readily with most other gallinaceous birds. The name pheasant is also popularly extended to other birds of the sub-family Phasianinæ, as well as to species of very different families—*e. g.* in some parts of the U. S. to the ruffed grouse (*Bonasa umbellus*), etc. (See PHASIANIDÆ and PHASIANINÆ.)

Pheasant-Shell, a collector's name for the shells of *Phasianella*.

Pheasant Springs, tp., Dane co., Wis. P. 1065.

Phelan (JOHN D.), jurist; entered public life as representative in the Alabama legislature in 1833, while editor of the Huntsville *Democrat;* attorney-general of Alabama 1836–39; Speaker of the house 1839; a judge of the State circuit court 1841–51, of the supreme court 1851–53 and 1863–65; clerk of that court 1853–63 and 1865–68; and then became law-professor in the University of the South, Suwanee, Tenn.

Phelps, county of S. E. Missouri. Area, 650 sq. m. It is uneven, well wooded, and very fertile. Corn and livestock are leading products. The county is traversed by Atlantic and Pacific R. R. Ores of lead, copper, and iron abound. Cap. Rolla. P. 10,506.

Phelps, county in S. Nebraska, bounded N. by Platte River, formed since the census of 1870. Area, 550 sq. m.

Phelps, p.-v. and tp., Ontario co., N. Y., on the Auburn branch of New York Central R. R., has 5 churches, 1 bank, 1 newspaper, several malt-houses, 1 agricultural steam-engine manufactory, rich deposits of gypsum, and stores. Here is also the most extensive dépôt for peppermint and other essential oils in the world. P. of v. 1355; of tp. 5130. JOHN M. WATERBURY, ED. "CITIZEN."

Phelps (ALMIRA HART LINCOLN), b. at Berlin, Conn., in 1793, was the daughter of a Mr. Hart and sister of Mrs. Emma Willard. In 1817 she was married to Simeon Lincoln, a journalist who d. 1823, and in 1831 she was married to the Hon. John Phelps of Vermont. She was for many years engaged in the instruction of young ladies, and conducted with success several seminaries and schools, the best known of which was the Patapsco Institute, near Baltimore, over which she presided from 1841 to 1856, assisted by her husband until 1848, when he died. Author of a series of textbooks for schools, of which the most widely known is the *Lectures on Botany;* also published tales and didactic works, chiefly for the young.

Phelps (ANSON GREENE), b. at Simsbury, Conn., Mar., 1781; was bred a saddler, but became a merchant of Hartford. In 1815 he removed to New York, and became a successful dealer in metals; was distinguished for liberality and for his deep interest in the missionary work and other benevolent enterprises. In his will he bequeathed $371,000 to different charities and religious societies. D. at New York Nov. 30, 1853.

Phelps (AUSTIN), D. D., b. at West Brookfield, Mass., Jan. 7, 1820; graduated at the University of Pennsylvania 1837; studied divinity at Andover and New Haven; was pastor of the Pine street Congregational church, Boston, Mass., 1842–48: became Bartlett professor of sacred rhetoric in the Andover Theological Seminary in 1849; author of *The Still Hour* (1859), *Hymns and Choirs* (1860), *The New Birth* (1867); was one of the compilers of the *Sabbath Hymnbook*, the *Sabbath Hymn- and Tune-book*, etc. for use in churches and Sunday schools.

Phelps (ELIZABETH STUART), b. at Andover, Mass., Aug. 13, 1815, was daughter of Prof. Moses Stuart and wife of Prof. Austin Phelps; was married in 1842, and d. at Andover Nov. 30, 1852. Under the anagrammatical name of "H. Trusta" she wrote *The Sunny Side*, *Peep at Number Five*, and other highly popular tales, mostly for the young.

Phelps (ELIZABETH STUART), daughter of Prof. Austin Phelps and of the foregoing, b. at Andover, Mass., Aug. 31, 1844; author of *Ellen's Idol* (1864), *Up Hill* (1865), *Mercy Gliddon's Work* (1866), *The Gypsy Series* (4 vols., 1866–67), *The Gates Ajar* (1868), *Hedged In* (1869), *Men, Women, and Ghosts* (1869), *The Silent Partner* (1871), and of frequent contributions to periodicals.

Phelps (JOHN SMITH), b. at Simsbury, Conn., Dec. 22, 1814; educated at Trinity College, Hartford; studied law; removed to Springfield, Mo., 1837; was chosen to the legislature 1840; sat in Congress without interruption from 1845 to 1863; was for a short time colonel of volunteers 1861; appointed military governor of Arkansas 1862; was a delegate to the Loyalists' convention at Philadelphia 1866, and became a commissioner to settle the war-claims of Indiana 1867.

Phelps (JOHN W.), b. in Vermont Nov. 13, 1813; graduated at the U. S. Military Academy, and appointed brevet second lieutenant of artillery July, 1836; captain 1850; was engaged in the Florida war, and in garrison and on frontier duty until the war against Mexico 1846–48, throughout which he served, and was brevetted captain for gallantry at Contreras and Churubusco, but declined. Resigned Nov., 1859. In the civil war he was appointed colonel of the 1st Vermont Vols. May 2, 1861, and two weeks later brigadier-general U. S. volunteers. During this month he took possession of Newport News. In November he accompanied Butler's expedition to the Gulf of Mexico; took possession of Ship Island, Miss., and cooperated with the navy in the capture of the forts below New Orleans and of the city, after which he was stationed above New Orleans, where he was the first to organize and arm negro slaves as soldiers, for which act he was declared an outlaw by the Confederate government. His action not being approved, he resigned his commission Aug. 21, 1862, and returned to Brattleboro', Vt., where since 1865 he has been vice-president of the teachers' association, and wrote *Secret Societies, Ancient and Modern*.

Phelps (OLIVER), b. in 1749 at Windsor, Conn.; became a successful merchant of Granville, Mass., and was in the commissary service of Massachusetts during the Revolution. He was one of the partners in the "Phelps and Gorham purchase" of 1788, by which the State of Massachusetts sold for $1.000,000 a tract of 2,600,000 acres now in eight counties of Western New York. This was a portion of a region of about 6,000,000 acres which New York ceded to Massachusetts at the Hartford Convention of 1786. Phelps and Allen were to pay for the land in the "consolidated securities" of that time, but a rise in the price of these securities prevented the complete fulfilment of the agreement, and they gave up a part of the lands. Phelps opened at Canandaigua (1789) a land-office, and invented a system of townships and ranges which, with modifications, has been generally adopted in surveying U. S. government lands. In 1795, Phelps and others bought of Connecticut the "Western Reserve" in Ohio, about 3,300,000 acres. He became a judge in a State court, and was in Congress 1803–05. D. at Canandaigua, N. Y., Feb. 21, 1809.

Phelps (SAMUEL SHETHAR), A. M., b. at Litchfield, Conn., May 13, 1793; graduated at Yale 1811; was appointed a paymaster in the army 1814; became a highly able and successful lawyer of Middlebury, Vt.; a judge of the State supreme court 1831–38; U. S. Senator 1839–51 and 1853–54. D. at Middlebury, Vt., Mar. 25, 1855.

Phelps (SYLVANUS DRYDEN), D. D., b. at Suffield, Conn., May 15, 1816; graduated at Brown University in 1844; studied divinity at New Haven; was ordained pastor of the First Baptist church, New Haven, Conn., in 1846. Author of *Eloquence of Nature, and other Poems* (1842), *Sunlight and Heartlight* (1856), *Holy Land* (1863), *Poet's Song* (1867), *Bible Lands* (1869), etc., and proprietor and editor of the *Christian Secretary*, Hartford, Conn.

Phelps (THOMAS S.), U. S. N., b. Nov. 2, 1822, in Maine; entered the navy as a midshipman in 1840; became a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1865, a captain in 1871; was engaged in many skirmishes on the rivers of Virginia and North Carolina in 1861 and 1862, and commanded the Juniata in the second

Fort Fisher fight; recommended to the department by Rear-Admiral Porter. FOXHALL A. PARKER.

Phelps (WILLIAM FRANKLIN), M. A., an American educator and author, b. Feb. 15, 1822, at Auburn, N. Y.; graduated at the State Normal School, Albany, in 1845, and at Union College, Schenectady, in 1851. For several years he was an instructor at the normal school above named; in 1855 was elected principal of the State Normal School at Trenton, N. J., and in 1856 was also placed in charge of the Farnum Preparatory School at Beverly, a branch of the normal school, jointly endowed by the State and Paul Farnum, a private citizen. Prof. Phelps held these important trusts until 1864, when he was elected president of the First State Normal School, Winona, Minn.—an office he still holds (1876). His reports on normal schools in New Jersey and Minnesota form two large volumes, and have attracted much attention both in our own and foreign countries. In 1875 he published his *Teacher's Handbook*, a professional work that has been received with marked favor by the educators and the press of the U. S. He is now engaged in the preparation of a *Manual for Country School Teachers*, and another work, entitled *The Art of Illustration*, for the use of teachers. In 1875 he was elected president of the National Educational Association for the Centennial year, and was also president of the International Educational Congress held at Philadelphia July 17–18, 1876.

Phelps (WILLIAM WALTER), b. at New York Aug. 24, 1839; graduated at Yale College with high honors 1860; studied in Europe; graduated with valedictory honors at Columbia College Law School; commenced the practice of law, residing at Eaglewood, N. J.; became a director of several banks, trust companies, and railroads; was chosen fellow of Yale College by the alumni of that institution July, 1872; was a prominent member of Congress 1873–75, and failed of re-election by a few votes.

Phelps City, p.-v., Atchison co., Mo., on Missouri River and Kansas City St. Joseph and Council Bluffs R. R. P. 252.

Phenic Acid. See PHENOL and CARBOLIC ACID.

Phenicine, or **Phenyl Brown,** a coloring-matter first prepared by Roth in 1865 by the action of nitro-sulphuric acid on phenol (carbolic acid). The acid is added in successive portions to the crystallized phenol, the mixture being cooled after each addition as long as red fumes are evolved. The whole is then poured into cold water, and the precipitate of phenicine washed and dried. Phenicine is a brown amorphous powder, slightly soluble in water, very soluble in alcohol, ether, and acetic acid. With alkalies it forms a fine violet-blue solution, which is changed to brown by the slightest excess of acid. It dissolves also in lime-water. It consists of two coloring-matters—one yellow dinitro-phenol ($C_6H_4(NO_2)_2O$), the other a black, humus-like body, both possessing the same tinctorial properties. Phenicine dyes silk and wool without the aid of mordants. On submitting the dyed silk or wool to the action of potassic chromate, or, better, cupric chromate acidulated with sulphuric acid, the color changes to a fine garnet-red. Cupric nitrate produces a similar change, but with less intensity. Cotton mordanted with sodic stannate or tannin readily absorbs phenicine, and acquires a deep purple on subsequent immersion in hot potassic chromate, but the color is changed to blue by alkalies, and easily destroyed by soap. Strong nitric acid changes phenicine into a resinous paste, which dissolves in ammonia, forming a brown solution which dyes silk and wool somewhat like archil. C. F. CHANDLER.

Phe'nix, p.-v., Kent co., R. I.

Phe'nol ($C_6H_6O = C_6H_5OH$), **Phenic Acid, Carbolic Acid, Phenyl Hydrate, Phenylic Alcohol,** or **Coal-tar Creosote,** discovered in coal-tar by Runge, produced by the dry distillation of salicylic acid, either alone or mixed with caustic lime or baryta; of gum-benzoin, of the resin of *Xanthorrhœa hastilis*, of quinic acid, or of chromate of pelosine. It is formed when anisol is heated with concentrated hydriodic or hydrochloric acid to 130°–140° C.; by boiling the sulphate, nitrate, or hydrobromide of diazobenzene with water; by fusing potassic phenyl-sulphite with excess of potash; by heating acetylene with fuming sulphuric acid, forming the acid $C_2H_2SO_3$, and fusing this with an excess of potash; and by heating monochlorobenzene (C_6H_5Cl) with sodic hydrate. It is found in small quantity in the products obtained by passing the vapor of alcohol or acetic acid through a red-hot tube, or by distilling glycerine with calcic chloride or zinc chloride. Castoreum owes its peculiar odor to phenol. The urine of the cow, horse, and man yield it in small quantities. Commercial creosote often consists entirely of phenol, but the true creosote from wood is a totally different substance.

Preparation.—Phenol is prepared from coal-tar. The tar is separated by fractional distillation into (1) light oil of coal-tar, crude coal-tar naphtha; (2) heavy oil of coal-tar, "dead oil;" (3) anthracene oil; (4) pitch which remains in the still. From the light oil the phenol is most easily prepared. The oil is rectified by distilling with a current of steam, and leaves behind a portion known as "naphtha tailings," which contain about 15 per cent. of phenol, with very little of its homologues cresol, C_7H_8O, and phlorol, $C_8H_{10}O$. These tailings are agitated with caustic soda, the sodic compound is decomposed by an acid, and the crude phenol thus obtained as a separate layer is rectified by distillation. To remove the last portions of water the phenol is either heated to near its boiling-point, and dried by passing a current of dry air through it, or it is rectified over anhydrous cupric sulphate. The crystallization is accelerated by dropping into the liquid phenol a few crystals or fragments of the solid phenol. The small quantity of phenyl sulphide, which often gives to phenol a very offensive odor, may be separated by distillation with a little litharge. From dead oil it is more difficult to obtain pure phenol, owing to the presence of much cresol. But the mixture of the two, which is better than pure phenol for disinfecting purposes, is readily obtained. The dead oil is agitated with caustic soda, and the heavy layer of the sodic compound is decomposed by an acid. The crude mixture of phenol and cresol thus obtained is subjected to fractional distillation, rejecting the first and last portions of the distillate. By careful fractioning the pure phenol can be separated from the cresol, or by selecting the portion which boils between 366° and 370° F., dehydrating it with cupric sulphate, and placing in it a few crystals of phenol. Dead oil contains from a trace to perhaps 12 per cent. of phenol, cresol, etc., the "tar acids," according to the part of the distillate it represents, the entire product of dead oil averaging about 5 per cent.

Properties.—Phenol occurs in long colorless needles or in white crystalline masses, sp. gr. 1.065, melts at 93°–95° F., and boils at 368°–370° F. The crystals deliquesce on exposure to the air by absorbing a trace of water. A lump of fused calcic chloride causes the liquid to solidify. Phenol does not redden litmus. It smells like wood-tar creosote, and attacks the skin like that substance. It dissolves in about 20 parts of water, and mixes in all proportions with alcohol, ether, and strong acetic acid. It unites with camphor, forming a liquid. Shaken with one-fourth its weight of water and exposed to 40° F., a hydrate ($2C_6H_6O.H_2O$) crystallizes in large six-sided crystals. The aqueous solution of phenol coagulates albumen and preserves animal substances from decomposition. It even removes the fetid odor from meat which is already in a state of decomposition. Fish and leeches die when immersed in the aqueous solution, and their bodies subsequently dry up on exposure to air without putrefying. These properties have led to the extensive use of phenol as an antiseptic and disinfectant. It is used in all grades of purities—dead oil for privy vaults, sewers, cattle-yards and cars, and purer forms for street gutters, cellars, water-closets, dwellings, clothing, etc. All grades except dead oil should be mixed with 20 to 50 parts of water before they are applied, or they may be mixed with dry slaked lime, sawdust, clay, etc. and applied in powder; the first-mentioned mixture is sold under the name of carbolate of lime. Many mixtures of carbolic acid are advertised as disinfectants which are practically worthless. A mere odor of phenol is not sufficient to prevent putrefaction. (See DISINFECTION and FERMENTATION; also "Phenol as a Disinfectant," G. Grimaud, *Comptes rend.*, lxxiii. No. 3, July, 1871, and P. C. Plugge, *Am. Chemist*, iii. 183; "What Substances are truly Disinfectants," *Am. Chem.*, ii. 400; "Experiments on Disinfectants," *Am. Chem.*, ii. 141; "The Right Use of Disinfectants," H. Letheby, *Am. Chem.*, iv. 381; "The Disinfection Question," Kletinsky, *Am. Chem.*, iv. 131; "Disinfection and Disinfectants," E. Waller, *Am. Chem.*, vi. 2.) Water containing $\frac{1}{4000}$th of phenol was found to preserve bodies at the Paris Morgue. Plugge found that 1 to $1\frac{1}{2}$ per cent. killed all the small organisms in putrefying liquids, 4 per cent. arrested and prevented alcoholic fermentation, $\frac{1}{250}$th checked and stopped lactic fermentation in milk, $\frac{1}{500}$th checked and $\frac{1}{250}$th prevented peptonification of albumen. He considers phenol superior to ferrous sulphate, chloride of lime, chlorine, permanganates, and mineral acids. Dead oil has been extensively used for preserving timber. (See report of T. J. Cram, *Am. Chem.*, ii. 332.)

Phenol is highly poisonous except in an extremely dilute solution. The best antidote is olive oil, administered in large quantities. Sulphuric acid converts phenol into phenyl-sulphuric acid. Strong nitric acid converts it into trinitrophenic acid, PICRIC ACID (which see), an important dye, $C_6H_3(NO_2)_3O$. Weaker acid forms mono- and dinitrophenic acid. By the action of nitro-sulphuric acid,

added in small quantities to an excess of phenol, PHENICINE (which see) is formed. Chlorine and bromine act upon phenol, forming substitution-products. Standardized bromine-water is used as a quantitative test for phenol. An alcoholic solution of phenol is turned brown by an alcoholic solution of ferric chloride; wood-tar creosote gives an emerald green color under like conditions. Passed in vapor over zinc-dust, phenol yields benzol, C_6H_6. Phenol solutions boiled with a solution of mercurous nitrate assume a deep red color; $\frac{1}{20000}$th gives a very distinct reaction. A solution of phenol mixed with one-fourth its volume of ammonia and a few drops of a $\frac{1}{20}$th solution of bleaching-powder, and gently warmed, becomes blue (green if very dilute); sulphuric and hydrochloric acids change to red; $\frac{1}{4000}$th of phenol gives a strong blue. When a solution of 6 per cent. of potassium nitrite in concentrated sulphuric acid is added to a mixture of equal volumes of phenol and concentrated sulphuric acid, the solution becomes first brown, then green, and finally deep blue. By the action of potassic cyanide on phenol a potassic isopurpurate is formed, which is the beautiful dye "grenate brown;" it is explosive by friction when dry. By treating phenol with sulphuric and oxalic acids an important scarlet dye is obtained, known as coralline, aurine, rosolic acid, PÆONINE (which see), etc. By heating pæonine with aniline a blue dye, azuline, is obtained. Phenol unites with alkalies and other bases, though it is an alcohol, not an acid. On heating the soda compound in carbonic acid, half the phenol distils off, leaving a sodic salicylate, which is now the source of the valuable salicylic acid.

(See *Watts's Dict.*, vol. iv., 1st and 2d Suppl., articles "Phenol," "Pæonine," "Aurine," "Coralline," and "Rosolic Acid;" *Wagner's Technology*, p. 580; paper by F. C. Calvert in *Chem. News*, xvi., 297; and paper by Dr. E. R. Squibb in *Proc. Am. Pharm. Ass.*, 1868.) C. F. CHANDLER.

Phenol Colors. See PHENOL.

Phenols, a class of bodies formerly called secondary alcohols. They are derived from the aromatic hydrocarbons by substituting hydroxyl for hydrogen. Benzol (C_6H_6) yields the primary phenol, C_6H_5OH. Toluol or methyl-benzol (C_7H_8 or $C_6H_5(CH_3)$) yields cresol (C_7H_8OH or $C_6H_4OH(CH_3)$), which is not identical with benzyl alcohol, C_7H_8OH or $C_6H_5(CH_2OH)$. C. F. CHANDLER.

Phenyl (C_6H_5), a monatomic radical, which exists in aniline, phenol, etc.

Phenylamine. See ANILINE.

Phenylic Acid. See PHENOL.

Phe'ræ, an ancient city of Thessaly, in a fertile plain near Mount Pelion, 10 miles W. of its port, on the Pagasæan Gulf, on the site of the modern *Velestino*. It was a splendid and prosperous town, and under the government of the tyrant Alexander, notorious for his cruelty, it became the controlling power of the whole of Thessaly and played a conspicuous part in Greek politics. But the treachery of Alexander induced the Thebans (see PELOPIDAS and EPAMINONDAS) to aid the oppressed Thessalians; and after the battle of Cynoscephalæ his dominion was again confined to the city and district of Pheræ. He was, nevertheless, still strong enough to land troops in Attica and plunder Piræus. In 359 B. C. Alexander was murdered, and in 352 B. C. Pheræ passed with the rest of Thessaly into the hands of Philip of Macedon.

Pherecydes OF LEROS, a Greek logographer, flourished in the fifth century B. C., and lived in Athens. Of his great work on Greek mythology, often quoted, though under various titles, by ancient writers, the existing fragments have been collected and edited by Müller, in *Historicorum Græcorum Fragmenta* (Paris, 1840).

Pherecydes OF SYROS, a Greek philosopher of the sixth century B. C., was a rival of Thales and the teacher of Pythagoras. Of his work, which bears the mystical title Ἑπτάμυχος, and seems to have been a product of poetical intuition rather than of philosophical reasoning, some fragments are still extant, and have been edited by Aug. Wolf in his *Literarische Analekten* (Berlin, 1817).

Phid'ias, the greatest sculptor of Greece, perhaps of all ages and lands, b. at Athens 500 B. C.; was taught by Hegias and Ageladas; his career as a sculptor (he gave but brief attention to painting) began under Cimon, but reached its glory under Pericles, with whose splendid epoch his name is indissolubly associated. He was a man of lofty soul, majestic intellect, consummate knowledge of the principles of his art, and wonderful skill in design. The buildings that crowned the Acropolis at Athens are believed to have been erected under his direction, and much of the work—how much cannot be known—may be ascribed to his hand. The great statue of Athene in the Parthenon, of gold, ivory, and precious stones, was, there is little room for doubt, executed by him. It was finished 437 B. C. Later, he completed the colossal statue in gold and ivory of Jupiter in the temple of Olympia at Elis. It sate enthroned in the temple for 800 years, and was finally destroyed by fire about 475 A. D. Of these works, which commanded the admiration of all Greece, and have given the master an immortal renown, nothing but the fame remains. An imitation of the Jupiter's head is preserved in the Vatican Museum. Much work has been attributed to Phidias which there is reason to think he neither executed nor designed. Tradition gave him no less than nine statues of Athene in different cities—one of bronze on the Acropolis of Athens, a group of bronze figures at Delphi, and other works, a description whereof must be sought in books on sculpture. His share in the Elgin marbles is disputed. The incidents in the life of Phidias are uncertain. That he met great changes of fortune from the fickleness of his countrymen, that he shared the popularity and the unpopularity of his patron, Pericles, was accused of crimes against the state, embezzlement, and even impiety, and imprisoned, may be believed. He is supposed to have had a long life, and to have died from poison about 432 B. C. (See K. O. Müller, Flaxman, Winckelmann, Lübke.) O. B. FROTHINGHAM.

Phigali'an Marbles, a sculptured frieze from the cella of the temple of Apollo at Bassæ, near Phigalia, in Arcadia. It represents the struggles of the Centaurs and Lapithæ. By an act of vandalism it was removed in 1814 to Great Britain, and is now in the British Museum. The temple itself is one of the best preserved in Greece.

Philadelphia. See ALA-SHEHR and AMMAN.

Philadel'phia, county of Pennsylvania, bounded E. by the Delaware River, is identical in area and population with the city of PHILADELPHIA (which see).

Philadelphia, p.-v., cap. of Neshoba co., Miss.

Philadelphia, p.-v. and tp., Jefferson co., N. Y., on Rome Ogdensburg and Watertown R. R. P. of v. 384; of tp. 1679.

Philadelphia, the principal city of Pennsylvania, in population second in the U. S., and largest in territorial area, is situated on the W. bank of the river Delaware, commencing on the S. at Bow Creek, about 2½ miles below the mouth of Schuylkill River, and extending along the Delaware to Poquessing Creek, about 5 miles below Bristol, in Bucks co. Distance N. E. of Washington, 136 miles; S. W. of New York, 87 miles. By the course of the Delaware, which inclines from the extreme point of the southern boundary toward the eastward, then nearly N. and N. E., the front of the city along the river is 23 miles. The shape is irregular, and presents upon the map a rough resemblance to the head of a knight with helmet, and visor up. The western and a portion of the southern boundaries are Montgomery and Delaware cos. On the N. the city is bounded by Montgomery co. and a portion of Bucks. In 1763–64 the celebrated English surveyors, Charles Mason and Jeremiah Dixon, who were sent over to fix the boundaries between Pennsylvania and Maryland, placed the initial point of their work at the most southerly portion of Philadelphia as then laid out, a distance of about 7 miles N. of the present southern boundary. They found the situation to be 39° 56′ 29.1″ N. lat.; the longitude of the City Hall, between the Delaware and the Schuylkill, is 75° 9′ 54″. The principal streams which flow through the city are Schuylkill River, Wissahickon and Mill creeks (which empty into the Schuylkill), Hollander's, Cohocksink, Gunner's or Aramingo, Frankford, Wissinoming, and Pennypack creeks, which empty into the Delaware. The southern part of the territory on the Delaware and on both sides of the Schuylkill is low. Between Point Breeze and Greenwich Point the land rises between the Delaware and Schuylkill, and a plateau commences, gradually rising and extending as high as the parallel of Fairmount, at which there is a moderate rise between the two rivers, which continues until in the upper part of the city, at Germantown and Chestnut Hill, the land lies at a considerable altitude above the level of tide-water. The ground on the W. side of Schuylkill River rises gradually from the southern portion, and becomes hilly opposite Fairmount. N. of that point the banks of the river are lofty up to the northern boundaries. The area is 129.382 sq. m., or 82,603 acres. From the size of the city the character of the population is urban, suburban, and rural. Portions of the town are thickly settled, governed by the interests of a great metropolis. In other sections town and country interests mingle, and in yet others the population is governed by agricultural customs and all the cares of the country. The city includes what was once the county, in which were several villages of considerable size. The principal of these were Frankford, Holmesburg, Germantown, Chestnut Hill, Manayunk, and Hamilton and Mantua, now included in West Philadelphia. The streets in the well-built parts of the city are paved with granite

blocks and cobble-stones, the footways with flagstone and brick. The houses are in great majority of red brick, the sombre appearance of which is gratefully relieved by doorways, window-heads and sills, and steps of white marble, of which latter material there is abundance a few miles distant from the city. Of late years the painful uniformity in the style of building has been broken up by the introduction of other materials—brownstone, sandstone, green serpentine, white and blue marble, iron, and light-colored brick. Almost every house of modern construction, however humble it may be, is provided with a bath-room supplied with hot and cold water from a kitchen range, and there are water-closets, small portable heaters in the cellar, and gas-fixtures in every room. The baths supplied by the city waterworks in 1875 were 51,214—a number far exceeding any other city in the world. At the same time 122,961 dwelling-houses were supplied with water from the city works. Every house has space adjoining for a yard or a garden, so that ventilation can be secured. By a law passed in 1855 no new house can be built on a street of less than 20 feet in width, and every dwelling-house must have adjoining it on the side or in the rear not less than 12 feet square of open space. In the number of dwelling-houses Philadelphia exceeds any city in America, and perhaps is only surpassed in that particular in Europe by the city of London. In 1870, according to the U. S. census, there were 112,366 dwelling-houses in Philadelphia, in which lived 674,022 persons, of whom 490,398 were native and 183,624 foreign-born. The whites were 651,854, the colored 22,147, Chinese 13, Indians 8—an average of 6.01 persons per dwelling-house. There were at that time 127,746 families—an average of 5.28 per family. Since the census of 1870, according to the returns made by the building inspectors, there were built in the year 1870, and up to the end of 1875, 28,249 new dwelling-houses and 4117 other buildings. In Mar., 1876, the city police, under orders of the mayor, counted the dwelling-houses, and returned the number at 143,936. By municipal census Apr. 1, 1876, the population was returned as 817,448 : males over 21, 226,070 —under, 171,998; females over 21, 246,634—under, 172,746. Total males, 398,068; total females, 419,380. The buildings of all kinds are at least 150,000. The tenement-house scarcely exists in the city; the greater portion of the population includes but a single family to each house; and these advantages, with incidental comforts, have gained for Philadelphia of late years the pleasant appellation of "the City of Homes." There are over 600 building associations in operation, having a very large aggregate capital, which is derived from the payments of the members, so that the borrowing of money for building purposes is easy. The system of selling land on ground-rent, by which the purchaser becomes possessed of a lot of ground upon no other obligation than to pay in the shape of rent the annual interest on the original value of the ground, has greatly facilitated building operations. The purchaser is free from the danger of foreclosure, as would be the case upon mortgage, and the seller cannot demand the principal, yet is compelled to take it and extinguish the rent whenever offered.

The streets were originally laid out so as to run nearly due westward from Delaware River, intersected by other streets running nearly N. and S. This plan has been generally carried out, although in some portions of the city the directions of the streets are different in accordance with the formation of the ground. The streets, however, cross at right angles almost everywhere. There are about 1200 miles of streets opened, and over 700 paved. The Schuylkill is crossed by 14 bridges, 3 of which are for special railroad use; 3 for railroad and general use; 8 are entirely for city travel. The finest bridge is at Girard avenue, in the Park. It is of iron, of light and handsome construction, is 1000 feet long and 100 feet in breadth, being wider than any other in Europe or America. The sidewalks are 16½ feet each, and the roadway 67 feet wide. The Spring Garden (or Callowhill) street bridge carries two streets, one upon the upper deck and one upon the lower. It is of iron and very handsome in appearance. It is 1290 feet long and 48 feet wide. The upper floor, which connects Spring Garden street, is 32 feet above the lower floor, which continues Callowhill street. The whole length of the bridge, abutments, and approaches is 2730 feet. At Chestnut street is a handsome iron and stone bridge 1528 feet long, of two spans of 398 feet each. South street bridge is built with a draw, which opens two water-passages of 77 feet each. Its length with its approaches is 2419 feet. The Market street bridge, which was the oldest in the city, being finished in 1804, was totally destroyed by fire Nov. 20, 1875. A practicable structure was built at the same place by the Pennsylvania Railroad Co. in 28 days. The new construction is larger and better than the old, and, although a temporary affair, seems strong enough to last for twenty years.

The streets in the built-up part of the city are lighted with gas; at the end of 1875 there were 10,729 public lamps. The gas-mains (city and Northern Liberties works) extended 672 miles; the street water-mains at the beginning of 1876 were 662 miles in extent; drainage is carried off by 136½ miles of sewers and culverts. Means of transportation between various parts of the city are particularly necessary in consequence of the wide extent of ground which it covers. There are 19 horse-railroad companies, the tracks of which are laid down upon 242 miles of streets. They had in use at the beginning of 1875, 903 cars, drawn by 5490 horses, and in the year 1874 carried 76,465,489 passengers. The receipts from passengers alone were $4,355,231.14. There is a good deal of local travel by the large railroads operated by steam. They convey numerous passengers daily to and from the stations on the lines of their roads within the city. Water is supplied by 6 pumping-works operated by steam and water-power. There are 7 great reservoirs, and a very large one, which is to have a capacity of 750,000,000 gallons, is partially completed in the East Park. Fairmount, Schuylkill, Belmont, and Roxborough and Chestnut Hill works are upon or near Schuylkill River. The Delaware works furnish water from Delaware River to the north-eastern portion of the city. Another pumping-station has been projected upon the Delaware above Frankford, and the construction authorized. In 1875 the city works supplied 15,097,160,906 gallons. The price of water is low; the assessments for water-rents in the year 1875 were $1,025,278.50; for 1876, $1,093,864. The gas manufacture is principally by the city works at Market street, Callowhill street, Point Breeze on the Schuylkill, and Manayunk, 21st Ward. New works will shortly be erected on the Delaware above Port Richmond. The Northern Liberties gasworks are upon Laurel street below Front. The city works manufactured in 1875, 1,873,192,000 cubic feet of gas, which was an increase over 1874 of 106,924,000; the Northern Liberties works manufactured 87,744,590 cubic feet; total, 1,960,936,590 feet. Gas is supplied since Mar. 1, 1876, at $2.15 per 1000 cubic feet. The receipts for sale of gas by the city works were $2,877,348 in 1875. The public lights consumed 313,373,748 cubic feet. The total number of lights supplied by the city works was 1,191,393. The average illuminating power of the city gas was equivalent to 16.61 candles.

The food-supply has always been abundant and varied. A rich agricultural and grazing country surrounds the city, and the means of access to the markets are easy. Meats, poultry, fish, oysters, butter, eggs, and vegetables of all kinds suitable to the seasons are plentiful, and the prices moderate. It is impossible to obtain statistics of the food-supply, the sources being so many. The trade is not only in the hands of butchers and dealers in provisions, but in those of countrymen, fishermen, hucksters, etc. coming directly to market. The meat consumption is estimated at a weekly average of 4500 beef cattle, 15,000 sheep, and 10,000 hogs. At the droveyards in 1875 there were sold 141,000 beeves, 11,720 cows, 491,500 sheep, and 243,300 hogs. There are 28 market-house buildings belonging to corporations specially erected for use as places for the sale of food and provisions. Some of these are very large, costly, and elegant, being attractive and stately in exterior appearance, and within secured from all unpleasant odor by lofty ceilings and the ventilation which is ensured. The corporation of the city owns seven street-markets, relics of the past, which occupy the middle of highways in which they are located. They are together about 2½ miles in extent.

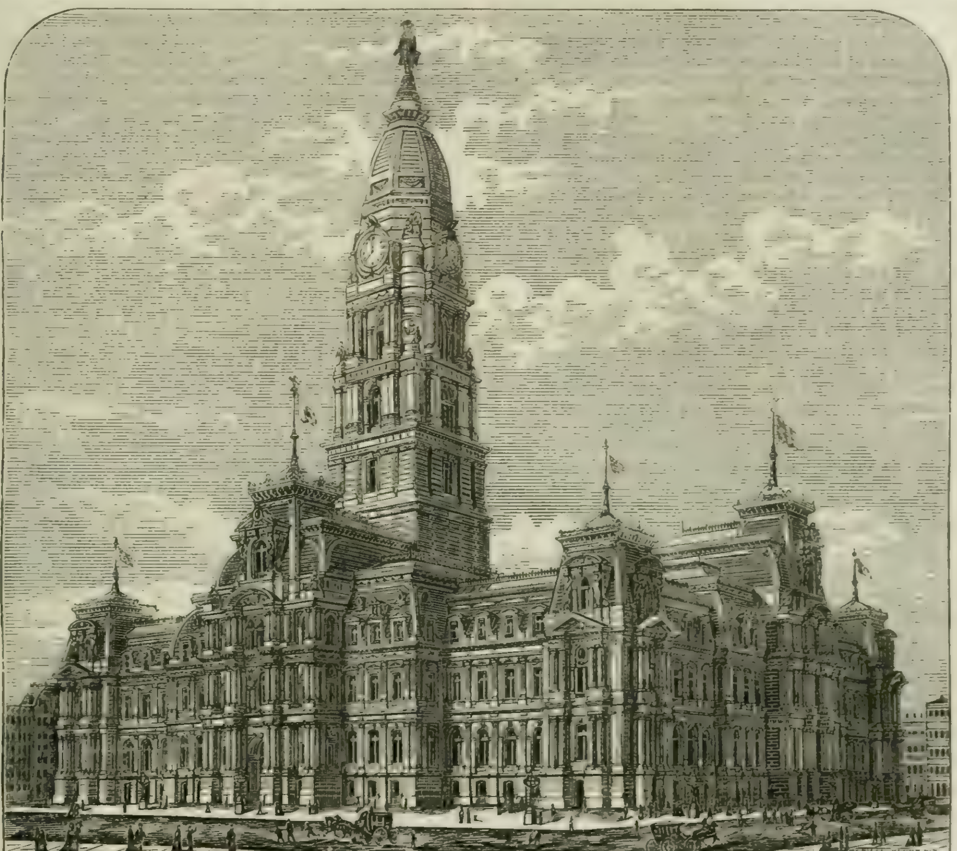
The health of the population is much improved by the manner of building, the amount of ventilation in private houses, the freedom allotted to each family, the supply of water, and the system of drainage. In 1875 the total number of interments in the city was 17,805 persons. Of these, 9100 were males and 8705 females; 16,871 white, 934 colored. The adult deaths were 8716; children, 9089. According to the estimate of the board of health of the population July 1, 1874, the death-rate was 19.66 per 1000 persons. The English registrar-general in 1872 found the highest death-rate to be at Madras, 37.6; Vienna, 34.4; New York, 30.1; Paris, 24.4; London, 22.7. The number of registered births in 1875 was 17,933; number of registered marriages, 6144.

The city government is controlled by a mayor and councils. The city councils sit in Independence Hall, occupying the second story. The mayor's office is in City Hall, corner Fifth and Chestnut streets. Various other public offices are upon the square, but in consequence of want of space several are placed in other parts of the city. A new city hall was commenced at Broad and Market streets in Aug., 1871, and is partially built. It will be of granite and marble, 470 feet in length from E. to W., and 486½

feet from N. to S. It is to be surmounted by a tower crowned by a statue of William Penn at the altitude of 450 feet—one of the highest towers in the world. The design is in the Renaissance style, and very rich and elaborate. The area is larger than that occupied by the buildings of the U. S. Capitol at Washington.

The total of city expenditure for 1875 was $13,446,451.73. Total receipts, including balance from 1874, $15,774,375.33, with a cash balance Jan. 1, 1876, of $2,463,502.72. This return does not include a floating debt unpaid at the end of 1875. The amount of funded and floating debt Jan. 1, 1876, was $69,716,524.17; assessed value of taxable property Jan. 1, 1876—at full rate, $537,213,282—tax, $2.05 per $100; suburban, $38,031,673—rate, $1.36¾; farm, $20,168,423—rate, $1.02½; aggregate tax, $11,739,364.81. In addition, there was a public-building tax of 10 cents per $100, equal on all property—making the full rate, city, $2.15, suburban, $1.46¾, farm, $1.12½.

The police force is under the control of the mayor. It numbered at the end of 1875, 1 chief of police, 1 fire marshal, 4 captains, 27 lieutenants, 25 turnkeys, and 1200 patrolmen. The force is to be considerably increased in 1876. There are 24 police districts and 26 station-houses, the Delaware and Schuylkill harbor police having stations of their own. There are 24 magistrates' courts for police and civil causes. There are 4 courts of common pleas, with 3 judges each, who sit at the State-house and have 7 court-rooms for their use. These judges by turn sit in the quarter sessions and oyer and terminer for the trial of criminal cases, having two court-rooms. The orphans' court has 3 judges. The supreme court of Pennsylvania sits in the State-house in full bench during several months of the year. The U. S. circuit and district courts are held in the post-office building, entrance on Library street near Fifth. The fire department consists of 36 companies, accommodated at 35 fire-stations, and had in Jan., 1875, 34 steam fire-engines, 4 hand-engines, 13 hose-carriages, 5 hook-and-ladder trucks, fuel-wagons, etc. The department consists of 1 chief engineer and 5 assistants, with a total force of 389 men and 123 horses. A signal



New City Buildings.

fire-alarm is connected with a police telegraph. There were 202 fire-alarm telegraph-boxes in Jan., 1876, and 5636 fire-plugs. The total number of fires in 1875 was 669, with an estimated loss of $1,193,970.05, covered by an insurance of $6,545,789. A fire-patrol service is maintained in the central part of the city at the expense of insurance companies, and is supplied with wagons and horses, gum and linen covers; it is the duty of the men to attend fires, rescue property, and cover goods to prevent them from being wet.

The manufactures are extensive, and greater in the variety of articles made, the number of persons employed, and the value of materials used than in any other city in the Union. New York exceeded Philadelphia in 1870 only in the value of the articles manufactured. The plentifulness of water, proximity to coal-fields, together with the breadth of the space available for large manufacturing establishments, and the comfort which mechanics may enjoy with their families, have contributed to this result. In 1870 the census statistics, revised by the board of trade, showed that the number of establishments in the city and vicinity operated upon Philadelphia capital and account was 8579. They employed 152,550 hands, of whom 100,661 were males above the age of 15 years, 40,760 females above the same age, and 11,129 children and youth. The amount paid in wages during that year was $68,647,874; capital employed, $204,340,637; value of materials used, $193,861,297; value of manufactured productions, $362,484,698. There were in the census tables nearly 100 classes comprising articles made in the city. The increase since 1870 can only be estimated. In the latter year there were in use 2177 boilers and steam-engines of 57,304 horse-power, and 59 water-wheels of 2696 horse-power. The boiler inspector of the city reports that there were 3068 steam-boilers in use at the beginning of 1876, an increase of 891, or over 33 per cent., in five years. At this ratio the number of manufacturing establishments at present would be nearly 11,500. Concerning the capital employed, a safe estimate might place it in 1876 at from $225,000,000 to $250,000,000.

The commerce of the port has been increasing for several years. The foreign trade shows the following results:

Years.	Exports.	Imports.
1870	$16,640,478	$14,952,371
1871	20,688,551	19,564,558
1872	21,484,803	26,304,051
1873	29,633,186	29,186,925
1874	29,878,911	25,004,748
1875	31,936,727	23,457,334

The amount of duties received at the custom-house in 1875 was $8,164,518.71. The vessels employed in the foreign

trade which entered the port were 501 American, of 563,528 tons, and 604 foreign, of 388,751 tons. The American vessels brought in goods worth $14,850,751; foreign vessels, $8,606,583; total, $23,547,334. Entries coastwise with foreign goods, tonnage 536,092. The total of arrivals, coastwise, was 8238 vessels; foreign, 1126; total, 9364 vessels. The principal importations were from England, value, $12,318,666; Cuba, $6,111,401; Belgium, $1,266,933. Of the articles imported the most valuable were cotton manufactured goods to the value of $1,122,292; tin in plates, $1,805,229; wool, manufactured, $2,575,986. There came through the port of Philadelphia destined to interior parts goods worth $1,123,975. The principal exports in 1875 were—of breadstuffs, petroleum (crude, refined, naphtha, and benzine), provisions, leaf tobacco, cigars, snuff, and cotton in bales, $17,819,798. Of the exports, more than one-half in value went to England, Scotland, and Ireland, $5,325,216 to Belgium, and $2,742,783 to Germany. There was a large increase in the exportation of breadstuffs and provisions over former years. In 1871 the value of the breadstuffs shipped from the port was $4,148,595; in 1874 it was $8,159,371; in 1875, $9,222,971. The increase of the trade of the port has been very much assisted by the establishment of new lines of steamships to Europe. The American Steamship line, plying between Philadelphia and Liverpool, and the International and the Red Star lines, from Philadelphia to Antwerp, have direct communication with all ports of the U. S., the Pennsylvania R. R., carrying freight to the ships' sides, affording great facilities for loading and unloading. The shipment of grain is aided by the use of elevators, one of which is at the dépôt at the foot of Washington avenue, and the other at the International Navigation docks at Girard Point on the Schuylkill. The Washington avenue elevator has storage capacity of 500,000 bushels, and can load three vessels at once. The Girard Point elevator is 200 feet long, 100 feet wide, and 124 feet high to the peak of the roof. It has a capacity of 800,000 bushels, and 6 vessels can be loaded at one time. The Pennsylvania R. R. Co. has a grain-storage building on the W. side of the Schuylkill, at Market street, 550 by 125 feet, with a storage capacity of 300,000 bushels, and can unload 125 cars, containing 45,000 bushels, a day. This railroad reaches tide-water on the Delaware at Greenwich Point in the lower part of the city, has branch tracks to Gibson and Girard Points on the Schuylkill, and is carried up the Delaware to Dock street, where there is a large freight dépôt for the receipt and delivery of goods to vessels. The steamships of the American line are of the first class, built of iron at Philadelphia, and are the only steamships plying between America and Europe which fly the American flag. The departures are weekly, and 6 ships are employed. The International line to Antwerp has 2 steamships, and makes semi-monthly trips. These vessels carry the Belgian flag. There are ocean steamship lines to Boston, New York, Charleston, and Savannah, and steam lines to various places N., E., and S. by canals. The provision trade, from $341,382 in 1871, had increased in 1875 to $6,381,408. The petroleum trade is very important. In 1875 there was exported from Philadelphia to foreign countries petroleum (crude, refined, naphtha, and benzine) valued at $7,927,399. Germany, Belgium, and the Netherlands take the largest portion of this product. Coal shipments are very large from the wharves of the Reading R. R. and the Lehigh Navigation Co. The greater proportion of these shipments is for American use. In 1874 the Reading R. R. Co. brought to Philadelphia 3,140,563 tons, and shipped from Port Richmond 2,051,127. There were carried through the Lehigh Canal 792,783 tons. The Reading R. R. Co. maintains a line of 14 steam-colliers. At its extensive wharves at Port Richmond are 23 piers with docks between, so that nearly 300 vessels can be loaded with coal at the same time. From 30,000 to 40,000 tons can be loaded every day. The petroleum trade concentrates principally at Gibson's Point on the Schuylkill, and at Greenwich Point on the Delaware, where there are extensive storage accommodations and pumping machinery to carry the oil into the vessels. Navigation is kept open in winter by the service of three powerful iceboats owned by the city.

Iron shipbuilding is carried on at Cramp & Son's yard, in which the steamships of the American line were built. The Philadelphia and Reading Coal and Iron Co. occupies an immense yard for the purpose of building iron ships for its own use; it has great buildings, launching docks, dry docks, shipways, etc. There are several other establishments for building iron ships in and near the city. The Pennsylvania Warehousing Co. has a powerful steam cotton-press at the foot of Queen street on the Delaware, which is capable of pressing a bale of cotton per minute. Commercial and business interests are guarded by the Commercial Exchange and the Chamber of Commerce, which have a large building on Second above Walnut; by the Board of Trade, and by 6 special trade exchanges. The elegant Merchants' Exchange of marble at Dock and Walnut streets, originally built entirely for mercantile uses, has for some years been diverted to other purposes.

The principal railroads which have their dépôts in the city are the Pennsylvania, which operates and controls more than 2000 miles of railroad in the U. S. and runs 1000 locomotives, 25,000 freight and 5000 passenger cars. It has 2 freight and 3 passenger dépôts in the city. The business offices of the company are in Fourth below Walnut street in a very large and imposing marble building. The office of the Philadelphia and Reading R. R. Co. adjoins the former on Fourth street, and is of brownstone, presenting a stately appearance. This company owns 1400 miles of road, 400 locomotives, 16,000 coal, 3600 freight, and 225 passenger cars. The dépôts are at Port Richmond, Thirteenth and Callowhill streets, and Ninth and Green. Other railroads are the North Pennsylvania to Bethlehem and the Lehigh Valley; the Philadelphia Wilmington and Baltimore; West Chester, to the town of that name in Chester co.; West Jersey, from Camden, opposite the city, to Cape May, N. J.; and Camden and Atlantic, to Atlantic City, N. J. The Baltimore Philadelphia and New York R. R., a new line, will be opened in 1876. The Lehigh Valley R. R. is considered a Philadelphia corporation, and has its main office in the city. The North Pennsylvania and Schuylkill Navigation Cos. have large and convenient office-buildings. Coal is brought in by nearly all the railroads, and by canal and Delaware River to the Lehigh Navigation Co.'s wharves at Windmill Island, opposite the city, and by Schuylkill Canal. The Delaware and Chesapeake Canal gives access to Baltimore, and connects with the Tide-water Canal extending on the Susquehanna to Harrisburg. The Pennsylvania Canal is in good order from that point to Pittsburg. The Delaware and Raritan accommodates the trade with New York.

There are 31 national banks, with a combined capital of $17,335,000, and 10 banks acting under State charters, with a capital of $2,100,950. Of these, the Bank of North America is the oldest in the country, having been chartered by the Continental Congress Dec. 18, 1781. It occupies a fine brownstone building in the Florentine style of architecture in Chestnut street near Third. The finest bank-buildings are upon Chestnut street. The Philadelphia, formed in 1803, occupies a massive granite building. The Farmers' and Mechanics' bank-building, of white marble in the Palladian style, adjoins. A few feet farther W. the Girard building, lofty and handsome, is occupied by the People's (State) bank. The First National has a massive granite building between Third and Fourth. The Girard National bank occupies a classic structure, with Grecian front and pediment, built for the use of the first Bank of the U. S. in 1798. There are 4 principal savings fund societies, the oldest, the Philadelphia, established in 1816, occupying a fine granite building at the corner of Walnut and Seventh streets. This society accepts very small deposits, and holds in trust over $4,000,000. Three trust companies have life insurance powers, and combined capitals of $1,800,000; 5 safe deposit and trust companies occupy buildings of elegant appearance and strongly built for the security of valuables. The Fidelity, Philadelphia, and Guarantee are upon Chestnut street. The two former occupy elegant buildings of fine white marble. The Guarantee has a very solid and peculiar-looking edifice in the Venetian style, of brick, graystone, blackstone, and tiles. There are 43 fire insurance companies acting under State charters, of which the Philadelphia Contributionship, incorporated Mar. 25, 1752, is the oldest in America. There are 7 fire and marine and 12 life insurance companies. Many American and foreign companies have agencies and do a large business. The most conspicuous of these is the New York Mutual Life Insurance Co., which occupies a magnificent fire-proof building at Tenth and Chestnut, of granite and iron, four stories high, which cost $1,000,000.

The U. S. custom-house and sub-treasury occupy a building on the S. side of Chestnut street, between Fourth and Fifth, of white marble, which extends through to Library street, 119 feet wide and 225 feet deep. The porticoes are in Doric style, and the building has long been considered one of the finest specimens of Greek architecture in the world. It was originally constructed for the second Bank of the U. S. The U. S. appraisers' building, Second street above Walnut, running through to Dock, is five stories in height, built of brick and iron, and considered thoroughly fire-proof. Adjoining the custom-house is the post-office, with a front of marble in the French style, the upper stories being occupied by U. S. courts and offices. The post-office, by the hands of 227 carriers, delivered 42,590,669 mail and local letters, postal-cards, and newspapers in 1875, being an increase of over 6,500,000 missives

upon the business of the former year; 31,537,843 letters, etc. were collected from local mail-boxes, being an increase of 4,500,000. Sales of stamps, envelopes, etc. amounted to $988,630.96; the money-orders issued were 40,333, amounting to $776,057.35; orders paid, 176,674, amounting to $2,217,623.84; international money-orders issued in 1875, 3794, amounting to $65,971.67, and paid 2564, amounting to $47,220.89. Foreign letters received, 631,542; sent, 780,361, showing considerable increase over the preceding year. There are 21 sub-post-offices in the city, and 913 street letter-boxes. The present post-office is entirely too small, and a new post-office building has been begun at the corner of Ninth and Chestnut streets. The cost is limited by Congress to $4,000,000; style of architecture, French Renaissance; length of building, 428 feet; width, 152; height to top of dome, 184 feet.

The U. S. Mint, corner of Juniper and Chestnut streets, is of marble; style of building, Grecian Corinthian. During the fiscal year ending June 30, 1875, there were coined at the mint of gold, silver, copper, and nickel 37,080,440 pieces, valued at $11,514,835; fine gold bars for commercial purposes were made worth $30,383.20; silver bars, $163,787.21. The U. S. government has 2 arsenals—1 at Frankford, on Tacony Creek, grounds contain over 62 acres. It is principally used for the manufacture of cartridges and other articles; 10,500,000 cartridges were made at this arsenal during the fiscal year 1874–75. The Schuylkill Arsenal, on Gray's Ferry road, occupies about 8 acres. It is employed as a great workshop and storehouse of clothing for soldiers, including everything that they wear or use in garrison or camp life, except arms. The value of goods on storage is very great, and the disbursements for materials and wages have frequently been as high as from $14,000,000 to $20,000,000 a year. The U. S. Navy-yard is at League Island, near the mouth of the Schuylkill, distant from Independence Hall about 7 miles. It is about 2 miles in length from E. to W., and from a quarter to half a mile wide. Area, including the back channel, 923 acres; depth of water in front, 26 feet. The Delaware at that point is 2800 feet wide. The back channel is a commodious harbor for monitors and other vessels. There are large buildings and docks upon the island. The repairing basin occupies 39 acres, the fitting-out basin 40 acres, and the storage-dock basin 7 acres. This island is marked upon the oldest map known of the Delaware River, that of Peter Lindstrom (1654–55). It was bought by the city of Philadelphia in 1862 for $310,000, and presented to the U. S. government for a navy-yard. The U. S. Naval Asylum, Gray's Ferry road below Bainbridge street, is of marble, 3 stories high, and stands upon a lot of about 25 acres. There are

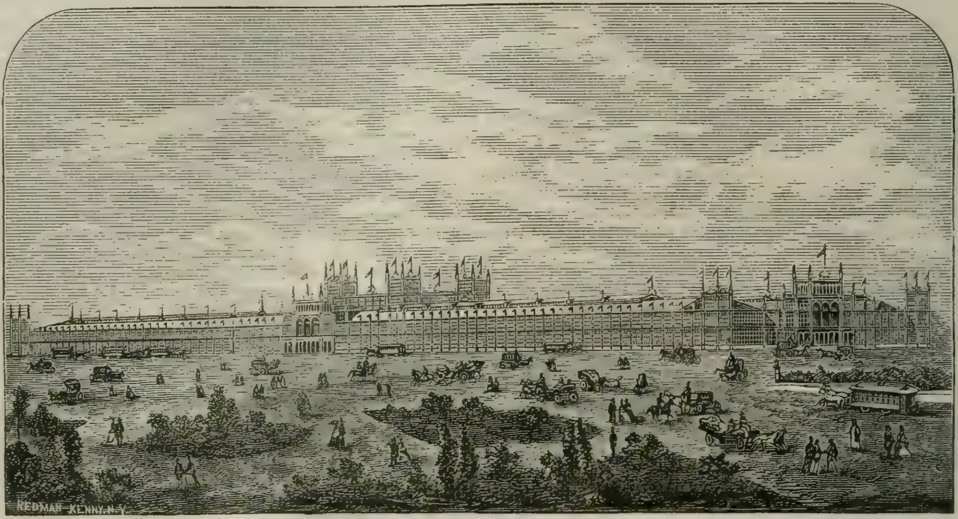
New Post-Office.

accommodations for 300 naval pensioners. The U. S. Hospital adjoining is of brick, was finished in 1868, and will accommodate 140 patients.

Among the prisons is the Eastern Penitentiary, on Fairmount avenue, of granite and stone in castellated style, 670 feet front; lot about 11 acres. The county (or Moyamensing) prison, Passyunk road near Tenth street, has a front of Quincy granite in the Tudor style of Gothic castle architecture; the female prison adjoining is of brownstone in the Egyptian style. There are cells for 400 males and 100 females. The House of Correction near Holmesburg, in the N. E. portion of the city, is massive and of great size, and built of stone. There are a central building and 8 extensive wings, with cells sufficient to hold 3000 persons. The House of Refuge for the reformation of boys and girls has 3 buildings of brick at Twenty-third and Parrish and Poplar streets. The Almshouse is on the W. side of the Schuylkill, S. of Darby road. The grounds occupy 30 acres. There are 5 main three-story buildings extending from the central buildings. One of these is occupied by the Philadelphia Hospital, the oldest in the country, founded in 1732. The insane department has constantly from 1000 to 1200 patients. The almshouse buildings hold at times a population of over 4000 persons. The cost of maintaining the institution and out-door poor in 1875 was $568,080.35; in 1874, 76,072 out-door poor were assisted.

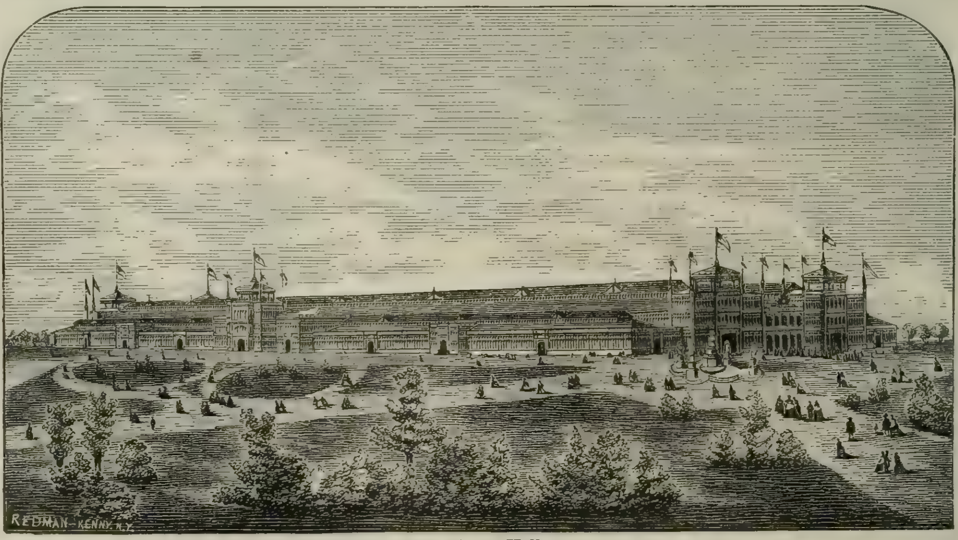
The educational institutions are many. The University of Pennsylvania, which may date its foundation from the academy founded by Franklin and others in 1749, occupies a lot of ground in West Philadelphia of more than 6 acres. The buildings are the largest and most conveniently arranged college structures in the country. The departments of science and art occupy an edifice 254 feet long by 124 feet in depth, 4 stories high, built of green serpentine and graystone in collegiate Gothic style, which is very attractive. The towers, pinnacles, gables, etc. make a fine appearance in the distance. In the same enclosure the medical department occupies another building of greenstone, in harmony with the style of the main building. There are accommodations for 600 medical students. The University Hospital, also of greenstone, occupies a portion of the ground. Girard College, for white male orphans, built under the trusts of the will of Stephen Girard, stands upon a lot of 41 acres at Ridge avenue and Nineteenth street. The main building is of marble, 169 feet long, 111 feet wide, and is surrounded on all sides by a range of fluted columns, 38 in number, 55 feet in height, 9 feet 3 inches in diameter at the base, and surmounted by richly-carved capitals. There are several outbuildings of marble for the accommodation of the professors and pupils. There are 20 professors and teachers, and in 1875 there were over 500 pupils. The cost of the building and grounds was $1,933,821.78. There are numerous other academies, schools, seminaries, and colleges in the city, charitable and under the control of religious denominations. There are 4 colleges for medical instruction, three of which—the University, Jefferson, and the Woman's College—are allo-

pathic, and the Hahnemann, homœopathic. The College of Pharmacy is devoted to the instruction of students for the business of apothecaries and druggists. There are 2 dental colleges, and a Polytechnic college devoted to instruction in engineering, mining, etc. The public schools are managed by the board of education and the school directors elected in the various sections. There were at the beginning of 1876, 198 public-school buildings, the value of which, with the appurtenant ground, was $5,288,672; school furniture a little under $290,000. There are 1 central high school for boys, 1 normal school for girls, 63 grammar, 29 consolidated, 127 secondary, 224 primary, and 47 night schools; total, 492; teachers in day schools, 1886; in night schools, 286; number of day and night school pupils in attendance, 109,695. The expenditure for the support of schools in 1875 was $1,634,653.26. The school buildings are scattered all over the city, many being of brick, but those built during late years of stone. The boys' high school is of brick; the girls' normal school is a large and handsome edifice of greenstone. The principal scientific institutions are the College of Physicians, which possesses a valuable museum and library, and the Academy of Natural Sciences, building of greenstone, at the corner of Nineteenth and Race streets, the museum of which contains 600,000 specimens of birds, shells, fishes, reptiles, mammals, with minerals, plants, etc. The collection of humming-birds alone contains more than 30,000 specimens. The Zoological Society facilitates the study of natural science at the Zoological Gardens, Fairmount Park. The grounds contain 33 acres, laid out with walks, flower-beds, etc. In the enclosure are a carnivora-house, aviary, monkey-house, eagle-house, pachydermata-house, bear-pits, restaurant, and other buildings. The cost of the buildings has been more than $200,000, and the collection of animals is large and interesting. The American Philosophical Society occupies a building upon Independence Square, in Fifth street below Chestnut. It contains a library and museum. This society originated from the Junto established by Dr. Franklin and others in 1743. The Wagner Institute of Science (free) occupies a building at Seventeenth street and Montgomery avenue. The Franklin Institute for the promotion of mechanic arts, established in 1824, has a building of marble containing a library, museum, and lecture-room on Seventh street below Market. The Horticultural Society occupies a very fine hall, 75 feet front and 200 feet deep, with sandstone front, on Broad street N. of Spruce, adjoining the Academy of Music.



Main Exhibition Building.

The Academy of Fine Arts, with a new and exceedingly striking building fronting 100 feet on Broad street and 260 feet in depth on Cherry street, is devoted to the promotion of drawing, painting, and sculpture, maintains a free art-school, and possesses a fine collection of statues and pictures. It was instituted in 1805. The School of Design for Women, at Filbert and Merrick streets, furnishes instruction in the decorative arts. Music has been cultivated by the Musical Fund Society for many years at its hall, Locust street above Eighth, and by the Handel and Haydn and other associations.



Machinery Hall.

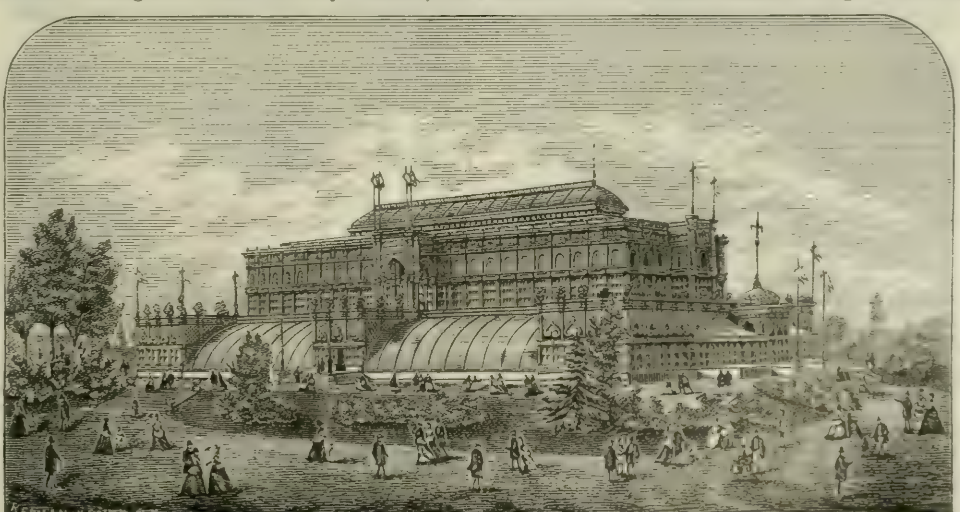
The oldest library is the Philadelphia, which occupies an old-fashioned brick building at the corner of Fifth and Library streets. It was founded July 1, 1731, by Benjamin Franklin and others. The company owns about 100,000 volumes. A fund amounting to about $1,500,000 was left by Dr. James Rush in 1869 for the

purpose of erecting a library building and for the support of the institution. The whole property is directed to be appropriated to the use of the Philadelphia Library Co. if the stockholders shall accept; if they decline, the institution is to become a free library under the name of the Ridgway Library, so called from the maiden name of the wife of Dr. Rush. The building, nearly finished (1876), is at Broad and Carpenter streets, and is of granite, with three porticoes on the front; 220 feet front, 105 feet deep. The Mercantile Library, Tenth above Chestnut, has a large number of members and 128,000 books. The Athenæum, Sixth below Walnut, occupies a building of brownstone in the Palladian style. It has a large library and a reading-room. The Apprentices' Library, corner of Fifth and Arch

Memorial Hall.

streets, loans its books free to boys and girls, young men and young women, and has 23,600 books. There is also a reading-room. The Pennsylvania Historical Society, Spruce street above Eighth, has a very valuable collection of historical books and MSS. and a museum of relics and curiosities. Numerous other libraries, corporate and denominational, possess a large number of books. There were in 1870 nearly 3700 libraries in Philadelphia, public and private, having 2,985,770 volumes.

The benevolent institutions are numerous. There are 24 hospitals for the relief of the sick and afflicted. The oldest of these, next to the Philadelphia Hospital at the almshouse, is the Pennsylvania, which was proposed in 1750 by Dr. Thomas Bond. It occupies the square bounded by Spruce, Pine, Eighth, and Ninth streets, and being built of brick in the old style of architecture, presents a venerable appearance. Connected with the institution are two insane hospitals for male and female patients, situate on the W. side of the Schuylkill upon a plot of ground of 111 acres. The buildings are of stone and very extensive, and each will accommodate about 250 patients. There is an insane asylum near Frankford under control of the Society of Friends. The hospital of the Protestant Episcopal Church, corner Lehigh avenue and Front street, covers a square of ground, and is an imposing brownstone building in the Norman style, 258 feet front, 256 feet deep in the centre, with wings of 200 feet; its capacity is 300 beds. St. Joseph's Hospital, Girard avenue and Seventeenth street, is of brick, four stories high, under control of the Sisters of Charity of the Roman Catholic Church; the number of beds is 250. The Presbyterian Hospital, Thirty-ninth and Filbert, has accommodations for 100 patients. University Hospital, Spruce street and Thirty-fourth, has at present accommodations for 146 patients. There are in addition the following: German, St. Mary's (R. C.), Jewish, Friends' Asylum for the insane, Municipal, Charity, Preston Retreat, Wills (for the eye), Orthopedic, Children's, Homœopathic, Women's, State, Gynæcological, and Mission. A new hospital building has been begun which is to be attached to the Jefferson Medical College. All the hos-



Horticultural Hall.

pitals under the management of religious sects are open to the afflicted without reference to their religious belief; besides the hospitals there are 15 dispensaries for the supply of medicines and medical attendance gratis to the poor.

There are 21 asylums for orphans and abandoned children, some of which occupy very large and elegant buildings. There are 19 homes for aged men and women. An asylum for the deaf and dumb, corner of Broad and Pine streets, occupies a block extending to Fifteenth street. The Pennsylvania Institution for the Blind, corner of Twentieth and Race streets, is devoted to the instruction of that class of unfortunates. There is a Working Home for blind men, and one for blind women, where they are given shelter and employment; for the reformation of fallen

women there are 5 asylums. There are two homes for inebriates; 11 industrial aid societies extend assistance to those who are willing to work and will embrace the opportunity. For assistance of various classes of persons there are 13 societies. There are 10 soup societies which supply the poor with food in winter. The national societies established for the relief of foreigners in distress are the German, St. George's and Albion (English), St. Andrew's (Scotch), Welsh, French, Hibernian, Swiss, and Italian. The German society has a hall on Seventh street above Chestnut. The St. George's society has lately finished a very elegant hall of white marble at Thirteenth and Arch streets. Among the principal halls of the charitable orders and associations is the Masonic Temple, corner of Broad and Filbert streets, built of granite, 150 feet by 245; the apex of the roof is 95 feet from the pavement and the highest tower 250 feet. The Norman porch is exceedingly elaborate. The interior is grandly finished in various styles of architecture. The hall is the finest Masonic structure in the world, and cost $1,300,000. There are 6 Masonic halls in other parts of the city. The principal Odd Fellows hall is on Sixth street below Race. There are 8 other Odd Fellows halls. The order of United American Mechanics has a large hall at the corner of Fourth and George streets, and the Independent Order of Red Men a stately brick building at Third and Brown streets. The leading social club is the Philadelphia, established in 1834, which occupies a large and plain-looking brick building at Thirteenth and Walnut streets. The Union League has a splendid club-house, of brick with brownstone trimmings, in the French style, at the corner of Sansom and Broad streets, which occupies the greater portion of a lot 100 by 200 feet. The Reform Club, also social and political, occupies a spacious building with marble front on Chestnut near Sixteenth street.

There were 534 religious congregations, including Israelites, in Jan., 1876, nearly all of which were provided with churches and buildings for worship. The Baptists had 71 churches; Congregational, 2; Evangelical Association, 6; Friends (Orthodox), 8 meeting-houses; Friends (Hicksite), 8 meeting-houses; Israelites, 9 synagogues; Lutherans (General Council), 22 churches; (General Synod), 6; (German Mission Synod), 1; (Independent), 1; Methodists, including African M. E., 104; Moravian, 4; New Church (Swedenborgian), 3; Presbyterian, 78; Presbyterian Reformed, 13; United Presbyterian, 11; Protestant Episcopal, 93; Reformed Episcopal, 5; Reformed, 20; Roman Catholic, 43; Unitarian, 2; Universalist, 4; other sects, 21. The churches of historic interest are Gloria Dei (Old Swedes'), on Swanson street near Washington, built in 1700; Christ church, Second above Market, commenced in 1727, finished in 1744; Trinity church, in Oxford township, 2 miles N. W. of Frankford, built 1709–14; St. James, Kingsessing (Swedish), built 1762–63; St. Peter's, corner of Third and Pine, dedicated Sept. 4, 1761. These churches are all Protestant Episcopal. The Third Presbyterian (Old Pine Street) church, corner of Fourth and Pine, was opened for worship in 1768; occupied by the British army during the Revolution as a hospital. St. George's, Methodist, Fourth below New, was used by the British in 1777–78 as a riding-school. The finest church buildings are the First, Fifth, Memorial, and Beth Eden, Baptist—the two former of brownstone, the two latter of greenstone and other material; Holy Communion (Lutheran), of greenstone, corner of Broad and Arch streets; Arch Street Methodist, at the corner of Broad street, of white marble; Second Presbyterian, Twenty-first and Walnut, of granite and other stone; West Arch, Presbyterian, Eighteenth and Arch, in the Corinthian style. St. Mark's, Protestant Episcopal, Locust street near Seventeenth, is considered by many the finest church in the city. The Roman Catholic cathedral of St. Peter and St. Paul is a magnificent building of brownstone, with a dome rising to the height of 210 feet. The Jewish synagogue Rodef Shalom, on Broad street, in Saracenic style, is large and of handsome appearance. Auxiliary to the religious denominations may be mentioned the Presbyterian and Baptist Boards of Publication, the Sunday School Union, and the Young Men's Christian Association, which occupy large and elegant buildings, and many other societies which are comfortably but not so grandly accommodated.

Agricultural Hall.

The cemeteries are about 20 in number, church burial-grounds not included. The principal one is Laurel Hill, on the E. bank of the Schuylkill, near the Falls, which was opened in Oct., 1836. It has been a favorite burial-place, and is crowded with cenotaphs, monuments, statues, tombstones, and other memorials, many of which are rich and extremely costly. West Laurel Hill is on the W. bank of the Schuylkill, at some distance above the old cemetery. Woodlands is on the Schuylkill below the University; the ground has handsome natural features and contains many fine tombs.

The principal place of amusement is the Academy of Music, corner Broad and Locust streets, a brick and brownstone building 140 by 238 feet. The exterior is plain; the interior is rich and elegant. There are fine lobbies, retiring-rooms, a splendid foyer, and a stage 72 feet 6 inches deep, 90 feet wide at the proscenium, 120 feet between the walls, and 70 feet high from the floor. There are four tiers, the auditorium being handsomely decorated with emblematic carvings, etc. The seating capacity is for 2900 persons. There are 3 principal dramatic theatres—the Arch, the Walnut, and the Chestnut, located respectively on those streets. The buildings of the two former are old, but have been refitted and modernized; the latter was opened in 1863. There are 2 principal buildings for Ethiopian minstrelsy, a museum building for the display of curiosities and for dramatic performances, and 5 variety theatres and a German theatre.

There are 2 parks and 13 public squares belonging to the city. The principal of these is Fairmount, which contains 2740 acres, and, next to Epping and Windsor Forest in London and the Prater of Vienna, is the largest park in the world. It is situated on both sides of the river Schuylkill, commencing at Fairmount and extending 5½ miles to the mouth of Wissahickon Creek, and along that stream 7½ miles to Chestnut Hill; total length of the Park, 13 miles. On the W. side, the Park extends from Spring Garden street to Chamouni and Roberts' Hollow, about 4½ miles. The natural features of the enclosure are extremely beautiful. The property was originally composed of country-seats, and the fine old forest trees have been preserved with great care. There are many shaded glens, ravines, and valleys in which are streams and springs of water. The ground is diversified, and as the beautiful river Schuylkill is in view from nearly all the roads in the eastern and western portions, the diversity is charming. There is an

art-gallery in the Park near the Green street entrance, in which is the *Battle of Gettysburg*, painted by Rothermel, and other pictures. A bronze statue of Pres. Lincoln, by Randolph Rogers, erected by the citizens of Philadelphia, is near by. There are groups and statues erected by the Park Art Association. A grand fountain, with a central figure of Moses striking the rock, and statues of Charles Carroll of Carrollton, Bishop Carroll, Commodore John Barry of the Revolution, and Father Mathew, apostle of temperance, erected by the Roman Catholic T. A. B. societies, was finished in 1876. Bronze statues of Frederick von Humboldt, Christopher Columbus, and John Witherspoon, a signer of the Declaration of Independence, were also erected in that year. The Wissahickon portion of the Park is traversed by a road which leads through a deep gorge wooded to the top, and with towering crags through which a romantic stream calmly pursues its way amidst the wild grandeur of the scenery. Hunting Park is in the upper part of the city, occupies 45 acres, and is not yet in use. The 13 public squares, 4 of which were laid out by Penn at the foundation of the city, are kept in good order and are attractive.

Among the buildings of historic note are—Independence Hall (the old State-house), in which the Declaration of Independence was adopted, and Congress Hall, on Independence Square, at the corner of Sixth street, in which Congress sat from 1790 to 1800, and in which Washington and Adams were inaugurated as President, and Adams and Jefferson as Vice-President. The U. S. Supreme Court sat in the City Hall, corner of Fifth and Chestnut. Carpenters' Hall, standing S. of Chestnut street, between Third and Fourth, was the place of assemblage of the first Continental Congress. The Declaration of Independence was written by Thomas Jefferson in the house standing at the S. W. corner of Seventh and Market streets. William Penn's mansion, built in 1682, the oldest house standing in Philadelphia, is on the W. side of Letitia street, below Market. The old London Coffee-house, S. W. corner of Market and Front streets, built in 1702, was, before the Revolution, the most fashionable resort in the city for strangers and citizens. The mansions of historic interest still standing are Cliveden; Chew's house, where was enacted one of the most memorable incidents in the battle of Germantown; Stenton, James Logan's house, near Germantown; Mount Pleasant, in the Park, built by Capt. John McPherson, bought by Benedict Arnold, the traitor, presented as a wedding-gift to his wife, and afterward occupied by Baron Steuben; Belmont, West Park, seat of the Revolutionary patriot Richard Peters, for a long time judge of the U. S. district court; the house of John Bartram, the botanist, W. side of Schuylkill, below Gray's Ferry; Solitude, built by John Penn, now standing in the Zoological Gardens; Woodlands, West Philadelphia, the seat of the Hamilton family; Fairhill, seat of the Norris family, and occupied for some years by the famous Revolutionary patriot John Dickinson.

The principal hotels are the Continental, S. E. corner Chestnut and Ninth, six and eight stories in height, covering 41,536 square feet of ground, with accommodations for 1200 guests; the Girard House, brownstone, immediately opposite, with lodgings for 1000; the La Pierre House;

U. S. Government Building.

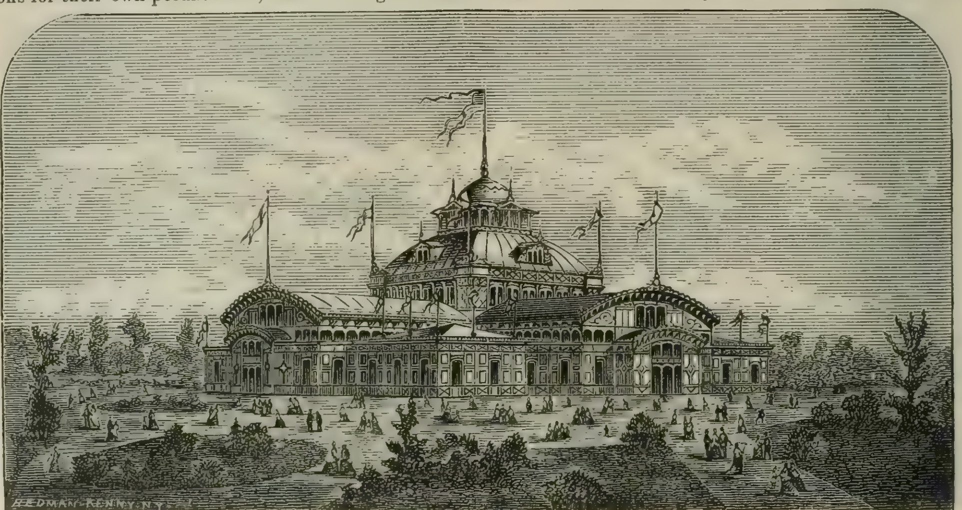
and the Colonnade. There are about 100 permanent hotels and inns of various sizes. For the accommodation of visitors to the Centennial Exhibition during 1876 several very large buildings have been specially erected, the majority of them being in the neighborhood of the Exhibition ground. Among these are the Globe, Transcontinental, United States, Ruloff, Aubry, Grand Exposition, Atlas, Diamond Street, and others, with accommodations for from 15,000 to 20,000 guests.

The active functions of the press are discharged by 14 daily papers, 4 of which are printed in the German language.. The *Public Ledger* has the largest circulation, which is daily from 90,000 to 95,000 copies; its advertising patronage is very heavy. There are 7 Sunday papers and about 50 weekly journals, literary, religious, scientific, legal, medical, and of a business character; 14 papers are issued monthly; over 20 magazines and many other publications are printed.

The preparations which have been made for the celebration of the centennial anniversary of American independence at Philadelphia have attracted much attention to the city. The place of the exhibition is in Fairmount Park, on the W. side of the Schuylkill. The grounds extend from the foot of George's Hill at the S. W. extremity of the Park, nearly over to the Schuylkill in some places, and are in extent about 236 acres. The plateau is about 100 feet above the river, and the buildings can be seen from a great distance. There are 5 principal buildings constructed by the Centennial Board of Finance, and about 100 others. Industrial Hall, the main exhibition building, is in the form of a parallelogram extending E. and W., 1880 feet long and 464 feet wide. Towers and central projections are at each end of the building and on the sides in the centre, which break up the uniformity that would otherwise detract from the appearance of so large a structure. The building is of glass, stone, brick, and iron, and covers in ground floor, upper floor, and towers 936,008 square feet, or 21.47 acres. The interior has a central nave 120 feet wide, two avenues 125 feet wide, two aisles 48 feet wide, and two 24 feet, with a central transept 416 feet in length and 120 wide, and 2 smaller side transepts. Cost, $1,600,000. Machinery Hall lies W. of the main building, and in appearance, although different in plan and decoration, assimilates with the other. It is 1402 feet long, 360 feet wide, with an annex on the S. side 208 by 210 feet. It covers 558,440 square feet, and with the upper floors provides 14 acres of floor-space. The building is of wood, iron, brick, and glass. The contract price was $792,000. The most elegant building is Memorial Hall, built at the cost of the State of Pennsylvania and the city of Philadelphia, which has been appropriated to the uses of an art-gallery, and is intended to be permanent. It is of granite, glass, and iron, perfectly fireproof. It is 365 feet long, 210 feet wide, 59 feet in height, surmounted by a dome of glass and iron terminating with a colossal bell, upon which stands a figure of Columbia at the height of 150 feet from the ground. The architecture is in the Renaissance style. Figures of colossal size stand at each corner of the dome representing the four quarters of the globe. Numerous other statues appear upon the building, and it is rich in decorations. The entrance is 70 feet wide, through three doorways 40 feet in height and 15 in width. The galleries, with the rotunda, are lighted from above. The building gives 75,000 square feet of wall for paintings and 20,000 square feet of floor for statues. Cost, $1,500,000. Although the largest art-building in the world, it has proved insufficient for the demands

upon it, and a temporary annex immediately in the rear, one story in height, 300 feet long, 250 feet wide, has been further enlarged by building two additional pavilions. Horticultural Hall is a building of very striking appearance, in the Moresque style of architecture of the twelfth century. It is of stone, glass, and iron, very ornate in appearance, and to be permanent in the Park. Length, 383 feet; width, 193 feet; height to top of lantern, 72 feet. The central conservatory, 230 by 80 feet, 55 feet high, surmounted by a lantern 14 feet high, occupies the main floor. N. and S. are four forcing-houses for the propagation of young plants, and the building is surrounded by magnificent flower-gardens. Cost of the hall, paid by the city of Philadelphia, $251,937. Agricultural Hall is constructed of wood and glass, and consists of a long nave crossed by three transepts, the style being Gothic, with towers and other ornaments. The nave is 826 feet long by 100 wide, with a height of 75 feet from the floor to the point of the arch. The central transept has a breadth of 100 feet, and the two end transepts are 70 feet each. The ground-plan in parallelogram would occupy a space of 465 by 630 feet, covering about 10¼ acres. Besides the main buildings there are many others of considerable size and of attractive appearance. Among them are the U. S. Government Exhibition Building, covering a space of 1½ acres; Women's Pavilion, for the exhibition of women's work, over half an acre in extent; buildings for executive officers, the Centennial Commission, jury, 6 large restaurants; special buildings erected by trades and occupations for their own peculiar use; and buildings erected by foreign governments for the accommodation of their subjects. Among these are structures erected by Great Britain, Japan, Germany, Sweden, Turkey, and other nations. Special buildings have been erected by the States of Ohio, Indiana, Illinois, Connecticut, Massachusetts, New Jersey, Kansas, New York, Michigan, Wisconsin, New Hampshire, and Pennsylvania for the accommodation of their citizens. The entire space covered by buildings, it is estimated, is over 75 acres. The Vienna Exhibition buildings occupied for all purposes 56 acres; the Paris Exhibition of 1867, 31 acres; and the Crystal Palace of London, 1851, 23 acres. Upon a narrow-gauge railroad within the grounds passengers are conveyed from building to building; it is 4½ miles in length. The railroad communication with all parts of the Union by the Pennsylvania, Reading, and Baltimore R. Rs. is direct to the Exhibition-grounds, the arrangements for transporting thousands of persons a day being admirable. Five passenger railways, extending to the most distant portions of the city, bring passengers to the main entrance. The Exhibition is to open May 10, and to close Nov. 10, 1876.

The spot on which Philadelphia is built was first discovered by Capt. Hendrickson in the yacht Onrust, which sailed from Manhattan (New York) in the year 1623. The Dutch settled upon South or Delaware River shortly after. The Swedes came in 1638, and settled along the river and within the boundary of Philadelphia. The Dutch built Fort Casimir near New Castle in 1651, which was conquered by the Swedes in 1654, and reconquered by the Dutch under Peter Stuyvesant in the same year. Ten years afterward the English captured Manhattan from the Dutch, and in due time appeared upon Delaware River and captured Trinity Fort. The Dutch reconquered the territory in 1673, but in 1674, by the treaty between England and Holland, which gave New York to the former, the settlements on the Delaware fell again under English authority. William Penn received his charter for Pennsylvania Mar. 4, 1681. Philadelphia was laid out in 1681–82. Penn arrived in the latter year, remained about 22 months, and went back to England. He returned in 1699, and found great changes. There were streets, houses, shops, warehouses, wharves, and shipping. The houses were 700; the population, 4500. Granting a charter to the city dated Oct., 1701, he went back to England, and never returned. Between the years 1739 and 1748 there were wars between England, Spain, and France, in which the colonies were in danger of invasion. Privateers were commissioned at Philadelphia, but there was no preparation for home defence. Great peril, menacing in 1747 from French privateers, created fears of attack upon the city. The Quakers, in majority in the assembly, refused to sanction measures of defence. As the last resort, voluntary associations of citizens who had no conscientious scruples against fighting were formed. They raised two regiments in the city, and built a battery below Swedes' church which mounted upward of 50 pieces of cannon. In 1755, in consequence of Braddock's defeat, the assembly was forced into the adoption of a militia law. Two regiments were raised in the city and county, Benjamin Franklin being colonel of the first and Jacob Duché of the second. The passage of the Stamp Act in 1765 led to proceedings in opposition, which compelled the stamp-master, John Hughes, to decline acting under his appointment. In 1768, in consequence of the passage of an act of Parliament laying duties on paper, tea, etc., an agreement was entered into by the people of the city to import no merchandise from England and to encourage American manufactures. In 1773 the tea-ship Polly, Capt. Ayres, from London, coming up the river, was stopped at Gloucester Point, N. J., and compelled to return without reaching the city. The first Continental Congress met Sept. 5, 1774, in Carpenters' Hall, and adjourned in October. The second Congress met on May 2, 1775, after the battle of Lexington. July 2, 1776, this body, which was sitting at the old State-house, adopted the resolution declaring the United Colonies free and independent of Great Britain. On the 4th of July the reasons for adopting the resolution of independence were embodied in the Declaration, which was adopted the same day. The Declaration was read to the people July 8 by John Nixon from an observatory erected in the State-house yard in 1770 to observe the transit of Venus. (See Declaration of Independence.) On this occasion the State-house bell, cast in 1752, bearing upon its side the remarkable motto, "Proclaim liberty throughout the land, unto all the inhabitants thereof," was rung in honor of the great event. After the battle of Brandywine the British troops under Gen. Howe crossed the Schuylkill at Fatland and Gordon's Ford on Sept. 22, 1777, and entered the city on the 26th. The Americans held the Delaware below, particularly in the neighborhood of Mud Fort (Mifflin) and Red Bank. The battle of Germantown on Oct. 4 caused the withdrawal of all outlying detachments, and the British army encamped within the city, which was defended on the N. by a chain of redoubts and abattis stretching from the Delaware at Kensington to the Schuylkill at Fairmount. To free the navigation of the Dela-



Women's Pavilion.

ware, Count Donop crossed the river with Hessians and chasseurs Oct. 21, and attacked the fort at Red Bank. He was defeated, repulsed, and himself killed. During this time there was a fight between the Pennsylvania galleys and the British frigates. Two of the latter, the Augusta and Merlin, were lost, being set on fire and blown up. Mud Fort was bombarded by the fleet and shore-batteries for six days, until it was untenable, when the commander succeeded in withdrawing safely to shelter at Red Bank. A portion of the American fleet succeeded in passing the city, and obtained safety in the upper part of the Delaware. Some vessels were taken and others burned and destroyed. The British evacuated the city June 18, 1778. Gen. Benedict Arnold was made military governor. Congress came back shortly afterward, and remained until June, 1783, when the mutinous conduct of regiments of the Pennsylvania line frightened the members off to Princeton. A convention to frame a Constitution for the U. S. met at the State-house in May, 1787, and adjourned on Sept. 18. George Washington was president and William Jackson secretary. It adopted the Federal Constitution, the ratification of which by a majority of the States was celebrated by a magnificent procession on July 4, 1788. John Fitch first demonstrated practically on the Delaware River in 1787, 1788, 1789, and 1790 the utility of steam navigation. In the latter year his steam-

Judges' Pavilion.

boat ran regularly for the carriage of passengers and freight to Burlington, Bristol, Chester, and other places, announcing the trips by advertisements in newspapers, and traversing during that season more than 3000 miles. Congress came to Philadelphia in 1790, and the city was the seat of the Federal government until 1800. The yellow fever was exceedingly disastrous in 1793, 1797, and 1798; the deaths by this pestilence in six years were over 12,000. The first waterworks were established on Schuylkill River at Chestnut street, and water distributed Jan. 1, 1801. The Schuylkill Navigation, the first great internal improvement connecting with the city, was finished 1825. The first railroad to Germantown was opened 1832. Gas was first distributed through the public streets Feb. 18, 1836. During the Asiatic cholera of 1832 the cases were 2314 and the deaths 935. In 1834, 1835, and 1838 abolition riots took place, the blacks being assaulted and their houses injured and torn down; Pennsylvania Hall, built by abolitionists, was set on fire by a mob and totally destroyed May 17, 1838. The Native American riots against the Roman Catholics took place in May and July, 1844. During this time houses were broken into and set on fire, 2 Roman Catholic churches and a female seminary were burned, and numerous persons on both sides were killed. On the night of July 7 a battle took place between the military and the mob, which resulted in the killing of 9 persons and the wounding of many others. This was the last great riot in Philadelphia. In 1854 the boundaries of the old city of Philadelphia were enlarged so as to include the adjoining districts and townships, and embracing the whole county within the bounds of the city. During the late civil war Philadelphia strongly adhered to the cause of the Union. In 1864 the Philadelphia branch of the U. S. Sanitary Commission held a fair in Logan Square, the net proceeds of which, $1,080,000, were appropriated to the relief of wounded, sick, and dying soldiers. The contributions to the Commission, including the fair-proceeds, were in Philadelphia $1,565,377.15. (See International Exhibition, in Appendix.) Thompson Westcott,

Ed. "Philadelphia Sunday Dispatch."

Philadelphia, p.-v., Loudoun co., Tenn., on East Tennessee Virginia and Georgia R. R.

Phi'læ [Egyptian, *Pilak*], an island of the Nile, situated in Upper Egypt, in lat. 24° 1′ N., contains celebrated remains of a temple of Isis built by Ptolemy Philadelphus, and of some other buildings of a more recent date.

Phil'brick (John Dudley), LL.D., b. in Deerfield, N. H., May 27, 1818; graduated at Dartmouth College in 1842; was engaged during the next ten years in teaching, first in the Roxbury Latin School, and then in Boston as instructor in the English High School, and as master of the Mayhew and Quincy schools; was principal of the Connecticut State Normal School 1853–55; State superintendent of schools in Connecticut 1855–57; superintendent of the public schools of Boston 1857–74; re-elected to the same post 1876; educational commissioner of Massachusetts to the Vienna Exposition 1873, where he was a member of the international jury; was also president of the State educational associations of Connecticut and Massachusetts, of the American Institute of Instruction, and of the National Teachers' Association; for ten years a member of the Massachusetts board of education, and from its origin a member of the government of the Massachusetts Institute of Technology; was editor of *Connecticut Common School Journal* and Massachusetts *Teacher;* and wrote numerous papers on education.

Phile'mon, a Greek play-writer, b. at Soli in Cilicia or at Syracuse in Sicily about 360 B. C.; lived mostly in Athens, where he often competed successfully with Menander; visited Alexandria. D. at Athens in 262 B. C. Some fragments of his comedies are still extant, and generally printed in the editions of Menander.

Philemon, Epistle of St. Paul to, was written at the same time as the Epistles to the Ephesians and Colossians. It is a private letter, begging forgiveness and acceptance as a brother beloved for a runaway servant, Onesimus, who had been converted through the apostle's teachings. It is stated by tradition that the letter was written from Rome. Others suppose Cæsarea was the place. One tradition makes St. Philemon a bishop of Colossæ, and in the Roman missal he is commemorated on Nov. 22.

Phil'idor (François André Danican), b. at Dreux, department of Eure-et-Loire, France, Sept. 7, 1726; received his musical education in the royal chapel, afterward in Holland and Germany, where he resided from 1745 to 1754; composed between 1754 and 1774 a number of operas, comic and serious, which were well received; but became most famous as an unrivalled master of chess-playing. His book, *L'Analyse du Jeu des Echecs* (London, 1777), was for many years considered the code of the game. D. in London Aug. 29, 1795. (See Allen, *Life of Philidor*, Philadelphia, 1864.)

Phil'ip, the fourth called to the apostleship by Christ, b. at Bethsaida, is often mentioned in the Gospels, especially by John (vi.; xii. 20–22; xiv. 8), but must not be confounded with Philip the Evangelist, mentioned in Acts

vi.; preached, according to Theodoret and Eusebius, in Phrygia; was married and had three daughters, according to Clement of Alexandria. D. at Hierapolis. His festival is celebrated by the Latin Church on May 1, by the Greek on Nov. 14. The *Acta Philippi* are apocryphal.

Philip, the name of five Macedonian kings, of whom two became very celebrated. PHILIP II. (359–336), b. at Pella in 382, a son of Amyntas II., spent while a youth three years as a hostage at Thebes in the house of Epaminondas, where he became familiar not only with Greek tactics, but also with Greek politics. At the moment he ascended the throne Macedonia was attacked from two sides by external enemies, the Illyrians and the Athenians, and in the interior it was torn by four pretenders and their factions. But in less than two years the young king repelled the Illyrians, bought off the Athenians, defeated and killed the pretenders, and established himself firmly in the country. He immediately began to work at the realization of his much-cherished plan, the acquisition of the supremacy over all Greece, and by his energy and shrewdness, his talents and unscrupulousness, he succeeded at last. He conquered Pydna and Methone, two Athenian possessions on the coast of Macedonia, the peninsula of Chalcidice, with the prosperous cities of Olynthus, Potidæa, Amphipolis, etc., all Athenian colonies or allies; and a part of Thrace, with the rich gold-mines, which yielded about £300,000 a year, and the town of Crenides, which soon became a flourishing city under the name of Philippi. And in spite of Demosthenes' thundering against him he achieved these conquests without occasioning any serious breach with Athens, for he understood how to bribe and how to deceive. Meanwhile, he had also defeated the tyrant of Pheræ and reduced the whole of Thessaly, and during the two sacred wars in 346 and 339 he acquired a foothold in Greece proper, called in by the Greeks themselves — in the first case, by the Thebans against the Phocians; in the second, by the Amphictyonic Council against the Locrians. Alarmed at his successes, Athens made a coalition with Thebes and other Greek states against him, but he routed the allied army at Chæronea in 338, and after this victory he actually became the master of Greece. By his admission as a member of the Amphictyonic Council shortly after the First Sacred war he and the Macedonians were recognized as belonging to the Greek nation, and by the congress at Corinth (in 337) he was chosen commander-in-chief of all the Greeks under a projected invasion of Persia. But the realization of this vast plan he had to leave to his son, Alexander; during his preparations he was assassinated at Ægæ by Pausanias. —Under PHILIP V. (220–179), b. in 237, Macedonia relapsed into insignificance. He dreamt, like his subjects, only of the re-establishment of the empire of Alexander. His whole attention was taken up by the East, by Pergamus, Bithynia, Syria, etc., and meanwhile the danger arose from the West, from Rome, which already held possessions in Illyria. The offers of alliance which Hannibal made he treated slightingly, and the war with Rome, which began incidentally, the first Macedonian war (210–205), he carried on without energy, though generally successfully. But in 200 the war began again, the second Macedonian war, in consequence of Philip's aggressive policy towards Pergamus and the Achæan association, now allies of Rome; and the Macedonian army was completely routed by Titus Quintius Flamininus at Cynoscephalæ in 197, and the country reduced to a submissive ally of Rome, relinquishing all its conquests in Europe and Asia, surrendering its fleet, and paying a tribute. CLEMENS PETERSEN.

Philip, the name of six kings of France, of whom the most remarkable are—PHILIP II., AUGUSTUS (1180–1223). (See CRUSADE, FRANCE, HISTORY OF, and RICHARD CŒUR DE LION.)—PHILIP IV., THE FAIR (1285–1314), b. in 1268, a son of Philip III., was an avaricious, haughty, and even cruel man, but courageous and eminently successful in extending the boundaries of France and consolidating the power of the Crown. In order to procure money the king taxed the clergy. The pope, Boniface VIII., forbade the clergy to pay the tax, and the king answered by forbidding the exportation from France of money or other valuables, thereby cutting off one of the richest sources of the papal revenue. The pope sent a legate, who remonstrated in an insolent manner with the king, and the king threw the legate into prison. Philip now convoked the States General, and having ascertained that the French people would stand by him even if he were excommunicated, he pursued his own course and confiscated the property of those prelates who sided with the pope. Meanwhile, Boniface assembled a council at Rome and excommunicated the king, but a French army under William de Nogaret captured Rome and imprisoned the pope. In 1304, at the election of Clement V., the papal residence was transferred to Avignon, and for a long time the papal authority was merely a weapon in the hands of the French king. Clement V. also sold the Knights Templar to Philip IV., who treated them in a most cruel and unjust manner in order to get possession of their wealth. (See TEMPLARS.)—PHILIP VI. (1328–50), the founder of the house of Valois, b. in 1293, a son of Charles of Valois, brother to Philip the Fair; was first proclaimed regent of France on the death of Charles IV. in 1328, but when the queen-dowager, who was pregnant at the death of her husband, shortly after gave birth to a daughter, who, according to the Salic law, was excluded from the French throne, Philip assumed the royal dignity and was crowned at Rheims. Edward III. of England, a grandson of Philip the Fair, laid claim to the French throne, and when Philip undertook to support David Bruce of Scotland, the English king made an alliance with Flanders and declared war in 1337, thus opening that terrible contest between the French and English dynasties which lasted for 100 years, exhausted England, and devastated France. The two prominent events of the war during the reign of Philip VI. were the battle of Cressy (1346), in which the French army was totally routed, and the capture of Calais by the English (1347). In the following year the plague, the so-called *Black Death*, entered France and made fearful ravages; but in spite of all these calamities the king, who was bigoted and debauched, went on with his carousals, squandering the money which was extorted from the people by heavy taxes and ruinous government monopolies.

Philip, the name of five kings of Spain, of whom two deserve a special notice.—PHILIP II., b. at Valladolid May 21, 1527, d. at the Escurial Sept. 13, 1598; succeeded his father, Charles V., in the Netherlands Oct. 25, 1555, and in the other possessions of the Spanish crown Jan. 16, 1556. The emperor's attempts at procuring the imperial crown of Germany and the Austrian possessions for his son failed, and his plan of bringing England into co-operation with his policy by Philip's marriage with Queen Mary miscarried; but Philip II. was nevertheless, on his accession to the throne, the most powerful monarch of Europe. He ruled over Spain, its vast dominions in America, the East Indies and Africa, the Two Sicilies, and Milan, Burgundy, and the Netherlands, to which in 1581 he added Portugal; and these countries were at that time the principal centres of European civilization and wealth. From his father's reign he inherited a war with France, the pope, and the Turkish sultan, who had made an alliance for the purpose of depriving the Spanish crown of its Italian possessions; but the duke of Alba, viceroy of Naples, drove the French out of Italy and compelled the pope to sue for peace under the walls of Rome, while the brilliant victories of St. Quentin and Gravelines, won by Egmont, enabled Philip to conclude an advantageous peace with France at Câteau-Cambrésis, Apr. 2, 1559. Nevertheless, the forty years' reign which now followed bears throughout the character of a miserable failure. The countries under his sceptre became devastated and forlorn, and the nations sank into degradation or rose in rebellion. And these calamities were not the results of any special ill-luck in his fate or of any strikingly predominating vice in his character. Like Robespierre, he was a small man placed by destiny in an immense situation, and by this distorted into a monster; the worst of him was his virtues. On leaving the Netherlands he confirmed the political privileges of the provinces, but he refused to repeal his father's ordinances against heretics. On the contrary, he would enforce them, and immediately set to work to extirpate heresy in the Netherlands by means of the Inquisition. He met with energetic resistance, and the duke of Alba was sent as governor to the country with an army of Spanish veterans. Egmont, Horn, and other prominent men were executed and horrible cruelties perpetrated. But the result was just the opposite of that which had been expected. The resistance, instead of dying out, grew into a revolution, and under the organization and leadership of William of Nassau the union of the seven provinces was formed at Utrecht in 1579, and a protracted war was carried on against Spain by land and sea. When Philip died, Spain was exhausted, but the provinces were not reduced to obedience. In his wars against the Turks or the Mohammedans in general he gained a brilliant success by the battle of Lepanto, Oct. 7, 1571. After this victory, it would have been possible to incorporate the northern coast of Africa into the political system of the civilized world, and Don John of Austria entertained some such idea; but Philip felt a jealous distrust of his illustrious half-brother, and the situation of the Mediterranean pirates remained the same after the battle as it had been before. The disastrous expedition against England, the destruction of the Invincible Armada, were mortifications which he bore with dignity, but the unfortunate war against Henry IV. of France and the dis-

advantageous Peace of Vervins (May 2, 1598) he felt as a deep humiliation. He shut himself up in sullen despair in the pompous palace-tomb he had built, and died shortly after of a most loathsome disease, leaving Spain exhausted almost to prostration, with its industry, commerce, and other material resources greatly impaired and disturbed, and the proud, adventurous spirit of its people curbed by despotism and influenced by fanaticism. He was four times married—with Maria of Portugal, Mary of England, Elizabeth of France, and Anne of Austria. By his first wife he had a son, the unfortunate Don Carlos—by his fourth wife he had another, Philip, who succeeded him. (See Prescott, *History of Philip II.* (3 vols., 1856–59), and Motley, *Rise of the Dutch Republic* (3 vols., 1856).)—PHILIP V. (1701–46), the founder of the house of Bourbon in Spain, b. at Versailles Dec. 19, 1683, the second son of the dauphin Louis, son of Louis XIV. by the Spanish princess Maria Theresa; was declared heir to the Spanish throne by the will of Charles II., who died childless Nov. 1, 1700. There was, however, another claimant to the throne—Archduke Charles of Austria—and war began almost immediately. (See SUCCESSION WARS, Spanish.) By the Peace of Utrecht (1713) Philip retained the Spanish crown, but he was compelled to surrender his possessions in Italy and the Netherlands to Austria, and Gibraltar to England. He was indolent, weak-minded, and always controlled by his surroundings. Under his first marriage, with Louisa Maria of Savoy, the princess Orsini had the predominant influence; after his second marriage, in 1714, with Elizabeth Farnese of Parma, the queen, Cardinal Alberoni, the adventurer Ripperda, and others held the reins. The policy of the queen was concentrated on the acquisition of the former possessions of Spain in Italy for her sons, for which purpose Spain waged several wars. (See SUCCESSION WARS, Austrian.) Meanwhile, the king became weaker and weaker. Jan. 10, 1724, he abdicated in favor of his eldest son, but as the young king d. Sept. 6, 1724, Philip was persuaded to assume the government once more, though he had become almost idiotic. At last he would not leave his bed, and nothing would arouse him from his mental stupor but the songs of Farinelli. D. at Madrid July 9, 1746. CLEMENS PETERSEN.

Philip, or **Metacom,** usually called **King Philip,** youngest son of Massasoit, sachem of the Pokanoket Indians of Massachusetts, succeeded to the chieftainship on the death of his brother Alexander 1662, when he visited Plymouth and promised friendship to the colonists, but in 1675 headed the great war known by his name, in which thirteen towns were destroyed and 600 colonists lost their lives. Philip was killed at Mount Hope Aug. 12, 1676, by a party under Capt. Benjamin Church, after his tribe had been nearly annihilated.

Philip the Bold, b. Jan. 15, 1342, a son of John, king of France, distinguished himself in the battle of Poitiers (1356), where he saved his father's life and received the surname of *Le Hardi*. Sept. 6, 1363, King John gave him, as a fief of the French crown, the duchy of Burgundy, which had become vacant by the extinction of the elder ducal line in 1361. Philip married Margaret of Flanders, heiress of Flanders, Artois, Rethel, and Nevers, and founded the younger ducal line, under which Burgundy became one of the most prominent powers of Western Europe. During the minority and subsequent insanity of Charles VI., Philip the Bold assumed the regency of France, which involved him in many feuds with his brother, the duke of Anjou, and his nephew, the duke of Orleans, but which he held to his death, Apr. 27, 1404.

Philip the Good, b. at Dijon June 13, 1396, a grandson of Philip the Bold, succeeded his father, John the Fearless, as duke of Burgundy after his assassination on the bridge of Montereau in 1419, and married in 1424 Jacobæa of Holland, heiress of Holland, Brabant, Zealand, and the rest of the Low Countries. In order to avenge the murder of his father, which had been perpetrated at the instigation of the dauphin, afterward Charles VII., Philip allied himself closely with England, and acknowledged by the Treaty of Troyes (1420) the English king as the legitimate heir of the French crown after the death of Charles VI. The arrogance of the English, however, provoked him afterward to break the alliance, and in 1435 he concluded a separate peace with Charles VII. and aided him in expelling the English from France. He governed his extensive possessions with great wisdom, and, in spite of several risings in Ghent and Bruges, occasioned by the heavy taxation, he was much loved by his subjects. D. at Bruges June 15, 1467.

Philippeville′, town of Algeria, province of Constantine, on the Gulf of Stora, forms the port of Constantine, is well built, and has a fine harbor and large fishing, manufacturing, and trading interests. P. 13,022.

Philip′pi, an ancient town of Macedonia, was built, or at least enlarged, by Philip, from whom it received its name. It became very famous as the place where the battle was fought in 42 B. C. between Brutus and Cassius on the one side, and Antony and Octavianus on the other. Brutus and Cassius were totally routed.

Philippi, p.-v. and tp., cap. of Barbour co., West Va., 12 miles from Baltimore and Ohio R. R., has 1 graded school, 3 churches, 1 weekly newspaper, 1 furniture establishment, 2 tanneries, 1 flouring and 1 saw mill, a fine court-house, and stores. The first battle of the rebellion was fought here. P. 1605. D. W. GALL, ED. "PLAINDEALER."

Philip′pians, Epistle of St. Paul to the, was written to the church at Philippi in 63 A. D. from Rome. It is not theological or dogmatic, but a generally friendly and encouraging letter to a people to whom the apostle was affectionately attached. An Epistle of St. Polycarp to the Philippians is extant in the Greek. It is valued for its quotations from the early text of canonical New Testament books. English translations exist by Cave, Wake, Clementson, etc.

Philip′pics, a name properly belonging to three splendid and spirited orations of Demosthenes against King Philip. The first was delivered in 352 B. C., the second in 344, the third in 342. There is also a fourth philippic, probably spurious, assigned by some to the year 341. The fourteen orations of Cicero against Mark Antony are also called philippics. They were delivered in 44 and 43 B. C., mostly in the senate, but the second and severest was written and not delivered. The name is applied to any severe personal attack in speech or print.

Phil′ippine Islands, a group of about 1200 islands, situated between the Pacific Ocean to the E. and the Chinese Sea to the W., and between lat. 5° 32′ and 19° 38′ N., and forming the northern part of the Malay Archipelago. The largest are Luzon, 51,300 sq. m.; Mindanao, 25,000; Samar, 13,020; Mindoro, 12,600; Panay, 11,330; Leyte, 10,080; Negros, Masbate, and Zebu. The total area is estimated at 120,000 sq. m., of which about one-half is under Spanish rule; the rest is divided into small independent states governed by native chiefs. P. 4,319,269. The Philippine Islands are of volcanic origin. Active volcanoes are found throughout the whole group, such as Mayon in Luzon and Buhayan in Mindanao, and earthquakes are frequent and often violent; in 1863, Manila, the capital of Luzon, was nearly destroyed, and in 1864 the whole province of Zamboanga, in Mindanao, was fearfully devastated. But the soil is exceedingly fertile, and as water is abundant both in lakes and rivers, and the climate is hot and moist, vegetable life reaches here an almost gigantic development. The mountains, rising to a height of 7000 feet, are covered to their very tops with forests of immense trees, yielding excellent timber and many of the most valuable sorts of wood. Teak, ebony, cedar, and gum trees, iron and sapan wood, are interspersed with bread-fruit and cocoanut trees, oranges, citrons, mango, tamarinds, and other varieties of fruit trees, the whole bound together with floating garlands of huge climbing plants and brilliant parasites. On the extensive slopes and in the valleys are cultivated abaca or manila hemp, of which over 30,000 tons are annually exported; tobacco, which the Spanish government keeps as a monopoly (from which it has an annual gross receipt of £1,062,041, paying out 67 per cent. for the cultivation and manufacture of the article, and taking in 33 per cent. as clear profit); cotton, sugar, coffee, indigo, rice, wheat, maize, pepper, ginger, vanilla, cinnamon, cocoa, etc. The animal and mineral kingdoms are splendidly represented. Of wild beasts there are none, but oxen, buffaloes, horses, goats, sheep, and swine of peculiar but excellent breeds are extensively reared; deer, wild-boars, pheasants, ducks, and fine fish are abundant; the forests swarm with monkeys, squirrels, parrots, humming-birds, and bees—the jungles with lizards, snakes, mosquitoes, tarantulas, and other insects. Gold is found; iron, copper, coal, vermilion, saltpetre, quicksilver, sulphur in immense quantities, both pure and mixed with copper or iron; mother-of-pearl, coral, amber, and tortoise-shell.

The Philippine Islands were discovered in 1521 by Magellan, who died here in the same year, and a few years after the Spaniards under Villabos took possession of the whole group. The inhabitants consist partly of negroes, who resemble those of the interior of Papua, and seem to have formed the aboriginal population. They live in the interior, are repulsive in aspect, and savage, and roam in bands, mostly occupied in robbery. The Malays are Roman Catholics, settled in villages, and engaged in agriculture and fishing. They possess many fine branches of industry—as, for instance, their beautiful mats and their elegant linen fabrics—and they imitate European indus-

try, shipbuilding, leather-dressing, carriage-building, etc., with great success. The Chinese, and the mestizoes, generally descending from Chinese fathers and native mothers, are mostly engaged in commerce. Very few Spaniards reside in the islands.

Phil'ippins [from *Philip Pustoswiät*, one of their former leaders], or **Staroverski** ("old-faith men"), a sect of Russian origin settled since 1700 in East Prussia and Lithuania. They reject oaths and the priesthood, refuse to do military service, rebaptize all converts from other sects, and have a celibate eldership. They are peaceable and industrious citizens, but have at times fallen into wild fanatical excesses. They cling persistently to the ancient liturgy of the Russian Church, which has been officially discountenanced for more than 200 years. The Philippins are a branch of the RASKOLNIKS (which see.)

Philippop'olis, town of European Turkey, eyalet of Adrianople, on an island in the river Maritza, which here becomes navigable and is crossed by several bridges. It has manufactures of silk, cotton, and leather, and carries on an active trade and a very extensive banking business. It is rather indifferently built, but has large and well-stocked bazaars. The surrounding plain is very fertile, and produces excellent wine and rice. P. 50,000.

Philippoteaux' (FÉLIX EMMANUEL HENRI), b. at Sedan Apr. 3, 1815; studied painting under Léon Cogniet, and began to exhibit in 1833, his first picture being *Glen Rocks*, an episode of the American war of independence. Remarkable among his subsequent works, mostly battle-pieces, are *The Retreat from Moscow* (1835), *The Capture of Ypres* (1837), *The Last Banquet of the Girondists* (1850), *General Bonaparte in Italy* (1853), *Defeat of the Cimbres* (1855), and episodes of the Algerian, Crimean, and Franco-German wars.

Phil'ips (AMBROSE), b. in Leicestershire, England, about 1671; graduated at St. John's, Cambridge, 1696; settled in London as a writer; was an associate of Steele, Addison, and their circle; wrote six *Pastorals*, which appeared in Tonson's *Poetical Miscellany* (1709) along with others by Pope—a circumstance which led to a bitter rivalry between the two poets; produced on the stage three tragedies, *The Distressed Mother* (1712), *The Briton*, and *Humphrey, Duke of Gloucester* (1721); commenced in 1718 a serial paper, *The Free-Thinker*, which attained great popularity; became secretary to the primate and to the chancellor of Ireland 1726; was chosen a member of the Irish Parliament; became registrar to the prerogative court 1734; returned to London, where he published a collection of his poems 1748. D. there June 8, 1749.

Philips, or **Phillips** (JOHN), b. at Bampton, England, Dec. 30, 1676; educated at Winchester School and at Christ Church, Oxford; wrote *The Splendid Shilling* (1703), a popular mock-heroic poem; *Blenheim* (1705), a poem in honor of Marlborough's victory; and *Cyder* (1706), an imitation of Milton and of Virgil's *Georgics*. D. at Hereford Feb. 15, 1708.

Phil'ipsburg, v., Clay tp., Montgomery co., O. P. 187.

Philipsburg, p.-b., Rush tp., Centre co., Pa., on Moshannon River and on Tyrone and Clearfield R. R., 20 miles from Tyrone, has schools, 5 churches, 1 bank, 3 hotels, a public library, 1 newspaper, 2 planing-mills, 1 tannery, a flouring-mill, foundry and machine-shops. P. 1086.

E. H. ELLSWORTH, ED. "JOURNAL."

Philis'tines, a people who occupied the southern seacoast of Palestine during most of the period of biblical history, and were almost constantly at war with the Israelites. As they are not mentioned among the occupants of the land in the time of Joshua, it is inferred that they were later invaders who came from Crete (Caphtor) during the obscure early period of the Judges. Their race-affinities have been much disputed. The genealogical table in Gen. x. seems to derive them from Ham, through Mizraim, but many commentators nevertheless consider them a Semitic people closely related to the Phœnicians, and not distantly connected with the Israelites themselves. The land of the Philistines was the low plain called the *Shefelah*, and their superiority in the arts of war and in the possession of weapons several times enabled them to conquer the Israelites. The five chief cities of the Philistines, Gaza, Ashdod, Ashkelon, Gath, and Ekron, had each their princes, who were united in a confederacy. The chief divinities of the Philistines noticed in the Bible were Dagon, Ashtaroth, and Baal-Zebub. The Philistines shared the fate of the Israelites in successive subjection to Assyria, Babylon, and Egypt, and disappeared altogether from history previous to the Christian era.

Phil'limore (JOHN GEORGE), LL.D., b. in Oxfordshire, England, in 1809; educated at Westminster School and at Christ Church, Oxford; was called to the bar at Lincoln's Inn 1832; became an eminent jurist, queen's counsel 1851, and professor at the Middle Temple; was chosen to Parliament 1852; wrote several legal works, and commenced the publication of a *History of England during the Reign of George I.* (vol. i., 1863). D. at Shiplake House, Oxfordshire, Apr. 27, 1865.—His brother, SIR ROBERT JOSEPH PHILLIMORE, D. C. L., b. in London Nov. 5, 1810, graduated at Oxford 1831, is also a distinguished lawyer and writer; sat in Parliament 1853–57; was knighted 1862; has been advocate-general, privy councillor, judge of admiralty, judge-advocate-general (1871), and master of the faculties (1873); author of *Commentaries on International Law* (4 vols., 1854–61).

Phil'lip (JOHN), R. A., b. at Aberdeen, Scotland, in May, 1817; was apprenticed to a house-painter; displayed such genius that through the aid of Lord Panmure he was enabled to study at the Royal Academy, London, 1837; exhibited his first historical picture 1840; returned to Aberdeen; employed ten years in delineations of the peasant life and the religious observances of Scotland; made several visits to Spain, where he found materials for numerous successful pictures; became a member of the Royal Academy 1859. D. at London Feb. 27, 1867.

Phillipp's, tp., Etowah co., Ala. P. 477.

Phil'lips, county of Arkansas, bounded E. by Mississippi River, which separates it from Mississippi. Area, 750 sq. m. It is in part level and subject to floods, but is extremely fertile and well timbered. Cotton and corn are extensively produced. The county is traversed by Arkansas Central R. R. Cap. Helena. P. 15,372.

Phillips, county of Kansas, bounded N. by Nebraska. Area, 900 sq. m. It is undulating, well watered, and adapted to wheat and stock raising. Since the census of 1870 it has been rapidly settled. Cap. Phillipsburg.

Phillips, tp., Hot Springs co., Ark. P. 239.

Phillips, p.-v. and tp., Franklin co., Me., on Sandy River. P. 1373.

Phillips (ADELAIDE), b. at Stratford-on-Avon, England, in 1833; came to Boston, Mass., in childhood; appeared on the stage at the Boston Museum 1843, and at the Walnut Street Theatre, Philadelphia, 1846; was for several years a favorite member of the Museum company; possessed a fine contralto voice, which by cultivation in Italy (1852–54) enabled her to become a successful prima donna, having appeared in Italian opera at Milan and Paris, as well as in the American cities. She resides in Boston.

Phillips (GEORG), b. at Königsberg Jan. 6, 1804, of Protestant parents; studied law at Göttingen and Berlin; became a convert of the Roman Catholic Church; wrote *Deutsche Geschichte mit besonderer Rücksicht auf Religion, Recht und Staatsverfassung* (2 vols., 1832), in which he defends all the extravagances and encroachments of the papal see; founded in 1838, together with Görres, the *Historisch-politische Blätter*, a periodical whose tendency was the re-establishment of the supremacy of the Roman Catholic Church in social life and the reduction of the state to a mere police institution; was appointed professor at Munich in 1833, at Innspruck in 1849, and at Vienna in 1851. D. at Salzburg Sept. 6, 1872. The most remarkable of his numerous writings are *Das Kirchenrecht* (7 vols., 1845–69) and *Deutsche Reichs- und Rechtsgeschichte* (2 vols., 1845–50).

Phillips (JOHN), LL.D., b. at Andover, Mass., Dec. 6, 1719; graduated at Harvard 1735; was for a time a preacher, but became a successful merchant of Exeter, N. H., where in 1781 he founded Phillips Academy at a cost of $134,000; gave also $31,000 to Phillips Academy, Andover, besides liberal sums to Dartmouth College and Nassau Hall, N. J. D. at Exeter, N. H., Apr. 21, 1795.

Phillips (JOHN), b. at Boston, Mass., Nov. 26, 1770; graduated at Harvard 1788; became a lawyer, and in 1809 a judge of common pleas; a State senator 1803–23; president of the State senate 1813–23; first mayor of Boston 1822–23; father of Wendell Phillips. D. at Boston May 29, 1823.

Phillips (JOHN), b. at Marden, Wiltshire, England, Dec. 25, 1800, was a nephew of William Smith, called "the father of English geology," of whom he was a pupil; became professor of geology in King's College, London, in the University of Dublin, and finally in the University of Oxford, and made important researches in electricity, magnetism, astronomy, and meteorology. Author of *Illustrations of the Geology of Yorkshire* (1829–36), *A Treatise on Geology* (2 vols., 1837–38), *Palæozoic Fossils of Cornwall, Devon,* etc. (1841), and other writings on geology. D. at Oxford Apr. 24, 1874.

Phillips (PHILIP), b. in Chautauqua co., N. Y., Aug. 13, 1834; was bred on a farm, but gave much attention to

music, which he studied under Lowell Mason; has for some years been distinguished as a composer of religious songs; became musical editor for the Methodist Book Concern at New York in 1866; has published collections of music for Sunday schools and social worship.

Phillips (Samuel, Jr.), LL.D., b. at Andover (North parish), Mass., Feb. 7, 1751; graduated at Harvard 1771; was a prominent legislator of Massachusetts, in whose senate he sat for twenty years, being for fifteen years its president; was a judge of common pleas 1781–98, and afterward lieutenant-governor; was a prominent merchant and manufacturer, and the principal founder of Phillips Academy, Andover, Mass. D. Feb. 10, 1802.

Phillips (Stephen Clarendon), b. at Salem, Mass., Nov. 1, 1801; graduated in 1819 at Harvard; became a merchant and a prominent State legislator; was in Congress 1834–38; mayor of Salem 1838–42; Presidential elector in 1840, and twice a Free Soil candidate for governor, besides holding various public offices; was many years connected with the State board of education, and one of the most prominent and public-spirited citizens of his State. He was extensively engaged in the lumber business in Canada, and perished at the burning of the steamer Montreal on the St. Lawrence, June 26, 1857.

Phillips (Wendell), the Tyrtæus of the anti-slavery cause in America, b. in Boston, Mass., Nov. 29, 1811, is the son of John Phillips, the first mayor of Boston, and was sent to Harvard College, from which he graduated in 1831; entered the Cambridge Law School, and after completing his studies in that institution in 1833, was admitted to the Suffolk bar in 1834. The times in which he entered upon the stage were clouded with political anxieties of the most serious character; and it was not in the nature of things for a young man of strong moral convictions, and with the consciousness of power lodged in an alert and vigorous body—a man, in short, in full spiritual and physical health—to stand outside the struggle that was already begun between the forces of liberty and slavery. William Lloyd Garrison, by his clear-headed, courageous, and uncompromising declaration of anti-slavery principles, had not only made that struggle inevitable; he had actually brought it about, and taken so bold a stand that it was impossible it should ever end until one side or the other should conquer. Those who knew the principles that were at stake, and how deep they struck down into the foundations of society, and who knew also what the man was who had pledged his life, his fortunes, and his sacred honor not to forsake the cause of liberty, knew well enough that the war was begun, and that it would be fought out to the end. The incidents of the anti-slavery contest, so far as Mr. Garrison was directly connected with them, have been already fully detailed in our account of his life. In 1835 the "Broadcloth mob"—so called because it was set on foot, and even led, by men of wealth and social position—broke into a meeting of the Women's Anti-Slavery Society and obliged it to disperse. Mr. Garrison, who was assisting at the meeting, was seized by the mob, a rope was put about his body, and he was dragged through the streets, the authorities refusing to interfere officially, and his life was only saved by the subterfuge of putting him in jail as a disturber of the peace. It is pertinent to our subject to state here that the women of the society behaved on this occasion with the heroism that might have been hoped for from such as they were—women of the best blood and breeding of Boston. The president of the society was Mrs. Maria Weston Chapman, than whom America never knew a better-trained, more cultivated, or more earnest woman, with nobler manners, with a larger heart, or richer in saving common sense. Wendell Phillips, not at that time twenty-five years of age, witnessed the extraordinary spectacle of this mob of gentlemen—well-dressed, rich, and the inheritors not only of money, but of all that had been done for culture and enlightenment in Boston for 200 years, yet still so sunk in essential ignorance as to believe they could fight moral conviction with brick-bats and ropes! And he saw, too, the courage of a band of women delicately born and bred, who in this hour of trial could teach men what strength belief in principle can impart to the weak. He saw, what those who saw it say can never be forgotten, the face of Maria Weston Chapman as she walked out of the hall, where, in answer to her dignified pleading, the mayor of the city had told her he had no power to protect her or her society. No mob, not even one of gentlemen, could have found it in its heart to insult such a woman, and if even the representatives of Beacon street and Park street opened up a way for this woman to pass through unharmed, it is not difficult to understand that a nature so nobly strung as that of Phillips's must have been greatly moved by such a sight. Nor will it surprise us to learn that from those earliest days the cause of the rights of woman has held an almost equal place in his mind with that of the rights of the slave; nor that when the one cause was gained, and slavery felt to be under foot, the cause of woman should have found in him one of its sturdiest supporters. Mr. Phillips made his first distinguished mark as an orator in 1837. A meeting had been called in Boston to protest against the murder at Alton, Ill., of the Rev. Elijah P. Lovejoy, the editor of an anti-slavery newspaper, who had been killed by a mob in that place while attempting to save his printing-press and his office from their fury. Mr. Lovejoy was a native of New England, a man of character and worth, and his death was deeply felt by the friends of the anti-slavery cause everywhere. The Boston mob had sown the seeds of open violence over the whole North, and the Alton mob, though it was made of different stuff from that which had its origin in Beacon street, was animated by the same spirit. The meeting in Boston would have ended in the smoke of a few perfunctory resolutions—and under the crafty leadership of the chairman, Attorney-General Austin, a cowardly conservatism had nearly gained so much—when Wendell Phillips in a manly, logical, and yet fiery speech took the meeting out of the hands of the Sauls who held the clothes of the slayers of the martyrs and were consenting unto their death. From this time Mr. Phillips, having once set his hand to the plough, never looked back. He gave up his commission as a lawyer, since he could no longer hold himself bound to obey the Constitution of the U. S., which, as a lawyer, he knew protected the holder of slaves in those rights which Phillips had determined not only never to recognize, but to destroy. It must be remembered that in taking this step Wendell Phillips made a sacrifice of social position and of ambitious prospects such as few young men have ever made in any country. He had good grounds for every hope that can animate a youth. He was well born, he was well bred, he had a fortune assured without labor, and was thus free, loving labor, to strike his furrow where he would. He had all personal advantages, and such native gifts as an orator—graces and strengths that played against a background of solid learning and accomplishment—that it was inevitable all the prizes of the world he lived in would have been heaped into his hands had he only been willing to serve that world in its own way. On the other hand, when he turned and looked, he saw but a grim prospect. Certainly, he did not, as Mr. Garrison did, see ruin and starvation staring him in the face. All his material wants were secured from peril, but everything else that makes life dear to social man was on the hazard of the die he cast when he joined the anti-slavery cause and gave up his position at the bar. Perhaps never anywhere, out of France, did political and religious hatreds have such a swing as they had in the Boston of the first half of this century. No one who does not know these days by experience can imagine the social pressure that was brought to bear on those who took up the anti-slavery cause in earnest. The trouble was, that these converts were not poor fishermen and carpenters, but were socially every way the equals of the people who persecuted them. They were born as well, had fed as well, and when they were called on to endure the winter's cold, with doors shut in their faces that once were gladly opened, with averted glances in the street, and open cuts from old-time friends, they must have been callous indeed not to feel this cruelty. But all was borne with high-hearted cheerfulness and sweetness; and let one who as a boy was by good fortune an eyewitness of this noble company's behavior testify how inspiring it was to live even in the shadow of such serene and honest heroism. Phillips, then, had great compensations, and bought with what in simple faith and loyalty to right he meant for a sacrifice the confidence and intimate companionship of men and women with whom it was a high privilege to live and share their work. From this time, giving up all other employment, Mr. Phillips devoted himself with unfailing energy to the advocacy of the anti-slavery cause. He was the orator, above all others, by the charm of a powerful logic, a wit that played about his theme with the purity and the power of the sunbeam, and a command of the English language that showed him familiar with the works of every master. It may fairly be questioned whether there ever spoke in America such an orator as Wendell Phillips. He had, united, such weight of matter and such manliness of manner, with only so much grace as may be allowed in a man, that no audience, though it were packed with enemies when he began, but would be his friend when he had ended. He spoke, so far as it was physically possible, wherever he was called, and always without pay—sometimes, very often indeed, paying his own travelling expenses. He never used notes in speaking, nor, we believe, wrote out his speeches beforehand. His manner was grave and dignified, with but few gestures, and those struck out from the fire of the moment; and they had such truth and aptness as no premeditation can give.

His characteristics as a speaker were—a logical, lawyer-like setting out of his subject and great closeness in his argument, so that if he went off a little to meet an interruption, or to answer a question, or to parry the thrust of an insult or a threat interjected, he quickly returned and beat out the iron on his anvil. He had no pathos, nor ever tried to move that way; he had not Mr. Lincoln's Eastern gift for story-telling; but he knew well the charm of anecdote, of illustrations from history and biography, and his speeches were rich in the objective charm that comes from the apt introduction of these. No speaker was more welcome; and when the storm of the anti-slavery agitation was somewhat subsided, and people had learned that it was useless to try to stay the stream, no name was surer to draw out the population of the towns and villages to the lyceum than that of Wendell Phillips. In New York and Boston he was always sure of a crowded house, and he was always ready to speak for any cause he held dear, especially for temperance, of which he was always a distinguished advocate, and for woman's rights. He sometimes lectured on topics apart from his main errand, and one lecture, *On the Lost Arts*, has been delivered by him an immense number of times. For such deliveries as these we believe Mr. Phillips has always been paid, but with a generosity characteristic of the man the money earned in this way has been turned into some needy treasury or found its way into hands whose needs were not to be made known. The anti-slavery cause, so far as it could be the work of one man, was Mr. Garrison's creation without a doubt, but Mr. Phillips took the water out of Mr. Garrison's great cistern and with it refreshed the whole land. This new Paul planted, and this new Apollos watered; and, as they did all for the love of God, they would be the first to declare that he alone gave the increase in which we to-day rejoice. Since the abolition of slavery, Mr. Phillips has been busier than before in the lyceum. Besides temperance and women's rights he has lectured often and written much on finance, the relations of labor and capital, and the effort to secure a fairer division between the capitalist and workmen of the fruits of their joint toil. He has advocated prohibitory legislation in regard to the sale of liquors, maintaining that thus far the attempt to govern great cities on the basis of universal suffrage has been a failure, owing to the influence of the dram-shop. He has urged that the national banks be deprived of the right to issue bills, and that the government furnish all the national currency, separating it wholly from any coin basis, and let the currency rest solely on the credit of the government.

CLARENCE COOK.

Phillips (WILLARD), LL.D., b. at Bridgewater, Mass., Dec. 19, 1784; graduated at Harvard 1810; was a college tutor 1810–15; became a lawyer of Boston, Mass.; was a judge of probate 1839–47; became in 1843 president of a life insurance company; author of treatises on *Insurance* (1823), *Patents* (1837), *Political Economy* (1828), etc.

Phillips (WILLIAM), b. in Boston, Mass., Apr. 10, 1750; was a successful merchant, an ardent patriot, and a liberal benefactor of Phillips Academy, Andover, and the Andover Theological Seminary; was lieutenant-governor of Massachusetts 1812–23. D. May 26, 1827.

Phillips (WILLIAM WIRT), D. D., b. in Montgomery co., N. Y., Sept. 23, 1796; graduated at Union College 1815; studied at the New Brunswick Seminary; became pastor of the Pearl street Presbyterian church, N. Y., 1818; was transferred to the Wall street church 1826; prominent in the public concerns of the Presbyterian Church; was trustee of the college and seminary at Princeton, member of the council of the New York University, president of the board of foreign missions, and moderator of the General Assembly 1835. D. in New York Mar. 20, 1865.

Phil′lipsburg, p.-v. and tp., cap. of Phillips co., Kan., on Deer Creek.

Phillipsburg, p.-v. and tp., Warren co., N. J., on Delaware River opposite Easton, Pa., on Morris and Essex, Central New Jersey, Lehigh and Susquehanna, and Belvidere Delaware R. Rs., has 1 newspaper and large manufactures, chiefly of iron. P. 5932.

Phillipsburg, b., Moon tp., Beaver co., Pa. P. 554.

Phillipston, p.-v. and tp., Worcester co., Mass. P. 693.

Phil′lipstown, tp., Putnam co., N. Y. P. 5117.

Philmont, p.-v., Claverack tp., Columbia co., N. Y., on Harlem R. R.

Philo, p.-v. and tp., Champaign co., Ill., on Toledo Wabash and Western R. R. P. of v. 291; of tp. 1184.

Phi′lo Judæ′us, b. at Alexandria about twenty years before Christ; spent his whole life there, with the exception of two journeys he made—one to Jerusalem, and one to Rome. Of his life very little is known, though he is often mentioned by Josephus, Eusebius, and Hieronymus. He was of a wealthy family, and occupied a conspicuous position in his native place. In the year 40 A. D. he was chosen a member of the embassy which the Jews sent to Rome to Caius Caligula. The embassy stayed in Rome over half a year without being admitted to the presence of the emperor; but during the reign of Claudius a learned defence of the Jews, written by Philo, was read in the Roman senate. The embassy he has described in his *Legatio ad Cajum*. In Alexandria he devoted all his time to studies, and although as a philosopher he is without original genius, and as an author without original style, the peculiarity of his situation as mediator between Greek and Oriental wisdom, between Platonism and Judaism, between polytheism and monotheism, gave his writings a great influence in his own time, and makes them interesting to ours. During the reign of the Ptolemies many Jews had gathered at Alexandria, allured by the marvellous progress of that city in wealth and commercial importance. At the time of Philo they occupied two of the five wards of the city, and they were found also in the three others. But having come into close contact here with Greek civilization and Greek philosophy, it became difficult for them to maintain their original character as Jews unalloyed. They naturally endeavored to reconcile that which in their sacred books they considered as divine revelation with that which in the Greek speculation they felt to be true. From this intermixture of Greek and Oriental views sprang Gnosticism, Neo-Platonism, and that school of Christian theology which is generally called the Alexandrian, represented by Clemens Alexandrinus, Origen, and others. But the first representative or manifestation of this peculiar spiritual atmosphere of Alexandria is Philo Judæus. He was a very pious and religious man, and believed himself to be an orthodox Jew. He was very severe on those of his countrymen who found it easy to accommodate the faith of their ancestors to the new circumstances; yet he is himself their representative, their type. His many writings are generally divided into three classes—those defending his countrymen, *Contra Flaccum, Legatio ad Cajum, De Nobilitate*; those interpreting and explaining the sacred books of the Jews and their ideas, *De Mundi Opificio, Legis Allegoriarum Libri III., De Monarchia, De Præmiis Sacerdotum, De Posteritate Caini, De Cherubim, De Pœnitentia*; and those treating metaphysical subjects, *De Mundi Incorruptibilitate, Quod Omnis Probus Liber, De Vita Contemplativa*. Of these three classes, the second and third are the most interesting with respect to his standpoint. His method of interpretation is the allegorical. The texts of the sacred books are not made subjects of positive criticism, but employed as opportunities for the development of theories. Thus, the garden of Eden represents God's wisdom, and the four streams issuing from the garden the four virtues emanating from wisdom. Adam, hiding away from God, represents vice, which bereaves us of the aspect of the good. In his total view of the universe he retains the genuine Jewish separation between God and the world, but he knows how to reconcile it with the Greek polytheism and pantheism. While in the Old Testament the world is in God's hand like a cloth, which he folds or unfolds just as he pleases, with Philo matter is an eternal principle. His idea of God is thoroughly monotheistic, but between God and matter he finds a convenient place for the ideas of Plato transformed into the angels of the Old Testament. These ideas or powers or angels form the medium through which God reveals himself to the world, and they are all gathered together in a divine world-spirit, a divine intellect, the *Logos*. CLEMENS PETERSEN.

Philology. See LANGUAGE.

Philopœ′men, b. at Megalopolis, Arcadia, in 252 B. C., of a noble family; received a careful education, and gave early evidences of his military and administrative talents; distinguished himself greatly in the battle of Sellasia (221 B. C.) as leader of the horse; lived subsequently for several years in Crete, and was chosen commander-in-chief (*strategos*) of the Achæan League in 208 B. C., a position which he held eight times. It was his policy to put down rigorously all internal dissensions and feuds in order to deprive the Romans of any opportunity of interfering in Greek affairs; and although his plan was finally baffled by the fickleness of his countrymen and the meddlesomeness of the Roman senate, in details he achieved many brilliant successes; thus, he compelled the Spartans to join the league, which was an important step toward the establishment of a united Greece. He was in Greek history the last character of a heroic cast. When the Messenians revolted against the league, he was seventy years old and sick in bed, but he rose immediately and put himself at the head of the army of the league. In the ensuing battle he fell into the hands of the enemy, and their commander sent to him a cup of poisoned wine, which he emptied (183 B. C.).

Philop'olis (P. O. name SPARKS), Baltimore co., Md.

Philos'ophy [Gr. φιλοσοφία, from φίλος and σοφία, "love of wisdom"]. The introduction of this term is currently attributed to Pythagoras on the authority of Cicero (*Tusc.*, v. 3) and Diogenes Laertius (i. 12; viii. 8), but the oldest writer known to use it is Herodotus (i. 30). The Seven Wise Men were called σοφισταί, to denote their practical sagacity rather than their knowledge of science as such. Socrates, however, is said to have called himself a philosopher in order to reprove the Sophists of his time, he being only a seeker of wisdom—they, self-styled possessors of wisdom.

Its Definition.—Many noteworthy definitions of this science may be culled from its writers. While the Stoics made it include "a striving after virtue in the sciences, physics, ethics, and logic," Epicurus declared it to be the rational pursuit of happiness. Plato had already designated philosophy as the acquisition of true knowledge (ἐπιστήμη = scientific knowledge), and Aristotle had defined it as the science of being as being (τὸ ὂν ᾗ ὄν). The relation of cause and effect furnishes the basis of the definitions of the earlier among modern philosophers (Descartes, Bacon, Hobbes, Leibnitz). Wolf returns substantially to the Aristotelian basis by defining it to be the science of possible existence in so far as possible, thus referring to the logical conditions of existence. Fichte makes it the science of sciences (*Wissenschaftslehre*); and this conception is very generally adopted, with slight modifications, by later thinkers. Whenever man attempts to refer all of his cognitions to one, he begins to philosophize. Each nation's philosophy is an endeavor to solve the problems of the world, as they appear to it from the standpoint of its national life, by some one principle. This principle may be any cognition selected from the realm of nature or from that of mind. The systems of philosophy of a given nation or time may differ as to the one principle chosen as the explanatory one, but they are certain to agree in the elements of the problem to be solved. For the philosophy of a given epoch endeavors to state in ultimate terms the elements of the problems of its epoch. A philosophic solution of a problem consists in the reduction of the immediate and contradictory elements, as they are given in life, to the ultimate terms or expressions which indicate the universal and necessary conditions out of which those elements have arisen. Hence, every philosophy has two factors: (1) the temporal and finite one, which includes the empirical elements to be explained—that is, the then present world of man and nature, which involves problems to be solved; (2) an eternal and infinite element, or the permanent and unchangeable ultimate idea through which the solution is wrought out and by which the temporal and finite is explained: this element is the conception of the absolute as it finds expression in the solution. Thus, the different systems of philosophy start from different phases of life (because its phases, from one age to another, are perpetually changing), and yet they arrive at substantially the same result if they are complete systems. The difference, therefore, between the systems of philosophy of different peoples appertains rather to the empirical factor than to the character of the general terms in which the solution is expressed and contained. It has been pointed out (see GENERALIZATION) that in the most rudimentary form of knowing—*i. e.* in sense-perception—there is a synthesis of the two extremes of cognition: (1) the immediately conditioned content, which is the particular object as here and now perceived; (2) the accompanying perception of the self or Ego which perceives—that is, the activity of self-consciousness, the knowledge that it is I who am subject in this particular act of perception. Hence, in sense-perception two objects are necessarily combined: (*a*) the particular object here and now presented; (*b*) the universal subject of all activity of perceiving. This universal subject, which is thus its own object in all forms of knowing, appears in two characters if we reflect upon it: (1) it is absolutely particular—*i. e.* present in this special moment now and here, and in this special act of perception; and (2) it is absolutely universal, retaining its self-identity under the constant change or flux which essentially belongs to the process of the immediate now and here, or present moment. The present now is a point in time, and thus has no duration except through the synthetical addition of past and future time, which *are* not, but either *were* or else *will be*. Thus, such a thing as the perception of a permanent or a *relation of any sort* (for example, the one of identity or of difference, the most elementary and fundamental ones) cannot transpire without attention on the part of the subject who perceives to the perception of self or to the universal factor which is present in perception. This act of attention to self is reflection, self-perception entering all perceptions. The degree of the power of reflection or of attention to self-consciousness measures the ability to generalize or the ability to think; or, in other words, the strength of thought. For the minimum of this power of reflection admits barely the possibility of combining the perceptions of time-moments that are slightly separated, and hence its results are bare perceptions of identity or difference, without the quantity and quality thereof. Sense-perception increases in richness of knowledge in proportion as the power of synthesis or of combining the successive elements of perception increases. And this power of combining such separate elements is contingent on the power of reflection or of attention to the self-activity in perception. Such reflection has been called "second intention," and is the condition of all generalization. Self-consciousness is therefore the basis of all knowledge; for all predication—from the emptiest assertion, "This is now," up to the richest statement involving the ultimate relation of the world to God as the highest principle—is possible only through a withdrawal of the mind out of the limiting conditions of the particular here and now by means of attention to its own activity, which, as already pointed out, comprehends the two phases of absolute particularity and absolute universal potentiality in one. This is the psychological basis of the general principle laid down regarding the identity of systems of philosophy and their phases of difference. The naïve state of mind of the uncultured human being, alike with the acute philosophical intellect or the intuition of the religious mystic, involves in all its activities and at every moment thereof this phase of attention to the self-activity or to the subject which knows. The naïve or non-philosophical stage of consciousness differs from the philosophical stage in the fact that the latter sets up some one of its cognitions as the highest principle, through which it attempts to explain the totality of said cognitions, while the former makes no such attempt. The philosophical activity of the mind is therefore a *third intention*, or act of attention which has for its object the reference of individual cognitions, whether particular or general, to an assumed supreme principle. This philosophical act, it is evident therefore, is a species of reflection different from that reflection which is implicit in all cognition. It is an act of withdrawal of the mind from immediate cognition, which arises through the first and second intention (or perception and reflection), and a concentration of the attention upon the relation of that immediate cognition (as existing in its separate details) to all cognition as totality. It is therefore systematic knowing. Moreover, as already suggested, it may posit as its supreme principle any one of its cognitions, taking, for example, an empty one lying close to the sensuous pole of cognition, or a concrete one lying close to the pure Ego. Thus, it may make matter, or some form of matter, as water, air, fire, or ether, the philosophical principle which is to explain all things, being universal and particular at the same time; or it may take for this purpose Reason (νοῦς), the Will, the Idea, the Good, *Causa sui*, the self-representing monad, or some form nearly approaching the pure Ego, for its principle. But the psychological presupposition underlying all philosophy, whether materialistic or spiritualistic, is the fact of withdrawal or abstraction of the mind from its first stage of cognition, and the contemplation of the same under the form of relation to a single principle—*i. e.* to an absolute totality. This contains the remarkable result that in this species of knowing the mind views its first principle, or the primitive existences by which it explains things as self-activities; which means that mind sees under its knowledge its own form as the ultimate truth of all. Take the standpoint of materialistic philosophy, for example: Matter is the ultimate principle, the whence and whither of all. Matter is thus posited as a universal which is the sole origin of all particular existences, and also the final goal of the same. Hence, matter is active, giving rise to special existences, and also changing them into others with all the method and arrangement which we can see in natural laws. For matter must contain in it potentially all that comes from it. Hence, matter is creative, causing to arise in its own general substance those particular limitations which constitute the differences and individuality of things. It is negative or destroyer in that it annuls the individuality of particular things, causing to vanish those limitations which separate or distinguish this thing from that other. Such a principle as this "matter" is assumed to be, which causes existences to arise from itself by its own activity upon itself and within itself, entirely unconditioned by any other existence or energy, is self-determination, and therefore analogous to that factor in sensuous knowing which was called the Ego or self-consciousness—an activity which was universal and devoid of form, and yet incessantly productive of forms, and destructive of the same. All this is implied in the theory of materialism, and exists there as separate ideas, only needing to be united by inferences. But "mat-

ter" as such idea is a cognition which arises only through reflection; it is perceived by "second intention," for first intention only refers or relates to immediate particular objects, and not to general objects like "matter," which is only a term for the persistent activity which recurs in the perception of whatever objects it apprehends in time and space. As cognition of the mind, therefore, "matter" is a product of "second intention," but as philosophic principle it is more than this: it is this special cognition of matter posited as the absolute or as the totality and entirety of cognition, and hence not as limited through other particular cognitions, but as containing within itself all limitations necessary for the particularization of other cognitions. Hence, it is a pure Ego in so far as the possibility of all special ideas are concerned, and an active process so far as actual particular existence arises from it. Thus, the position even of materialistic philosophy implies the thought of a totality which is purely universal, and a pure activity originating particular existences at the same time. And here we meet the most important distinction which belongs to the definition of philosophy. The degrees of consciousness are various, and differ through the completeness with which they grasp the determinations of the self-activity of the Ego. On the stage of philosophy consciousness grasps determination as a totality, and hence as self-determination. But this may happen in all shapes, from the emptiest up to the fullest and concretest. Even in materialism the attempt to explain the world through an ultimate principle indicates the certitude of the mind of the objectivity of its principle of self-determination, and it therefore implicitly asserts and presupposes that the truth of things is self-determination. And yet it may under this form so far contradict itself as to represent its content, "matter," to be a mere spatial existence, thinking under the term a vague abstraction as the origin of all immediate particularity and as the final cause thereof, without distinctly defining to itself these attributes as belonging to matter as highest principle. There are, then, various forms of philosophy, differing in the degree of completeness in which they consciously define their highest principle as the concrete Universal which originates the particular by its self-activity, and thus realizes itself in its own externality.

The distinction of philosophy from religion (and religion would be thought at first to be a reduction of all specialty to an absolute principle (God), in the same manner as defined for the province of philosophy) lies in the fact that while philosophy attempts to comprehend the totality of things through its absolute principle, religion *represents* its absolute in the historical relation of Creator of the world, and thus while it does subordinate all knowledge to one of its own principles, the mind in religion is not active in its third intention, but only in its first and second intentions. Religion offers its teaching to the lower and lowest stages, as well as to the highest stages of theoretical consciousness; for its revelation, although of the highest essence, is not immediately addressed to the theoretical reason, but rather to the Will. Hence, it presents its absolute, not for assimilation, but for practical reconciliation with the individual. The relation of theosophy or mysticism to philosophy is here to be defined. Setting out from the standpoint of religion, and positing the absolute of religion as not only the principle of human action, but also of theoretical cognition, the religious mystic explains the world of nature and of history through it. This constitutes theosophy. It purports to arise through special illumination of the mind through the Absolute, and may be very profound and complete in its theory of things, but will of necessity use categories borrowed from religion, and consequently tinged with pictured representations, while philosophy uses its thoughts abstractly, and derives them from the activity of reflection.

The province of literature is to be distinguished from philosophy through the fact that its works seek an æsthetic unity of form, rather than a unity in the principle portrayed. It may happen, as in the poem of Lucretius, *De Rerum Natura*, that a philosophical treatise assumes an æsthetic form, but such form does harm to the requirements of scientific method. The essay and the literary criticism may offer profound reflections, but they are necessarily hampered through their form when it is literary rather than scientific.

The sciences, finally, are more difficult to distinguish from philosophy, especially the mental sciences. Indeed, philosophy is sometimes made synonymous with mental science, or with psychology. While religion agrees with philosophy in content (the relation of the Absolute to the world), it differs from it in form (employing the principle of faith or authority instead of logical necessity); the sciences, on the contrary, agree in form, but disagree in content. They treat of the systematic arrangement of materials within special provinces, rather than the reduction of the same to the first principle of all. The province of philosophy may include those of all special sciences, and even those of art and religion, jurisprudence and ethics, psychology and ethnology, in so far as those provinces are made elements of the problem of the universe to be solved by a first principle.

Its Method.—Philosophy alone can cognize methods, whether of other provinces of mental activity or of its own procedure. First and most obvious is the analytic method, which proceeds by resolution of a whole into its parts, and is a method of invention or discovery, inasmuch as it concentrates indefinitely the power of the mind upon a subject by attacking its details singly. This method is in philosophy what the microscope is in anatomy and kindred physical investigations. It proceeds from the vague to the distinct and clear. Then there is the synthetic method, which proceeds by combination or composition, and is a method of generalization or of principles—a method of explanation rather than of discovery. Besides these species of method, their union gives rise to higher species of method: (1) deductive method, proceeding from the necessity of the whole to the necessity of the parts; (2) inductive method, proceeding from particulars contingently given to their necessary unity; (3) dialectic method, which by the analysis of its object discovers its essential dependence upon other objects and its unity with them; again, considering the new object, which has arisen synthetically through the discovery of dependence in its first object upon other objects, it discovers by analysis a new form of dependence, which leads to a new synthesis, etc. It is a method of ascent toward a first principle by the discovery of presuppositions, and by their addition to the object considered. It is contrasted by Plato (*Repub.*, bk. vii. ch. xiii.) with the mathematical method (that of simple deduction), as the method which removes its hypothesis (*i. e.* its first object) and ascends toward a first principle (ἐπ' αὐτὴν τὴν ἀρχήν), while geometry and the kindred sciences use fixed hypotheses (*i. e. assumed* first principles), and are unable to show their necessity as the dialectic method does by the discovery of presuppositions. The method of Aristotle is dialectic in the same sense as that of Plato, differing only in this, that he makes it more exhaustive by laboriously collecting and discussing all the inadequate phases that fall under each subject, exhibiting at last the true archetype or adequate realization of the species, as though he had empirically discovered it by careful investigation. The dialectic method contains the process of analysis in union with that of synthesis. Its analysis proves to be a synthesis because it reveals dependence, and hence the relation of the part to a whole. It must be present under all forms of necessary thinking, even when the thinker is unconscious of his method; as, in fact, he may be even of all method, and still think philosophically. The inductive and deductive methods, so called, unite analysis and synthesis also, but in the former the side of analysis is partly suppressed, in the latter that of synthesis. Again, the dialectic method is skeptical when it lays chief stress on its negative side, on that of the destruction of its hypothesis through the discovery of dependence, and speculative when it subordinates the negative phase to the total result, which is constructive of a more comprehensive and deeper thought—hence, of a truer thought.

Its Classification.—(A.) From the foregoing definition of philosophy it is evident (*a*) that there is one province of thought which belongs partly in the domain of philosophy and partly in that of religion—to wit, theosophy or mysticism. In it the dogma is partially rationalized, and therefore belongs to the realm of cognition instead of faith. Theosophy is the first form of philosophy, therefore, inasmuch as it makes its appearance as an outgrowth from religion, the effort being made to realize the content of religion as truth. (*b*) Thought perfectly independent from religion, and intent on constructing a rational view of the world and on reducing its common notions to consistency, originates systems of materialism. It is not yet sufficiently disciplined to seize consciously its higher cognitions (those of the soul, for example) as first principles with which to explain the world; it therefore posits a cognition lying close to its ordinary experience and most familiar to it, as the explanation of all. (*c*) It gradually discovers what it has implied by endowing a principle with the power of originating all things, and comes to adopt, step by step, more spiritual principles until it reaches pure idealism and recognizes the world of sense-perception as phenomenal manifestation of absolute mind. (B.) Above this standpoint begins the series of systems founded on perception of method (the fourth intention of the mind, making for its object the operations of the mind in its third intention, or ordinary philosophizing). (*a*) The first

system founded on perception of method is skepticism, which breaks the link between subject and object, between the mind and the truth, by calling attention to the process or method of the mind in philosophizing, and exhibiting the modifying effect of mind upon truth. It shows that the activity of the mind enters and constitutes an element of truth, and therefore invalidates it. (*b*) The second system founded on the perception of method is the system of speculative psychology, which perceives the positive side of method, and its necessary universality as principle of existence or as logical condition of the world. This last system is sometimes called pure science, science of ideas in and for themselves, ontological logic, science of knowledge, absolute idealism, etc. Examples of each of these five systems may be found in the subdivision *History of Philosophy.*

Its Departments.—The old division of Wolf makes four departments in philosophy: (*a*) ontology, (*b*) rational psychology, (*c*) cosmology, (*d*) theology. This may be modified to meet the present development of philosophy thus: (*a*) pure science or logic or methodology—dialectical discussion of general ideas; (*b*) science of nature, corresponding to rational cosmology; (*c*) science of spirit, including numerous subordinate spheres, such as (1) psychology, (2) ethics, (3) politics and history, (4) æsthetics, (5) theology (natural). This corresponds nearly to the division of the ancients into (*a*) dialectics, (*b*) physics, (*c*) ethics. (Other distinctions which appertain to this subject will be found under the *History of Philosophy*, and in many instances under their several titles throughout this work.)

Its History.—The history of philosophy, according to the definition discussed in this article, will contain the record of all thinking which refers the manifold of experience to an ultimate principle; this explanatory principle being materialistic on the one hand in the elementary stages of thought, and idealistic in the more advanced stages, while it becomes a principle of method (or a principle at once ontological and psychological) in the highest thinking.

The Orient has generally been excluded from the domain of the history of philosophy, on the ground that its thinking is not emancipated from religious authority. Religion and philosophy are mingled in a species of theosophy in Asia, but are worthy of study as a phase of transition containing the embryonic shapes and metamorphoses that become fully developed and distinct in the literature, religion, and philosophy of the Western peoples. The Chinese systems of Lao Tzŭ (604 B. C.) and Confucius (550 B. C.) posit a first principle (called *Tao* by the former, and *Tai-ki* by the latter), an abstract indeterminate substance, whence arise masculine and feminine principles that beget all things.—The caste system gives rise to limitations so irksome and galling that the great problem in Indian thought is emancipation; it seeks relief from the rigid particularity of the distinctions (tedious ceremonial observances) which it encounters in life, by flight to the indefinite, vague, and empty ground of substance of all things, and finds solid satisfaction in contemplating Brahm —*i. e.* the pure identity wherein neither caste-differences, nor the bewildering luxuriance of tropical nature, nor even the prolific creations of its own active fancy and teeming intellect, any longer find subsistence to vex and weary it. Besides the Sankhya or rational system, there is the Nyaya, or logical system of Gautama, and its modification in the atomic system of Kanada, called the VAISHESHIKA (which see); the Vedic system, full of mysticism, including the elder school of commentary called *Purva Mimansa*, founded by Jaimini, and a later one called *Uttara Mimansa*, founded by Krishna Dwaipayana.—The philosophic stand-point of the Persian consciousness is considered to be an advance upon those just considered, in that it gives greater validity to the negative element—that of limitation or finitude, the principle of individuality or particularity. It posits a process, the conflict of light and darkness or of good and evil, the positive and negative, as the explanatory principle of the universe.—The worship of Hercules and of Adonis in Syria and of Osiris in Egypt indicate a progress over the standpoint of Zoroaster, in that the principle of particularity is still more highly prized. Purification through pain reconciles the finite and infinite, and it is not necessary to annihilate the former. Immortality of the individual becomes explicable, and the Egyptian mind is mostly occupied with this thought.—Western Asia (including Egypt) occupies itself with the problem of individuality and its essential inherence in the absolute. Its influence appears in the Ionic philosophy, particularly in the teachings of Anaximander and Heraclitus; in the Pythagorean philosophy; in neo-Platonism; in gnosticism; in the mysticism founded on the *Cabbala;* in the early Christological speculations of the Church; in Arabian mysticism.—The history of philosophy in the Occident, beginning with Greece, has to do with independent thinking, and is no longer obliged to seek its material in systems that are partly religious, partly ethical, and partly speculative. Greek philosophy begins with the Ionic school in Asia Minor, Thales, Anaximander, Anaximenes, and Heraclitus being its chief names. They set up material principles—(*a*) water, (*b*) the indefinite (matter), (*c*) air, and (*d*) fire—as the origin of things. Pythagoras, an Ionian by birth and taught in its school of philosophy, founds a society in Lower Italy, and proclaims numerical harmony as his principle. The Eleatic school (also of Lower Italy) sets up the principle of pure being; it included Xenophanes, Parmenides, and Zeno. Empedocles of Sicily taught that love and hate are the ultimate principles, while Anaxagoras at Athens announced the important doctrine that Reason (νοῦς) arranges and orders all things. Leucippus and Democritus of Thrace founded the atomic philosophy. The Sophists, of whom the most important were Protagoras, Gorgias, and Prodicus, discovered and applied the principles of ratiocination, or the dependence of conviction upon grounds or reasons. Socrates investigated universals, seeking ultimate grounds for conviction in order to establish moral principles on a firm basis. The νοῦς of Anaxagoras becomes with the Sophists individual reasoning—with Socrates, universal reason as conscience. Plato, continuing the investigation, finds the theoretical universals, the ideas or archetypes, antecedent to and dominant over the world of experience. Aristotle, finally, takes an empirical inventory of the world, and completes the demonstration that νοῦς is the principle of things in detail, being their final cause. He finds that all universals are phases of one universal Reason (νοῦς ποιητικός), which is the highest principle. His doctrine of first and second entelechies defines the relation of individuals to this absolute Reason and the grounds of the immortality of man. He maps out the paths of the several particular sciences, and makes important investigations in many of them. His pupils, Eudemus and Theophrastus, and his commentators, Alexander of Aphrodisias, Porphyry, Themistius, Simplicius, and, later, Avicenna and Averroës, deserve mention in any notice of Greek philosophy, however brief. The Stoic school of Zeno of Citium, whose system is ethical in its tendency, the school of Epicurus, whose system is an atomic materialism, belong to the decline of Greek philosophy. (This brief summary of the first phase of Greek philosophy may be supplemented by reference to articles in this CYCLOPÆDIA devoted to special titles here named, and particularly to the following: THALES, PARMENIDES, ZENO OF ELEA, HERACLITUS, PYTHAGORAS, SOPHISTS, SOCRATES, PLATO, ARISTOTLE, STOICS, ZENO OF CITIUM, TELEOLOGY, FORM, MATTER, SUBSTANCE, IDEA, SIMPLICIUS, SEXTUS EMPIRICUS, LUCRETIUS.) The revival of Greek philosophy at Alexandria after the Christian era was occasioned by the contact of Greek thought with Orientalism. Alexandria was the focus or centre for the East and the West. Neo-Platonism, accordingly, is the struggle to define the relation of Greek thought to spiritual religion. Its distinguished names are Ammonius Saccas, Plotinus, the two Origens, Porphyry, Iamblichus, and Proclus. Its principle is the transcendence of the Deity, and it labors to explain how the world emanates from a primal one which is in nowise related to it, and is devoid of all antithesis, and therefore unthinkable. Boëthius, through his *Consolatio* and his translation of a portion of the *Organon*, and by his commentary on the *Isagoge* of Porphyry, transmitted almost all that was known of Greek philosophy by the Christians in the West for several centuries. (See articles on PLOTINUS, PORPHYRY, IAMBLICHUS, PROCLUS, GNOSTICS, MYSTICISM, PHILO.) — Within Christianity, Gnosticism arose in the second century as an attempt to construct a philosophy on a Christian basis. Philo had already speculated on the Logos. Valentinus made the νοῦς the "only-begotten" and the source of the Logos. Origen and Clement endeavored to assimilate some of the gnostic doctrines. After the Council of Nice had given definition to the orthodox faith, more attention was given to the philosophic justification of its dogmas. Athanasius, Gregory of Nyssa, St. Augustine, Synesius, Æneas of Gaza, Philoponus, and the pseudo-Dionysius the Areopagite contributed to this work. In the ninth century it was the translation of the writings of the pseudo-Dionysius by Scotus Erigena that gave rise to scholasticism. The controversy of nominalism and realism, in which Roscellinus, Anselm, Abelard, and William of Champeaux were the chief disputants, occupied the first period of scholasticism. The mastery of Aristotle and the refutation of the pantheistic commentary of Averroës were the chief business of the second period, in which appeared the great theologians Alexander of Hales, Bonaventura, Albertus Magnus, Thomas Aquinas, and Duns Scotus. Aristotle became the "*precursor Christi in naturalibus,*" as John the Baptist "*in gratuitis.*" Besides Averroës should

be named Avicenna, Alfarabi, Akendi, and Algazel among the Arabians, and Avicebron, Ben David, and Moses Maimonides among the Jewish philosophers. Roger Bacon and William of Occam did not follow the prevailing tendencies, the former being an experimenting physicist born before his time, and the latter an invincible opponent of the logical realism current. Nominalism under Occam destroyed the tendency to rationalize the dogma, and scholasticism went down altogether. (See articles on SCHOOLMEN, NOMINALISTS, REALISM, IDEALISM, IMMORTALITY, NECESSITY, OCCAM, DUNS SCOTUS, AQUINAS.) The fall of the Eastern empire brought many learned Greeks into the West, and kindled at Florence and elsewhere the direct study of Plato and Aristotle in the original Greek, whereas hitherto the interpretation of commentators had been generally accepted. Distinguished translators and new commentators, such as Ficinus, Pomponatius, Scaliger, appeared. (See FICINUS.) The naturalistic opponents of the traditional philosophy of the schools at this period, Nicolaus Cusanus, Jerome Cardan, Telesius, Patritius, and Ramus, prepared the way for an epoch of emancipation from authority, in which the leading spirits were Giordano Bruno, Francis Bacon, and René Descartes. The first of these attacked the ecclesiastical authority in matters of science; the second founded the empirical method of philosophizing; the third completed the emancipation from scholasticism by bringing the principles of philosophy to the test of consciousness and by discarding the authority of tradition. Thomas Hobbes applied Bacon's principle to politics; Geulincx and Malebranche explained the relation of mind and matter in the Cartesian dualism; Spinoza avoided the Cartesian dualism altogether by adopting the principle of One Substance, with the two attributes, thought and extension. Locke attempted a critical survey of the powers of the mind to cognize truth, and found sense-perception and reflection to be the sources of all ideas. Berkeley drew from Locke's doctrine the inference that we know only ideas and not the external world. Cudworth, author of the *Intellectual System*, and Henry More the Platonist, Gassendi the atomist, Grotius and Puffendorf, writers on international law, Bayle the pantheist, are among the foremost thinkers of the time.—Meister Eckhart, probably a pupil of Albertus Magnus, founded in the fourteenth century along the Rhine the most noteworthy school of theosophy yet known, and with his followers, Tauler, Heinrich Suso, John Ruysbroeck, and the author of *Theologia Germanica*, and Thomas à Kempis, exercised a most potent influence on the growth of thought in Germany and the rise of the spirit that produced the Protestant Reformation. Jacob Böhme, contemporary of Descartes and Lord Bacon, developed another system of theosophy nearly as remarkable as that of Eckhart, and in substantial agreement with it. With Leibnitz, theosophy becomes philosophy. His doctrines were systematized by Wolf, and held sway down to the time of Kant. In his *Monadology* he sets up in opposition to the mechanical system of Descartes the doctrine of monads, which have no mechanical relation to each other, but only the ideal or psychological one of representing each other.—David Hume is the point of departure for the chief systems of philosophy which have appeared during the past hundred years. His criticism on the idea of causality, reducing it to the mere "habit of surveying things constantly conjoined with each other," sapped the foundations of all dogmatic philosophy current at his time. La Mettrie, Voltaire, Rousseau, Condillac, Diderot, D'Alembert, Robinet (who anticipated Darwinism and the Spencerian "evolution"), and Von Holbach are noted thinkers in the same movement in France. Lessing began the struggle for literary independence in Germany, and Kant completed the reaction in philosophy and freed his country from its subservience to French ideas. The *Critique of Pure Reason* established on the ground of their universality and necessity the *a priori* character of causality and other categories, and demonstrated the self-activity of the mind in sense-perception. The *Critique of Practical Reason* showed that God, free will, and immortality are necessarily postulated by all acts of the individual as "regulative ideas;" they are the logical conditions of human action. These two *Critiques* rescued religion and morality, and the institutions founded on them, from the attacks of skepticism, but they denied the possibility of theoretical cognition in the realm of objective existence. This inability the later schools of German philosophy labored to remove. Fichte's *Science of Knowledge* showed in a systematic form the origin of the categories in the self-activity of the mind, and proved that the will is therefore presupposed everywhere as a conditioning factor in cognition. The sensuous factor of knowledge is accordingly subordinated, and the moral world is almost the only world that exists for Fichte. Schelling, however, reacts to the opposite extreme, and lays great stress on the evolution of unconscious organism in nature and human history. The central object of his system is therefore æsthetic art, wherein the unconscious reason reaches its completest expression. Schelling's school includes the distinguished theosophist Baader and the naturalists Oken, Carus, Oersted, Esenbeck, Steffens; the theologians Schleiermacher, Eschenmayer, Blasche, Görres; Schubert the cosmologist, Stahl the jurist, Solger and Ast, æsthetic writers; besides Krause, Troxler, Jacob Wagner, and others. Hegel, in opposition to Schelling's tendency to emphasize unconscious evolution, endeavored to grasp the content of nature and mind with self-conscious method. His "unity of thought and being" means that universal and necessary ideas, being the logical conditions of the world of experience, are as objective as they are subjective, any denial of this principle being self-contradictory, inasmuch as it assumes to pronounce *a priori* upon the objective possibility of existence—the very thing it repudiates. Hegel's philosophy, like that of Aristotle, takes an encyclopædic inventory of the world of nature and man, reconciling and interpreting all phases. The most eminent of the direct expounders of Hegel are Marheineke, J. Schulze, Gans, Von Henning, Hothe, Förster, Michelet, Rosenkranz, Weisse, Göschel, Erdmann, and Kuno Fischer. There is a left wing, so-called, which expounds the Hegelian system as a logical pantheism ("pan-logism"); a right wing, which expounds it in harmony with orthodoxy; a centre, which agrees substantially with the right wing, but introduces many modifications in the technicalities of the system. A school has also arisen which approximates more or less in methods the English and Scotch schools of empirical psychology. Its most eminent names are J. H. Fichte, Wirth, Zeller, Ulrici, Bona Meyer, and Liebmann. A materialistic tendency appears in the writers of the "left wing," and becomes complete in Strauss and Feuerbach.—Herbart reproduces Leibnitz as modified by the psychology of Kant and Fichte. His school is prolific in distinguished writers, of whom the most prominent are Beneke, Drobisch, Exner, Hartenstein, Steinthal, Lazarus, Waitz, Bonitz, and Wittstein. Lotze's system is a more independent reproduction of Herbartianism. Trendelenburg's system is based chiefly on Aristotle. The sensualistic system of Czolbe and the "philosophy of the unconscious" by Von Hartmann should be named for their popularity. Schopenhauer's pessimism has exercised much influence on the recent literature of Germany.—The ablest Italian philosophers of the present century are Galluppi, Rosmini, Gioberti, Mamiani (who publishes at Rome a journal devoted to speculative philosophy), and the Hegelians Vera, Mariano, and Spaventa.—In France, Laromiguière, Royer Collard, Maine de Biran, Victor Cousin, Jouffroy, Paul Janet, Rémusat, Ravaisson represent the empirical psychological tendency; St. Simon, Fourier, Leroux the socialistic; Comte, Littré, Taine, the positivist direction.—The Scotch school of Reid, Stewart, Brown, and Sir William Hamilton begins with a reaction against Hume, and tends toward the adoption of a modified Kantianism. The school of Locke and Hume is represented in the present century by Stuart Mill, Lewes, Spencer, and others. German philosophy in Great Britain has been introduced and interpreted by Coleridge, Carlyle, Hutchison Stirling, Jowett, Flint, T. H. Green, Ferrier, and others.—American philosophy counts (*a*) in its theological school such names as Edwards, Dwight, Taylor, Tappan, and Finney; (*b*) in its transcendentalist school, Marsh, Emerson, Margaret Fuller, A. B. Alcott, Theodore Parker, J. F. Clarke, George Ripley, O. A. Brownson (who became a "Thomist"), and F. H. Hedge; (*c*) in its psychological school (after the Scotch or after the French eclectics), Porter, McCosh, Bowen, and Mahan; (*d*) in its school based on original study of Kant or his successors, J. B. Stallo, L. P. Hickok, C. C. Everett, and E. Mulford. (See articles on IDEALISM, IDENTITY, KNOWLEDGE, REASON, SENSATIONALISM, TRANSCENDENTAL, UNDERSTANDING, DESCARTES, SPINOZA, MALEBRANCHE, BACON (FRANCIS), LOCKE, LEIBNITZ, HOBBES, HUME, KANT, FICHTE, SCHELLING, HEGEL, SCHLEIERMACHER, SCHOPENHAUER, HERBART. Consult also, on the general problems recurring in the history of philosophy, GENERALIZATION, INFINITE, MIND, MORAL PHILOSOPHY, PSYCHOLOGY, SCEPTICISM, SOUL, THOUGHT, UNIVERSALS, WILL.) The chief historians of philosophy are Stanley, Bayle, Brucker, Tiedemann, Buhle, Tennemann, Reinhold, Ritter, Hegel, Schwegler, Erdmann, Scholten, Cousin, Lewes, Zeller, K. Fischer, L. Ferri; periodicals devoted to speculative philosophy are—*Zeitschrift für Phil. und philosophisch. Kritik* (at Halle); *Phil. Monatshefte* (at Berlin); *Die Neue Zeit* (at Prague); *La Filosofia della Scuole Italiane* (at Rome); *Mind, a Quarterly Review of Psychology and Philosophy* (at London); *Revue philosophique de la France et de l'Etranger* (at Paris); *Journal of Speculative Philosophy* (at St. Louis). WILLIAM T. HARRIS.

Philosophy, Moral. See MORAL PHILOSOPHY, by PRES. NOAH PORTER, S. T. D., LL.D.

Phil Sheridan, tp., Wallace co., Kan. P. 80.

Phil'tre [Gr. φίλτρον], a love-potion, an aphrodisiac preparation. Philtres were much used in ancient Greece and Rome, and the Thessalians had special eminence in their preparation. From the accounts which have come down to us, many of their ingredients were harmless, or at most disgusting, and used on account of some purely fanciful efficacy; while others, it would seem, were violent poisons. Thus, a doubtful tradition says that the poet Lucretius died in consequence of a strong philtre given by his wife; and some hold that Caligula's madness was caused and maintained by his wife's philtres. The use of these potions is prevalent in almost all barbarous and half-civilized lands. As of old, magic arts are employed to add force to the supposed natural powers of the drugs.

Phips (Sir WILLIAM), b. at Woolwich, Me., Feb. 2, 1651, was one of a family of twenty-six children by one mother; was a shepherd, but when eighteen was apprenticed to a shipbuilder and learned to read; went in 1684 to England, and obtained means to fit out a vessel to recover the silver of one of the Spanish plate-fleet wrecked off the Bahamas, but was not successful until 1687, when he obtained treasure worth some $1,500,000 (some accounts say $3,000,000), for which he got some $80,000, besides receiving knighthood and the office of high sheriff of New England; captured Port Royal, N. S., with his fleet, and went unsuccessfully against Quebec; was the first royal governor of Massachusetts 1692–94; built the fort of Pemaquid, Me., 1692; co-operated with Mather in the witchcraft trials, until at last his own wife was accused; was suddenly called to England 1694 to answer charges against him. D. in London Feb. 18, 1695. His enterprise and patriotism were remarkable, and his native abilities fair, but he was ignorant, ill-tempered, credulous, and the tool of abler men.

Phips'burg, tp., Sagadahoc co., Me. P. 1344.

Phlebi'tis [Gr. φλέψ, φλεβός, "vein," and *-itis*, affix denoting inflammation], inflammation of the coats of a vein or veins. Phlebitis may occur in any part of the body from direct injury and accidental or surgical wounds. Idiopathic or primary phlebitis occurs chiefly in the lower extremities, especially in the tortuous expansions and dilated pouches of varicose veins. When a vein is inflamed its contained blood coagulates, adheres to the walls of the vessel; a local fibrinous mass (thrombus) obstructs or wholly suspends the circulation. Exceptionally, this thrombus organizes, connecting with the nutritive capillaries of the venous coats. More often it partly or wholly breaks down, disseminating pus and contaminating the blood, or giving off particles which are carried by the blood to the different parts of the body, and may lodge in the small vessels of large organs, occluding them. Such plugs or emboli deprive a tract of tissue of its nutritive blood-supply, and lead to the condition of fatty degeneration or abscess. Phlebitis, if acute, may be announced by chills and febrile disturbance preceding the local inflammation. The affected vessels are hard, tortuous, prominent, visibly elevated if the surface be viewed in profile. There is a dusky redness over and in the immediate vicinity of the vein, with slight tumefaction and redness of an erysipelatous character, shading off into adjacent tissues. Nodular prominences exist at the site of the valves in the veins. The vein is sensitive to touch, and the entire part tender and painful if moved. Œdema or dropsical swelling, evidenced by pitting upon pressure, may result from the obstructed circulation; in the extremities this swelling may be considerable, with sense of great weight, due to accumulated venous blood and serous transudation. Following childbirth, phlebitis occasionally occurs, usually in the lower extremities, due to local thrombi following the perverted blood of the puerperal state, and probably resulting from absorption of septic matter by the open uterine sinuses. This painful condition is known as *phlegmasia alba dolens*, and popularly termed "milk leg." Indeed, at present the infection of the blood by septic matter and local thrombosis as the causes producing phlebitis is generally conceded. Phlebitis and venous thrombosis are chiefly interesting as endangering embolism in other parts of the body, metastatic abscesses. The "multiple abscesses" of the liver follow inflammation of the venæ portæ. Coexisting abscesses in the brain, lung, liver, spleen, and kidneys may develop from a general poison of the blood. When a vein is enlarged and rigid, as in the sinuses of the cranium, the veins of old hæmorrhoids, or stricture of the rectum, or the varicose veins of the leg, its inflammation is very liable to infect the system. The treatment of phlebitis will be by local antiphlogistics and internal administration of antiseptics and tonics.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Phlegma'sia (synonyms, *Phlegmon, Phlegmonous Inflammation, Pseudo-erysipelas, Diffuse Abscess*), an acute inflammation of the subcutaneous cellular tissue, tending to suppuration, in which the pus formed has a tendency to become infiltrated through the tissues, instead of collecting into one place as in ordinary acute abscess. The causes of this variety of inflammation are sometimes very obscure. It has often been ascribed to infection or an ordinary cold, but these causes are in all probability only hypothetical. We do find it resulting from mortifying shreds of tissue in wounds, and complicating injuries, but in by far the greater number of cases it arises spontaneously in debilitated individuals—persons suffering from mal-assimilation, and who have consequently a thin and impoverished blood, which is incapable of producing a healthy inflammatory action. In such individuals we generally find it occurring in the extremities, especially in the fingers and hand. The symptoms of phlegmasia are those of ordinary inflammation somewhat aggravated—viz. pain, heat, redness, and swelling; there is always more or less œdema of the affected part, and, as a consequence of it and the swelling, we have a tense, shining skin; a throbbing, synchronous with the pulse-beats, is one of the chief symptoms of the disease, and generally immediately precedes the suppurative process. In a few days the skin becomes red at one or more points, and fluctuation appears. Sometimes the œdema and swelling exist to such a marked extent that the skin is deprived of blood, and consequently becomes gangrenous; and as a complication we often have immense sloughs of integument coming away, exposing the uncovered muscles and fasciæ beneath. Accompanying these local symptoms there is always a high fever. In the treatment the first indication should be to remedy as far as possible the condition of the system which has acted as a predisposing cause of the trouble; for this purpose aperients and such tonics as quinine and iron should be given. Locally, suppuration should be hastened by warm applications, and as soon as fluctuation appears at any point an exit should be made for the pus by the lancet; should two or more outlets be found to communicate subcutaneously, the sinus or sinuses should be laid open the entire length, and be allowed to heal from the bottom. Sometimes local depletion, if practised at the outset of the disease, will cut it short.

EDWARD J. BERMINGHAM. REVISED BY WILLARD PARKER.

Phlogis'ton [Gr. φλογιστός, "burnt," from φλογίζειν, "to burn"], a term introduced into chemistry by George Ernest Stahl in 1697 to designate a principle whose existence was first pointed out by Johann Joachim Becher in 1669. This principle corresponds, in a measure, with what is known to the science of the present day as *vis viva*, living force or *energy*, and the extreme crudity of the theoretical science of Becher's day is illustrated by the singular name he gave to his principle—"an inflammable earth." Becher supposed that metals and all bodies that can burn contain this "inflammable earth," and that the process of combustion—that is, *fire*—consists in the loss of this principle or thing or substance by the burning body. Becher died in the same year (1682) in which a work of his was published attempting to develop his theory. Fifteen years later, Stahl, giving credit to Becher for the original conception, first published his theory of *phlogiston*, which was an imponderable principle contained in metals and combustible bodies, combustion consisting in its evolution. Burnt bodies and metallic oxides were "dephlogisticated" bodies. Incombustibility on the part of any substance indicated that it had been burned and had lost its phlogiston, just as we should now say that it had lost its *potential energy*—or *energy of chemical condition*, as we might call it. In those days chemists knew nothing of the nature of air or of oxygen, or of the fact that in burning oxygen combines with the burning body, and that the product of combustion represents in substance or weight or quantity of matter the sum of the body burnt and of the oxygen. The phlogistic theory at once took a deep hold upon the chemical world, which it retained for nearly a century, all chemical phenomena being interpreted by it and all chemical teaching based upon it. The depth of this hold is shown by the fact that Priestley, the discoverer of oxygen in 1774, who in that discovery proved at the same time that a metallic oxide (mercuric oxide) was a compound of metal and oxygen, did not recognize the tremendous significance of this latter fact, and even called his new and wonderful gas "dephlogisticated air." (See OXYGEN.) It even stands as matter of history that long after Lavoisier and others had overthrown the phlogistic theory, and demonstrated the true nature and functions of oxygen, and

its relations to fire and combustion, and even up to the day of his death in 1804, Priestley remained an unconvinced adherent of the then almost obsolete phlogiston. This may have been due to Priestley's realization of the indisputable truth that *something*—and something of commanding power and importance—is set free and *does* escape during combustion—namely, what we now call *energy*, as before remarked. A curious phase of the progress of the theory of phlogiston was the distinct recognition, soon after the time of Stahl, by many of his most earnest disciples, of what could not escape any conscientious laboratory worker, the fact that burnt bodies are *heavier* than before the combustion. To reconcile this class of facts with phlogiston, the latter was by some, by an extraordinary subsidiary hypothesis, endowed with *specific levity*, thus imparting to its compounds, combustible bodies, a tendency to *fly from* the centre of the earth. At this day it is difficult for us to realize the different aspect that all nature and all natural phenomena must have presented in the light—or rather in the false glimmer and deceptive gloom—of this strange theory of Stahl. HENRY WURTZ.

Phlox [Gr. φλόξ, "flame"], a genus of a few annual and nearly thirty perennial herbs of the order Polemoniaceæ, all but one Siberian species North American. There are many fine artificial varieties in flower-gardens, chiefly belonging to *P. paniculata, maculata, Drummondii,* and *subulata*, all natives of the Atlantic U. S.

Phocæ'a, an ancient city of Asia Minor, an Ionian colony situated on the peninsula between the Cymæan and Hermæan gulfs, 25 miles N. W. of Smyrna, was famous in antiquity for the daring enterprise of its inhabitants, who were the founders of Massilia in Southern France, Alalia in Corsica, Rhegium on the Sicilian Strait, and other flourishing settlements. Unable to defend themselves against the Persians under Cyrus, they made a truce of one day with Harpagus, who besieged them, brought their women, children, and property on board their ships, and set sail for Corsica. Under Persian rule the city never acquired any importance. The ruins of it now extant are insignificant.

Phoc'idæ [from *Phoca*, the Latin name of the seal], the typical family of pinniped mammals exemplified in the form of the common seal. The body tapers backward, and the hind feet project posteriorly in the same line; the fore limbs are flippers; the hind ones not flexible forward; the head more or less dog-like; no external ears are developed; the teeth are variable—viz. M. $\frac{5}{5}$ or $\frac{6}{6}$, C. $\frac{1}{1}$, I. $\frac{6}{4}$ or $\frac{4}{4}$ or $\frac{4}{2}$; incisors of the lower jaw conical; the skull has the mastoid processes swollen, and they superficially appear to form a part of the auditory bullæ; the postorbital processes are null or obsolete; no alisphenoid canals exist; the anterior limbs are smaller than the posterior, and their feet have digits which become successively abbreviated, and all are armed with claws; the posterior flippers are emarginate, the third and fourth digits being shortest, and are generally provided with claws. The family is represented by three distinct sub-families: (1) Phocinæ, represented in the northern hemisphere by the genera *Phoca, Pagophilus* (= *Pagomys*), *Erignathus, Histriophoca, Pusa* (= *Halichœrus*), and *Monachus*; (2) Cystophorinæ, with *Cystophora*, or the hooded seal of the northern hemisphere, and *Macrorrhinus*, or the elephant seals of the southern hemisphere and the Californian coast; and (3) Stenorhynchinæ, confined to the Antarctic or southern seas, with the genera *Lobodon, Ogmorhinus* (= *Stenorhynchus*), *Leptonychotes*, and *Ommatophoca*. The smallest of the seals is the ringed seal, or *Pagophilus fœtidus*, which attains to little more than four feet in length; the largest the elephant seal, or *Macrorhinus elephantinus*, which is sometimes known to reach the length of thirty feet. The following species are found on the eastern coast of North America, as well as in the European waters and the Arctic seas generally: *Phoca vitulina*, the common seal; *Pagophilus grœnlandicus*, the harp seal; *Pagophilus fœtidus*, the ring seal; *Erignathus barbatus*, the great seal; *Pusa* (*Halichœrus*) *grypus*, the gray seal; and *Cystophora cristata*, the hooded seal. These all feed almost entirely on fishes, which they capture with great dexterity. They are awkward on land, and progress thereon by dragging their body forward chiefly by means of their fore feet, the hind limbs scarcely or not at all assisting; but in the water are very graceful. They generally bring forth but one young—rarely two—at a birth. THEODORE GILL.

Pho'cion, an Athenian general, b. about 402 B. C., of humble descent, but excellently educated; commanded with great success against Philip II. of Macedon in Eubœa, Megara, Byzantium, and other places. In politics, however, he sided with the Macedonian party, and was an unrelenting adversary of Demosthenes. After the death of Antipater he became implicated in the intrigues between Cassander and Polysperchon, fled to Phocis, was delivered up to the Athenians, and by them condemned to take poison (317 B. C.), and his corpse was hurled unburied across the frontier. One year later the Athenians raised his statue and erected a fine monument in his honor.

Pho'cis, an ancient division of Greece in Hellas proper, was bounded S. by the Corinthian Gulf, E. by Bœotia, N. by Doris, and W. by Locris. It was very mountainous, being almost entirely covered with the famous mountain-range of Parnassus. Its north-eastern part was traversed by the river Cephissus, which formed a beautiful and fertile valley. Delphi, Elatea, and Cirrha were its principal towns. It derived its chief historical interest from the circumstance that the famous oracle of Delphi was situated in its territory. But this circumstance became at last the cause of its ruin. A verdict of the Amphictyonic Council ordered the Phocians to pay a fine for having used a tract of land which belonged to the oracle. When the Phocians refused to pay, a ten years' war (generally called the Sacred war), from 355 to 346 B. C., broke out, in which they fought bravely, maintaining themselves by the treasures of the temple; but at last they were conquered, chiefly by the strategy of Philip of Macedon, and then their cities, twenty-two in number, were destroyed, and they were scattered in villages, of which none was allowed to contain more than fifty houses.

Phœbe. See DIANA.

Phœ'be-Bird, or **Pewee,** a well-known fly-catcher of the U. S., the *Sayornis fuscus*, which often builds under old bridges, mills, and at other points near the water. It is easily recognized by its well-known note, whence its name is derived.

Phœbus. See APOLLO.

Phœni'cia [probably from the Gr. φοίνιξ, "a palm tree"], the name by which the Greeks, and after them the Romans, indicated the narrow coast-land between the mountains of Lebanon and the Mediterranean, which with a breadth of from 10 to 12 miles extends from Aradus, in lat. 34° 52′ N., to Mount Carmel, in lat. 32° 30′ S. The inhabitants themselves called their country *Canaan*, "lowland." It was hilly, much broken up by spurs of the Lebanon, rocky and barren in some places, level but sandy in others, and nowhere specially fitted for agriculture. But it had excellent harbors and a most favorable situation for commercial pursuits; and these natural advantages were developed by the teeming population with extraordinary energy and success. Wealthy cities, which extended their enterprises over the whole known world, dotted the coast from N. to S.—Tripolis (*Tarablus*), Byblus, called by the Hebrews Gebal (*Jebail*), Berytus (*Beyroot*), Sidon (*Saida*), Tyre (*Sûr*), Ptolemais (*Acre*), Dor, etc.; and several of these cities, such as Sidon and Tyre, formed at various periods powerful empires. Our knowledge, however, of the people and its history is aphoristic, and in many points utterly insufficient. The Phœnicians have left no literature and no artistic monuments. A few coins, a few inscriptions—among the most important of which are that on the sarcophagus of King Eshmunazar, discovered in 1854 near Sidon, that on a stone disinterred in 1845 near Marseilles, that on the monument at Dhiban in Moab, discovered in 1868, etc.—a number of names of localities, and a couple of scenes in Plautus's *Pœnulus*, are all that remain of their language and industry. Our views of them we must compose from notices gleaned from Hebrew, Greek, Roman, and other writers, but it must be added that these notices are sufficient both to prove that in ancient times the Phœnicians exercised a powerful and beneficial influence, and to give a general idea of their life and character. Their language belonged to the Semitic family, and was nearly related to the Hebrew, but whether they themselves immigrated into Phœnicia from the coasts of the Erythræan Sea, as stated by Herodotus, is uncertain. Their religion was a nature-worship centring in the idea of generation, and their gods were generally worshipped in a double form—one abstract and lofty, and the other local and concrete, such as Baal and Melkarth (Heracles), Astarte and Tanith (Aphrodite), etc. In their political constitution and social organization they resembled the later Greeks more than the contemporary Eastern peoples or the Egyptians. Each city with its adjoining territories formed an independent state, governed by an hereditary king and a powerful aristocracy, but it seems as if some single city—Sidon at one time, Tyre at another—always held a sort of supremacy, perhaps only as president of some kind of league. Within the state the population consisted of free men and slaves; and slaves, besides being among the most important articles of Phœnician commerce, were used to such an extent that at one time they conspired in Tyre, revolted, and succeeded in driving out of the city the free population. The oldest of the Phœnician cities was Sidon, but

Tyre became the most celebrated. King Hiram of Tyre entertained friendship with Solomon, and their fleets went together to Ophir. At this time the Phœnicians had colonies on the Persian Gulf and the Red Sea, from which they traded with India, Persia, Arabia, and Nubia. In Babylon, Nineveh, Thebes, and other great cities they inhabited a ward of their own. The Mediterranean Sea was girded all round by their commercial stations and colonies —along the northern coast of Africa (see CARTHAGE), the Ægæan Islands, the eastern coast of Greece, Sicily, Etruria, Gaul, and Spain. They knew the way to Britain, perhaps into the Baltic, whence they brought amber to Greece. They worked the silver-mines of Spain and the lead-mines of Britain, and they penetrated in Africa to Timbuctoo. It is probable, however, that they were principally a commercial and not an industrial people. They transferred goods without manufacturing them; they spread the arts without inventing them. They brought the alphabet, the compass, the application of astronomy to navigation, the use of coins, etc. to Greece and Etruria, but whether they had themselves invented these arts is doubtful. The same is the case with respect to their most famous articles of commerce—Tyrian purple, glass, etc. Nevertheless, Tyre must have been the seat of considerable industrial skill and activity, since King Hiram could supply Solomon with all kinds of workmen. The country was successively conquered by Assyria, Babylon, and Persia, but, characteristically enough, this circumstance seems to have had no influence on its prosperity. It was the rise of the Greek communities which drove the Phœnicians out of the eastern part of the Mediterranean, as it was later the enterprise of the Roman merchants which drove them out of the western. After the conquest by Alexander and the destruction of Tyre the country lost its importance and was incorporated with Syria. (See Heeren, *Historical Researches* (1833); Schröder, *Die Phönizische Sprache* (1869); Renan, *Mission de Phénicie* (1874); Lenormant and Chevallier, *Les Premières Civilisations* (1874).) CLEMENS PETERSEN.

Phœni′cia, p.-v., Shandaken tp., Ulster co., N. Y., on Esopus Creek.

Phœnicopter′idæ [*Phœnicopterus*, φοινίκεος, "purple," and πτερόν, a "wing"], a family of birds of peculiar organization whose species are known under the English name "flamingoes." The form is somewhat swan-like, the neck being elongated and slender; the head moderate; the bill large, and with the anterior half abruptly deflected; the upper mandible depressed, especially in its deflected portion; the lower mandible compressed; the lateral margins finely laminated, like those of the duck's bill; the nostrils linear, in the groove of the mandible, and covered by a membrane; wings moderate and pointed; tail short; legs very long, slender, and slightly compressed, covered in front with transverse scales, which extend on the tibia as well as on the tarsi; toes comparatively short, the anterior three united together by a membrane, the posterior free and short; the claws of all short. In their osseous structure, as in their external characters, they are almost intermediate between the duck-like birds (Anatidæ and Palamedeidæ) and the stork-like birds (Ciconiidæ); there has, therefore, been considerable doubt as to their systematic position, some authors having associated them with the wading birds and others with swimming birds; on the whole, however, they appear to be most closely related to the stork-like forms, although forming a peculiar type or "super-family" by themselves, named by Huxley Amphimorphæ. Species are found in the tropical and sub-tropical regions of both the eastern and western hemispheres. Eight species are recognized by G. R. Gray, of which four are found in the Old World and four in the New. They mostly frequent the sea-shore or salt marshes, and associate in flocks of many individuals, whose safety is generally guarded by one of their number who acts as a sentinel. "When flying they form two lines, springing from one bird, which gives the appearance of a triangle, but they alight in a straight line, and generally remain so even when seeking their food. They are capable of running quickly, but when walking assist themselves by placing their upper mandible on the ground." The female is said to build a subconical nest of mud, in which she deposits two or three eggs, and sits crouched over them. (For figure, see FLAMINGO.) THEODORE GILL.

Phœ′nix [Gr. φοίνιξ], a fabled bird of Arabia, mentioned in the myths of many Oriental nations as living 500 years or more, and at last burning himself alive upon a funeral-pyre of myrrh and spices. From the flames arises a new phœnix, who encases the ashes of the old in myrrh, flies with them to Heliopolis in Egypt, and there casts the ashes into the flames. Legends of the phœnix are found in the hieroglyphic writings and in Herodotus, and others are current now in India, Persia, and Arabia.

Phœnix, p.-v., cap. of Maricopa co., Ariz., on Salt River.

Phœnix, tp. of Henry co., Ill. P. 793.

Phœnix, p.-v., Schroeppel tp., Oswego co., N. Y., 16 miles N. of Syracuse, on Oswego Canal and River, has fine water-power, excellent graded schools, 3 churches, 1 bank, 1 newspaper, several hotels, 1 saw and 2 flouring mills, a cabinet manufactory, 2 coal-yards, a lumber-yard. Three railroads run through the village. P. 1418.

J. M. WILLIAMS, ED. "REGISTER."

Phœ′nixville, p.-b., Schuylkill tp., Chester co., Pa., 27½ miles N. W. of Philadelphia, at the junction of French Creek with Schuylkill River, on the Philadelphia and Reading R. R., has a public park, water and gas works, 1 seminary, 3 large public-school buildings, 9 churches, 3 banks, 2 public halls, 2 weekly newspapers, several hotels, the blast furnaces and mills of the Phœnix Iron Co., 2 cotton-factories, a sash and planing mill, a fire department. P. 5292. V. N. SHAFFER, ED. "INDEPENDENT PHŒNIX."

Phonautograph. See ACOUSTICS, by O. N. ROOD.

Phonet′ics, the science of speech-sounds, and the art of representing their combinations by writing. Speech-sounds are such of the phenomena of the resonance of enclosed masses of air variously excited by the organs of speech as are used for communication of thought. The resonance-cavities are the larynx, pharynx, nasal passages, and mouth, with various smaller parts. Each cavity has a separate resonance, and each resonance acts more or less in combination with all the others. The action of the resonance for vowels was first fully explained by Helmholtz (*Sensations of Tone*, my translation, 1875, pp. 153–172, 179–181, 724–741). It is necessary to distinguish the mode of exciting resonance and the fixed or variable forms of the resonance-cavities.

I. *Mode of Exciting Resonance.*—(1) "Irrespirates," sounds independent of respiration, which may or may not be carried on at the same time through the nose. The air in the resonance-cavities is excited by smacks, clicks, smokers' mouth-puffs, blowpiper's cheek-puffs, or implosion (due to sudden condensation). All these are recognized elements of language. (2) "Inspirates," sounds arising from drawing in air—(*a*) through the mouth only, as in chirps, whistles, sobs, gasps; (*b*) through the nose only, as in snuffling, or (*c*) through both nose and mouth, as in snoring. Common elements of expression, even in English. (3) "Expirates," sounds arising from expelling air from the lungs. (*a*) "Physems," or bellows-actions of the lungs, with constant pressure (force, loudness, modern accent), with discontinuous pressure (jerks, the main element of aspiration), or with condensation suddenly relieved (explosions, one element of post-aspiration). (*b*) "Glottids," or actions of the elastic glottis, which, when the vocal chords forming it are wide apart, give either inaudible breath (physem weak) or "flatus"—that is, audible breath (physem strong). When the glottis is narrowed, but not closed, they give "whisper." When the glottis is closed elastically, they give "voice." When the glottis is closed inelastically, they give the Arabic *hamza*, or "check." These actions also, chiefly by various tensions of the vocal chords, produce variety of pitch (Sanskrit, Greek, and Latin musical accent, singing), and by different arrangements regulate the size and distinctness of the periodical puffs of air on which voice depends (original quality of tone, expression); with other effects not so marked. (*c*) "Arytĕnads," or actions of the gristly glottis, giving by various actions the Arabic *hha* or wheeze, and *ain* or bleat, and the Danish *r*. (*d*) "Hisses," arising from flatus driven through narrow passages, as for *s*, *sh*. (*e*) "Sonants," arising from driving the voice into closed cavities, where the air rapidly becomes too condensed to sound. (*f*) "Buzzes," arising from driving the voice laboriously through passages suitable for hisses, and hence producing the effect of a mixture of voice and flatus, as for *z*, *zh*. (*g*) "Vocals," arising from driving the voice easily through a partially-obstructed cavity, or one periodically obstructed and relieved by a vibrating membrane, as for *l*, *r*. (*h*) "Vowels," arising from letting the voice resound clearly in comparatively unobstructed cavities of the mouth separately, or mouth and nose combined, which modify the original quality of tone.

II. *Fixed Forms of Resonance-Cavities.*—(*a*) "Oral Vowel Positions," the uvula, being pressed against the back wall of the pharynx, shuts off the nasal cavities; the tongue, in part or in whole, is raised to different heights within the mouth, but not sufficiently to touch the palate; the throat (pharynx), in whole or in part, is lengthened, shortened, widened, or narrowed; the lips are more or less closed or opened; or all these alterations of tongue, throat, and lips are variously combined. The number of possible oral vowels is infinite; at least 60 genera are known, and 15 to 20 of them are common in European languages. (*b*)

"Orinasal Vowel Positions," the nasal passages are open to the larynx by the advance of the uvula, and the various membranes of the nose are variously brought into action, at the same time that the various oral vowel positions are assumed. Each oral vowel generates various kinds of orinasal vowels. The four French orinasals in the words *an, on, un, vin* are best known. (*c*) "Oral Consonant Positions" have the nasal passages cut off, as for oral vowel positions, and either entirely obstruct the passage of air, flatus or voice (as for "mutes," *p, t, k*, positions without sound and rendered effective only by "glides," III. 10); for "implodents," with a sound due to implosion, as in modern Saxon *p, b* or *t, d*, I. 1; and for "sonants" (as *b, d, g*, I. 3, *e*); or is only adapted for hisses" (such as *f, s, sh, th*, I. 3, *d*); buzzes (such as *v, z, zh, dh*, I. 3, *f*); or "vocals" (such as *l, r*, I. 3, *g*); by the formation of narrow or choked passages, or the introduction of a vibrating valve. Such positions are very numerous. (*d*) "Nasal Consonant Positions" have the nasal passage open, but the mouth (generally) closed as for mutes, and also generally voiced (as *m, n, ng*), but many other forms occur.

III. *Changing Forms of Resonance-Cavities.*—(1) If while a violin-string is bowed the stopping finger is slid on the finger-board from the nut toward the bridge, the result is a series of musical sounds, changing by insensible degrees. The first and last sounds may or may not be of sensible duration. In each case the changing sounds are called "glides." (2) If the extreme sounds have sensible duration and the glide is short, the glide becomes a "slur," to which case the word will be here specially limited, although musically it has a wider signification. (3) When no glide or slur occurs, there is a "break" or silence during change of position. (4) In speech, glides and slurs are the cement by which elements are bound into syllables. Speech-glides were first recognized, I believe, by myself in my *English Phonetics* (1854), and slurs in my *Early English Pronunciation* (Part IV., 1875, p. 1130). They generally arise from continuing sound during change of resonance-cavity, but there are also (5) "force-glides," arising from continuously variable bellows action of the lungs; (6) "pitch glides," from continuous alterations, chiefly in the tension of the vocal chords; and (7) "glottal glides," from continuous alterations in the degree of separation of the vocal chords, changing from flatus through whisper to voice, and conversely; and (8) "arytēnad glides," arising from continuous changing position of the gristly glottis. (9) "Vowel glides" arise from passing from one vowel position to another, and may be "lip," "tongue," or "throat glides," separately or combined two or three together, the results being "diphthongs" and "fractures" of the most diverse character and of great philological importance. (10) "Mixed glides" arise from passing from a consonant to a vowel position, and conversely, and are most remarkable in the case of mutes, as in *peep, took*, because it is solely by the glide that the mute becomes effective. When final, the mute often glides on to a click or some flatus (in English), and often (in English and German) flatus is interposed between the mute and the vowel, producing a passing glottal glide, the habits of different nations and individuals being extremely different. In such words as *see, cease, seize* there are glottal as well as mixed glides. (11) "Consonant glides" occur when we pass from one consonant position to another, of which one at least is capable of flated or voiced resonance, as in *tree*, where there is a consonant glide from *t* to *r*, and a mixed glide from *r* to *ee*. (12) All these glides give rise to slurs, which are more convenient to the speaker than breaks, because breathing is uninterrupted, and hence they constantly occur between syllables. (13) "Breaks" occur where the passage of breath is interrupted by some suspension of expiration, some check of the glottis, or some mute consonant. (14) The study of glides is one of the most important parts of phonetics for clear enunciation, intelligible singing, and comparative philology.

The above analysis of speech-sounds, here merely indicated, results from the most recent physiological and linguistic investigations, and its great complication would apparently involve immense difficulty in the attempt to find a method of representing speech-sounds to the eye. But writing is a very ancient invention, and the inventors had not even a remote notion of the mode in which speech-sounds are produced, which was not at all understood till the end of the last century (Kratzenstein, 1780, and Kempelen, 1791). The process originally pursued seems to have been from the picture to its name, and thence to the beginning of its name. At first, only pictures of things were probably used, and these were grouped so as to indicate events. The old Mexican writing seems to have been in this stage. Such pictures, worn down by rapidity of formation, give the Chinese ideographs, to which different sounds are assigned in each Chinese province. A certain number of such signs, indicating words which contained all the groups of sounds made use of in speech, forms the Chinese phonetic symbols, each of which is a monosyllabic word. These, transported to another system of languages, give the Japanese "syllabary," or a collection of signs each of which forms a syllable, being only a part of a word. In Egypt the syllabary was constructed by using a sign to express the first part of a word, probably up to the termination of the first vowel in its earliest form, but the picture of the class of words (determinative) was generally annexed. In the Semitic languages the same sort of syllabary was originally constructed, but at a later period, as in the modern Cherokee syllabary (the invention of which serves to show how natural is this process to the mind), the signs indicated syllables without any connection with an original picture or its name. In the East Indian languages the fact that syllables frequently ended with consonants, so that there was a glide after as well as before the vowel, led to various contrivances for indicating the suppression of the inherent vowel of a syllabarian sign, and also a means of replacing that vowel by another without the necessity of inventing a new syllabarian symbol. But to this day the Sanskrit and Dravidian systems of writing betray their original syllabarian character. When the Greeks borrowed the Phœnician syllabary, they gave it a real alphabetic character by dismissing the inherent vowel, and replacing it universally by a movable vowel, which generally had a preceding, and less frequently a following, glide. It was in this form that the Romans adapted the same Phœnician characters to their needs, and from these two original sources all modern European alphabets are derived. At an early period the Roman alphabetic system became general for most Aryan languages, and was subsequently used for languages of different families, as Basque and Hungarian. The diverse nature of the selection of speech-sounds and systems of glides and accents in use among the different nations of Europe has caused the Roman letters individually and in groups to have different significations in the several countries using them, and to be practically increased in number by the addition of various diacritical marks. These systems of writing were in many cases introduced by "clerks" (ecclesiastics), who were satisfied with a rough indication of the sounds of words at remote periods when the sounds of the languages thus reduced to writing were different from those now in use. But there was always an indisposition to make any changes in orthography, and this indisposition has increased since printing became widely used. Hence, the groups of letters have in many instances ceased altogether to recall the sounds of the words, and consequently alphabetical writing has in numerous instances almost reverted to ideographical symbolization. This is especially the case in English, where sign and sound are so practically independent, to the great detriment of education, that no one who sees an English word for the first time knows how to speak it, and no one who hears an English word for the first time knows how to spell it. The consequence is, that children cannot become good readers at sight, and good spellers without many years of instruction, which wastes time that should be devoted to acquiring knowledge, over the acquisition of an imperfect power of handling the mere tools of knowledge, reading and writing. The pretence for retaining an orthography so injurious to every speaker and learner of English is that by a change of spelling we should sacrifice the etymology of words, which is unknown in many cases; which the present spelling does not preserve in others; which no spelling could indicate with certainty, even to those acquainted with the old spoken (not merely written) forms of the English language and its Aryan relatives; which could be taught, as far it is now known, much better to those who spell phonetically than to those who do not; which is practically seldom present to the mind of any speaker; and which is a part of antiquarian and philosophic education, that those who insist on it rarely know anything about, and that millions of those who speak English have little concern with or power to appreciate. But a change is not impossible, for the old Athenians altered their spelling officially in B. C. 403, and within the last 100 years the Netherlands and Spain have altered theirs, the former having vainly tried to fuse etymology with phonetics, but the latter having wisely clung to phonetics only. Wallachian orthography shows the absurdity of an etymological basis. But Polish and Bohemian among Slavonic languages, and Hungarian among non-European, also show that the phonetic principle is not dormant.

Missionary enterprise and scientific linguistics have raised the question of a universal alphabet capable of writing all languages. We are still very far from being able to determine what should be the value, number, or form of the separate elementary symbols in such an alphabet, and how their combination should be indicated. Prof.

Lepsius of Berlin invented the "Linguistic Alphabet" (German ed. 1855), adopted under the name of the "Standard Alphabet" by the English Church Missionary Society in 1858 (2d English ed. 1863), and approved by many other missionary societies. It consists of a mixture of Latin and Greek letters, supplemented by a vast complication of diacritical marks, which render its use so laborious that in special adaptations most of these marks are omitted. It requires new founts of types (two of which have been cut in Germany, but the German types will not "work" with the English); and notwithstanding the number of its symbols (more than 250), it is defective for well-known languages, both in characters for elementary sounds and in the means of representing glides. Prof. Bruecke's *Neue Methode der phonetischen Transkription* (1863) introduces entirely new letters, based first upon the positions of the speech-organs, and secondly on the accompanying effects of flatus, voice, and glottal action. It is very philosophical for the consonants, but sadly deficient for the vowels, and altogether failing in glides. Mr. Melville Bell's *Visible Speech* has a similar basis, but its characters are formed on the totally different principle of picturing the positions of the speech-organs. It embraces a philosophic consideration of vowels as well as of consonants, and although deficient in glottids, glides, and some other symbols, it is by far the best and most practical attempt yet made. For the purposes of my *Early English Pronunciation* (1869–75, in progress) I introduced a system called "Palæotype," because it can be readily printed with ordinary or "old types." In this no attempt at systematic forms of letters has been made, because our phonetic knowledge does not appear to be advanced enough for that purpose, but unambiguous representatives are furnished for a far greater number of speech-sounds than have been considered by any other writer, including the 388 elements of Prince L. L. Bonaparte's alphabet (whose symbols, formed on a Latin and Greek basis with diacritical marks, are as yet unpublished; see my *Early English Pronunciation*, pp. 1298 and 1352), and all the classes mentioned in the preceding analysis have been more or less considered. The avowedly temporary signs of palæotype allow of a discussion of the analysis, synthesis, and classification of speech-sounds, and of practical applications for phonological and philological purposes (of which my *Early English Pronunciation* contains numerous examples), whence, perhaps, in time may result some basis of agreement as to the proper form of symbols for universal phonetics.*

In the mean time, the question of particular phonetics, or of writing the sounds of a particular language with sufficient accuracy for native use, is comparatively easy. It will be necessary in what follows to confine attention to the English language, for which, as we have seen, some orthographical amendment is urgently required. We have to remember that no two speakers pronounce precisely alike; that words are so diversely pronounced by even educated speakers in different parts of England and America that keywords alone do not sufficiently convey sounds; and that, especially in vowels, we must recognize the fact that only classes, and not individuals, can be represented. Also, the question of what forms an element is so difficult and delicate that we must trench upon the old solution of the syllabary by using combinations or groups as our real elements. Thus, we may write *ee* and *oo* as well-known separable sounds, and perhaps *s*, but certainly not *t*, which has no sound at all. We must acknowledge that *see*, *too* are syllabarian groups, ending with *ee*, *oo*, which are, however, preceded by much more than the mere hiss *s* or mute *t*—namely, by the "glides" from *s*, *t* to those vowels. In the case of *too* there is solely a mixed glide. In the case of *see* there is a hiss, a glottal glide, and a mixed glide. In *t* we have a philosophical element; not so in *d*, *s*, or *z*. With this view, in 1846, in conjunction with Mr. Isaac Pitman of Bath, I framed an alphabet of 40 letters for English, of which 23 were old and 17 new, the latter requiring new types, which were cut for several founts. This I have now abandoned, and since 1870 I have advocated an alphabet called "Glossic," adapted to every fount of Roman or fancy types. The immediate object I had in view was to create a system of writing the pronunciation of all the English dialects by one alphabet, based on prevailing literary usages, for which purpose Glossic has been adopted by the English Dialect Society. The secondary object was to provide a new orthography for English, to remove the present inconveniences, but of such a nature that it might be used concurrently with the present spelling for teaching to read in schools, and that by its legibility to all present readers it might obviate the fatal necessity of learning to spell in the old way. The following unexplained key-words will suffice to indicate the nature of the solution attempted for "literary" English only. After each approximate element is placed a word in "Glossic," followed by the same in "nomic" or usual spelling. In these words the accent-mark, a turned period (•), is used to indicate both length and strength, but in the subsequent example this is omitted, as being unnecessary to natives, except in unusual words and cases of ambiguity, though indispensable to foreigners. Of course due additions have been made to indicate foreign and dialectal sounds, but these are here omitted, as unnecessary for the mere purpose of illustration:

Key to English Glossic.—(1) Strong long vowels: *ee*, *bee·t*, beet, beat; *ai*, *bai·t*, bait, bate; *aa*, *baa·*, *baa·m*, baa, balm; *au*, *kau·l*, caul, call; *oa*, *koa·l*, coal; *oo*, *koo·l*, cool. (2) Strong short stopped vowels: *i*, *nit*, nit·, knit; *e*, *net·*, net; *a*, *nat·*, gnat; *o*, *not·*, not, knot; *u*, *nut·*, nut; *uo*, *fuot·*, foot. (3) Weak short open vowels (distinguished by having no accent-mark or consonant to glide to): *ee*, *troa·kee*, trochee; *i*, *wit·i*, witty; *ai*, *rai·lwai*, railway; *au*, *augus·t*, august, adj. (*au·gust*, subst.); *oa*, *win·doa*, window; *oo*, *in·flooens*, influence. (4) Diphthongs (each representing a large genus): *aay*, aye; *ei*, *heit*, height, hight; *oi*, *foil*, foil; *ou*, *foul*, foul, fowl; *eu*, *feu·d*, feud. (5) Glottid: *h*, *hai·*, hay. (6) Consonants: *y*, *yai·*, yea; *yh*, *yheu*, hew, hue; *w*, *wai·*, way, weigh; *wh*, *whai·*, whey; *p*, *pee·*, pea; *b*, *bee·*, bee; *t*, *toa·*, toe, tow; *d*, *doa·*, doe, dough; *ch*, *ches·t*, chest; *j*, *jes·t*, jest; *k*, *kee·p*, keep; *g*, *gai·p*, gape; *f*, *fei!* fie!; *v*, *vei*, vie; *th*, *thin·*, thin; *dh*, *dhen·*, then; *s*, *see·l*, seal; *z*, *zee·l*, zeal; *sh*, *mesh·*, mesh; *zh*, *mezh·er*, measure. (7) Consonantal L and nasals; *l*, *lai·*, lay; *m*, *mai·*, may; *n*, *nai·*, nay, neigh; *ng*, *sing·er*, singer; *ngg*, *ling·ger*, linger. (8) Vocal L and nasals: *l*, *lit·l*, little; *m*, *rith·m*, rhythm; *n*, *oa·pn*, open. (9) Trilled R (distinguished by being always before or between vowels only; frequently untrilled, but not vocal, in the U. S.; never untrilled in England, except when speakers have an organic effect; written *r'* with a following apostrophe, in first reading-books): *rai·*, ray; *mer·i*, merry; *mar·i*, marry; *hur·i*, hurry; *okur·ence*, occurrence. (9) Vocal R (distinguished by being never used before or between vowels; a mere vowel in England, which, however, may be followed, not replaced, by a trilled R, and must be so followed if final before a word beginning with a vowel; always replaced by a trilled R, preceded by a vowel in Scotland): Strong: *er* or *ur*, *her·b*, *hur·b*, herb; *mer·*, *mur·*, myrrh; *ker·*, *kur·*, cur; *oker·*, *okur·*, occur; weak: *er* or *ur*, *dol·er*, *dol·ur*, dollar, dolour, dolor; *prop·er*, *prop·ur*, proper; *eelik·ser*, *eelik·sur*, elixir; *tai·ler*, *tai·lur*, tailor; *on·er*, *on·ur*, honour, honor; *mer·mer*, *mur·mur*, murmur; *plezh·er*, *plezh·ur*, pleasure; strong: *eer*, *pee·r*, pier; *air*, *pai·r*, pair, pare, pear; *aar* (the vocal *r*, generally omitted in London), *paa·r*, par; *aur* (the vocal *r*, generally omitted in London), *nau·rth*, north; *oa·r* (frequently *au·* in London), *poa·r*, pore, pour; *oo·r*, *poo·r*, poor; *eir*, ire; *our*, our; *eur*, *yoor*, ure, your. (10) Vocal R, followed by trilled R (distinguishing by the occurrence of *rr* between vowels), *err*, *oker·ring*, occurring; *eerr*, *pee·rring*, peering; *airr*, *pai·rring*, pairing, paring; *aarr*, *maa·rring* (usually *maa·ring* in London); *oarr*, *poa·rring* (often *pau·ring* in London), pouring, poring; *oorr*, *poo·rrer*, poorer; *eirr*, *fei·rri*, fiery (distinct from *fei·uri*, also used); *ourr*, *flou·rri*, floury, flowery (distinct from *flou·uri*, also used for flowery); *eurr*, *keu·rring*, curing (the vocal R in *eerr*, *airr*, *oar*, *oorr*, *err*, *ourr*, *eurr* is often omitted in the U. S. and in Scotland, where *pee·ring*, *pai·ring*, *poa·ring*, *poo·rer*, *fei·ri*, *flow·ri*, *keu·ring* may be heard, but this is never the case in England). (11) Weak indistinct A, E, or U: *a*, *eidee·a*, idea (or *u*, *eidee·u*); *el*, *ei·del*, idol (or *ul*, *ei·dul*, distinct from *ei·dl*, idle); *em*, *buoz·em*, bosom (or *um*, *buoz·um*); *en*, *ten·ent*, tenant (or *u*, *ten·unt*; *ten·ant* with distinct weak *a* is unusual).

Exaamplz ov Unaksented Ingglish Glossik Objekts.—Too fasilitait lerning too reed. Too maik lerning too spel unneseseri. Too asimilait reeding and reiting too heerring and speeking. Too maik dhi riseevd proanunsiaishen ov litururi Ingglish aksesibl too aul reederz, proavinshel and foren. *Meenz.*—Leev dhi oald speling untucht. Introdeus along seid ov dhi oald speling a neu aurthografi, kunsisting enteirli ov dhi oald letters, and mainli ov dhi oald kombinaishenz, euzd invairriabli in aulredi familyer sensez. Emploi dhi neu speling in skoolz too teech kleer aartikeulaishen and distingkt reeding in boath aurthografiz. Alou eni reiter too reit in dhi neu speling oanli on aul okaizhenz widhout loozing kaast, proaveided hee euzez a riseevd proanunsiaishen. Dhat is, *aknolej dhi neu speling konkurentli widh dhi oald.* *Advaantejez.*—Redi akwizishen ov pour too reed and reit in dhi neu speling, widh graitly improovd proanunsiaishen. Dhi pour too reed in dhi prezent speling widhout speshel instrukshen, and widh dhi saim eez dhat reederz ov dhat speling kan purooz oalder

*For an account of certain phonetic peculiarities of the North American Indians see Haldeman's *Analytic Orthography* (Philada., 1860).—Eds.

aurthografiz, soa dhat aul prezent lituruteur wuod bikum eevn moar aksesibl dhan ever, and hens dhair wuod bee noa need faur prezent reederz too akweir a maasturi oaver dhi neu speling in aurder too maik dhemselvz inteligibl too dhoaz hoo euz it aloan. Noa ferdher okaizhen too lern dhi prezent speling faur reiting perpusez dhan prezent reiterz have too lern dhi speling ov Chauser and Wiklif. Dhi ridukshen ov dhi eksajeraited estimet in which dhi pour too reed and reit iz nou held too its troo level, kunsiderd az meerli dhi abiliti too handl toolz. Dhi saiving ov waist ov mentel pour in dhi prezent sloa and freekwentli imperfekt akwizishen ov dhis pour, and konsikwentli dhi gain ov teim faur dhi advaansment ov intelekteuel edeukaishen proper. *Difikeltiz.*—Dhi jenurel ignurens ov dhi naiteur ov speech-soundz. Dhi diffurens in dhi habits and fansiz ov speekerz. Dhi wont ov eni rashenel popeuler kunsepshen ov etimoloaji. Dhi egzistens ov a kunfeuzd, unfoanetik, paartli historikel, mainli teipoagrafikel, enteirli unfiloasofikel aurthografi in which vaast stoarz ov nolej hav been embaamd, and which iz soa difikelt too akweir dhat dhi meer pour too euz it iz esteemd in itself a maark ov edeukaishen.

ALEXANDER J. ELLIS.

Phonog'raphy [Gr. φωνή, "sound," and γράφειν, to "write"], or **Phonetic Shorthand,** any system of brief writing which expresses more or less fully and accurately the vocal elements of speech. The name "phonography" was first applied to a system of shorthand writing by Isaac Pitman in the second edition of his system, published in London in 1840, but had been applied as early as 1701 to a little work on phonetic spelling by J. Jones, M. D., London. The appearance of Pitman's system (first ed., London, 1837) marked an era in the history of shorthand writing. By the introduction of new stenographic material, a more accurate analysis of the vocal elements of the English tongue, and a more systematic presentation of the shorthand art, Pitman did very much to bring the possibility of verbatim reporting within the reach of persons of ordinary adaptability for the practice of the art. In the rapidly-succeeding editions of his work he introduced many ingenious improvements, so that his system soon stood in marked contrast to the awkwardness and arbitrariness of the systems of his predecessors. But if the succession of new editions was attended by the introduction of new and valuable stenographic material and further systematization, it also had the disadvantage, by reason of the uncertainty arising from frequent changes, of disheartening beginners and of delaying still further the introduction of phonographic correspondence. Pitman's has been the basis of every subsequent system which has received any considerable degree of public support; but it has not been taught to any extent in this country since the introduction of Graham's and Munson's systems. Graham's system, which is now written by a large proportion of the shorthand writers in the U. S., embraces many improvements upon Pitman's system. Its chief characteristics are simplicity, ingenuity, and analogic harmony throughout, and a comprehensive and elastic nomenclature—an entirely new feature. Its literature embraces about thirty volumes, including a phonographic dictionary, the first work of the kind ever attempted. We shall use, in illustrating this article, Pitman's system as modified by Graham.

The Phonographic Alphabet.—The material of the phonographic alphabet consists of the simplest geometrical characters variously modified and combined. Shorthand authors early found it necessary to analyze the vocal elements of the language and provide a more extended alphabet. Without going into distinctions too nice to be of any practical value for the purpose in hand, distinct signs are provided for forty elements in the "working alphabet." The consonants, with their appropriate signs and names, are illustrated in Fig. 1. The vowels are represented by means of dots and dashes, and the diphthongs by a combination of two dashes. They are written by the side of a consonant stroke, and the vowel-scale is made extensive by giving a different vowel-significance to the dot or dash according as it is written opposite the beginning, middle, or end of the stroke. The vowels are read before or after an adjacent consonant, according as they are written before or after perpendicular or inclined, or above or below horizontal strokes. (See Fig. 2.) They are named by their sound. In rapid writing they are not inserted except to indicate words of unusual occurrence or to vocalize proper names. Indeed, the consonant outlines of words are found to be so legible and suggestive that the vowels are usually left out even in phonographic correspondence.

FIG. 1.—*The Consonant Signs.*

Sign.	Sound.	Name.	Sign.	Sound.	Name.	Sign.	Sound.	Name.
	p	pee.		f	ef.		l	el.
	b	bee.		v	vee.		r	ar.
	t	tee.		th	ith.		m	em.
	d	dee.		Th	thee.		n	en.
	ch	chay.		s	es.		ing	ing.
	j	jay.		z	zee.		y	yay.
	k	kay.		sh	shay.		w	way.
	g	gay.		zh	zhay.		h	hay.
Additional Consonant Signs.								
	r	ray.	⊂ ⊃	w w	wĕh. wuh.	∪ ∩	y y	yĕh. yuh.
•	h	*hĕh* dot.	o	s	*iss* circle.		st	*steh* loop.
			O	ss	*ses* circle.		str	*ster* loop.

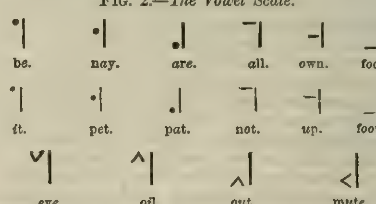
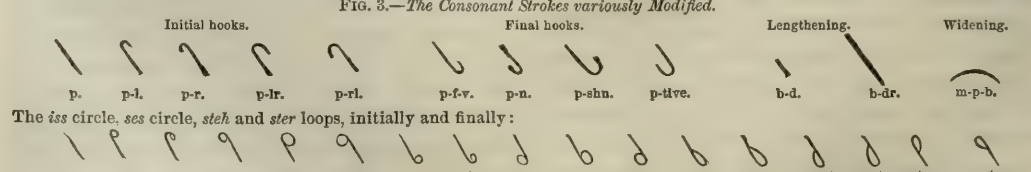


FIG. 2.—*The Vowel Scale.*

Modifications of the Consonant Strokes.—The primary consonant strokes are variously modified to indicate the addition of other consonants; thus, a small initial hook indicates the addition of *l* or *r*, according to the side on which it is written. A large initial hook indicates the addition *lr* (as in *ler, lor, lar*) or *rl* (as in *rel, ral,* etc.), according to the side on which it is written. A small final hook indicates the addition of the sound of *f, v,* or *n;* and a large final hook the addition of *shn* (*tion, sion, cion, cian,* etc.) or *tive,* according to the side on which it is written. The *iss* circle when written at the beginning of a stroke (hooked or not) implies that the stroke is preceded by *s;* when written at the end of a stroke (hooked or not), that the stroke is followed by *s*. The *ses* circle occurring initially or finally implies the precedence or succedence of *cis, ces, sis, ses, sus, sas,* etc. The *steh* loop initially or finally indicates *st*. The *ster* loop indicates *str* (as in *ster, stor,* etc.), but is not written initially. These circles and loops when written finally, on the side of the *n* hook (by making the hook into a circle or loop), signify the addition to the stroke, of *n-s, n-ses, cis,* etc., *n-st* or *n-str.* The sound of *s* may be added to a stroke modified by an *f* hook by writing the *iss* circle within the hook. *S* may be made to precede a stroke modified by an *l* or *r* hook by writing the *iss* circle within the *l* hook, or by making the *r* hook into a circle. By *halving* a stroke (writing it half length) *t* or *d* is added, according as the stroke is

FIG. 3.—*The Consonant Strokes variously Modified.*



light or heavy; by *lengthening* (writing it double length) *tr, dr, thr,* or *Thr* is added, according as the stroke is light or heavy; by *widening, p* or *b* is added. (See Fig. 3.)

Expedients for increasing Speed.—Various other expedients are made use of, as an initial dot or tick or small circle to imply a prefix, as *con, com, cog, circum, contra, self-con,* or *self-com;* a final dot or tick (light or heavy), or circle, to indicate the imperfect participle of verbs, an adverbial or other affix, as *ing, ings, ing -the, a, an,* or *ly; self, selves, bleness, fulness,* etc. Other affixes are indicated by an abbreviated termination, as *sv* for "soever" in *whosoever, whensoever,* etc. By "nearness" (writing two words near together) the omission of the connecting preposition "of," or of the prepositional phrases "of the," "of a," is implied. An outline written just touching the under side of the line of writing implies the precedence of "to," or "two." (See Fig. 4.)

Two other expedients for increasing speed remain to be noticed—phrase-writing and word-signs. By phrase-writing is meant the junction of several words without

FIG. 4.

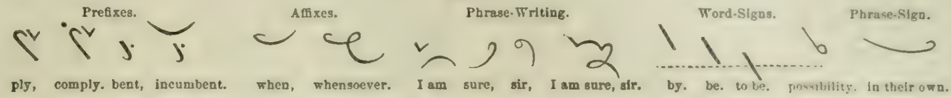
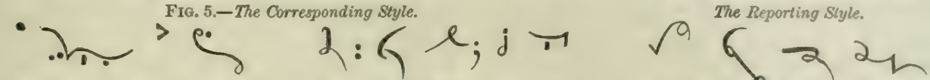


FIG. 5.—*The Corresponding Style.* *The Reporting Style.*



lifting the pen. The junction of words does not diminish, but rather increases, the legibility of the writing where the words are grammatically closely related, as in the phrase "I am certain." By the term word-sign is meant a primary character, simple or modified, which is memorized as an arbitrary and abbreviated expression of a certain word or words. The principle of word-signs is carried to a great extent, and like phrase-writing is one of the reporter's most important auxiliaries for increasing the speed of his writing; but word-signs being in a large degree arbitrary, give the phonographer more difficulty in reading his notes when they are "cold" and his mind is relaxed than the full or partial expression of words which are easily deciphered by reference to principle. (See Fig. 3.)

The average rate of public speaking is about 120 words per minute. To acquire this speed the phonographic student needs to devote to the art about one year of practice of two or three hours daily. The impassioned utterances of public orators sometimes reach as high as 250 words per minute; here none but the most expert can follow. Indeed, the requirements of the art in the present stage of its development are such that none but those peculiarly adapted for the work can ever hope to attain, even after years of practice, the high rate of speed just mentioned.

Phonography as presented in the best systems is scientific in its arrangement, and but the average intelligence, together with persistence, is required for its mastery in theory and practice. Though the possibility of verbatim reporting is still beyond the popular reach, it cannot be doubted (especially seeing the great advancement which has been made during the past twenty years) that writers of fair adaptability for the work will yet be able, after due training, to follow and record in permanently legible characters the most rapid utterances of public speakers. Fig. 5 illustrates the corresponding and reporting styles of phonography. (See also STENOGRAPHY.)

JOHN FRANCIS MEYER.

Phor′idæ [Gr. φορός, "carrying"], a family of gasteropod mollusks of the order Pectinibranchiata, distinguished by the attachment to the shells of foreign substances, such as stones, shells, etc., whence the name. The visceral sac is contained in a comparatively depressed spiral shell; the mantle margin is simple in front; the head has a rostrum elongated and tapering forward; tentacles subulate, sessile on the outer sides of the base of the tentacles; the lingual ribbon is provided with seven longitudinal rows of teeth; the central or rachidian has a narrow base, is dilated upward, and its margin has a large median and several lateral rounded teeth; the inner lateral is transversely sub-rhomboid, the outer lateral more or less elongated and claw-shaped; the foot is small, subcylindrical, and adapted for jumping rather than walking, and differentiated into an anterior expanded and a posterior tapering portion; the shell is trochiform, not pearly, and generally loaded with foreign substances attached at or near the angulated margin; the operculum is large, subannular, with the nucleus lateral and horny in texture. The family is composed of singular shells, remarkable on account of the peculiar habit expressed by the name. They progress by scrambling along, and, according to Adams, "often extending and fixing the front dilated portion of the foot, draw the hind lobe up to it, and then make another step, throwing forward the shell at every movement; they cannot glide like most other mollusks, but the form of their foot is admirably adapted to the nature of the floor on which they live, which is usually composed of the débris of dead shells." The family is generally divided into two genera: (1) *Phorus* or *Xenophora,* and (2) *Onustus;* the species are chiefly inhabitants of the Chinese and East Indian seas, but one species is found in the West Indies. THEODORE GILL.

Phor′mion, a celebrated Athenian general, b. of a distinguished family belonging to the deme Pæania; was sent in 440 B. C. with reinforcements to the Athenian troops blockading Samos, and in 432 he commanded the troops which were sent to reinforce Callias, besieging Potidæa. Here, after completing the circumvallation of the city, he led the rest of his troops against the Chalcidians, in which undertaking he was joined by Perdiccas, king of Macedonia. His first independent command he received in 430, when he led the Acarnanians against the Ambraciots, and in the same year he was sent with twenty ships to Naupactus, to prevent the Corinthian vessels from sailing out of the gulf, and to stop all vessels bound for Corinth. A Peloponnesian fleet was sent out to help the Corinthians, but, although much inferior in number, Phormion utterly defeated the enemy in two engagements, of which Thucydides gives a detailed description. Once more he commanded the Acarnanians with success, and in after-times they held his name in such respect that on a later occasion they asked to get his son, Asopius, as their general. His tomb, with a splendid monument, was on the road leading to the Academy, near those of Pericles and Chabrias.

Phos′gene Gas [Gr. φῶς, "light," and γεννάειν, to "engender"], (syn. *Chloroxycarbonic Acid, Chloride of Carbonyle;* Ger. *Chlor-Kohlenoxyd*). Formula, $CO.Cl_2$. Equal volumes of chlorine and carbonic oxide gases, mixed and exposed to sunshine, unite without explosion, the greenish color of the chlorine disapppearing, and the volume of the product (if the atmospheric pressure has access to it) becoming exactly one-half that of the mixture. Another mode of preparation, more convenient than the former, is to pass carbonic oxide gas through liquid pentachloride of antimony. Phosgene is a colorless gas, of an odor more suffocating and unpleasant than chlorine gas itself, drawing tears from the eyes. It does not fume in the air, though contact with water decomposes it. It has acid characters and reddens litmus. Water converts it into a mixture of muriatic and carbonic acid gases. It has as yet received no practical application. H. WURTZ.

Phos′phates, compounds, with basic bodies, of the PHOSPHORIC ANHYDRIDE, P_2O_5 (which see). Of all classes of the oxygen-salts as yet studied by chemists, this class presents the greatest difficulties and complexities. This is due to the circumstance, explained under the head of PHOSPHORIC ACIDS (which see), of the existence of a number of hydrates of phosphoric pentoxide, which contain the latter in such molecular forms as to possess different basicities, corresponding to the water in each hydrate. Moreover, even among the ordinary or orthophosphates—which comprise nearly all of any practical importance, and all for reference to which we can spare space—complexity, or at least great multiplicity, is occasioned by the fact that the three molecules of base are *interchangeable;* that is, in normal or neutral orthophosphates there may be three of one base, or two of one and one of another, or one each of three different bases. Besides this, there are two classes of *acid* orthophosphates, due to the replacement of one or two of the three basic molecules by one or two of water. Still further, there are compounds which are rated as *superbasic* orthophosphates, of which some natural minerals furnish examples. Of the orthophosphates, the following possess importance:

Ordinary Phosphate of Soda $(H_2O.2Na_2O.P_2O_5).24H_2O$;

Twenty-four Hydrate of Monohydric disodic orthophosphate.—This is the common commercial salt. It is an ingredient of blood and found in urine. It is prepared commercially by adding a slight excess of carbonate of soda to the crude phosphoric acid obtained from bones (see PHOSPHORIC ACIDS), and crystallizing. It forms fine large transparent prisms, oblique rhombic in form. The density-determinations indicate several allotropic modifications, Zimmermann giving 1.514, Schiff, Stolba, and Playfair and Joule all about 1.525, while Buignet gives 1.55, and Kopp as high as 1.586. On exposure to the air it undergoes rapid efflorescence, losing probably 10 of its $24H_2O$. Its taste is saline like common salt; alkaline to test-paper; soluble in 4 parts of cold and half as much boiling water. Much used in medicine and in the laboratory.

Microcosmic Salt, also called *Phosphorus Salt* [$H_2O.Na_2O.(NH_4)_2O.P_2O_5$].$8H_2O$, *Octohydrate of monohydric monosodic monammonic orthophosphate.*—Found abundantly in putrid urine, and as *stercorite* in guano. By reason of its forming, when fused, with loss of all its water and ammonia, a transparent glass of pure *sodic metaphosphate,* it is much used as a flux in the laboratory, particularly in blowpipe-analysis. Schiff gives for it the density 1.554, but for stercorite Dana's *Mineralogy* gives 1.6151.

Struvite is another mineral phosphate from guano, which seems to be *monammonic dimagnesic orthophosphate,* identical with the precipitate formed by a solution of microcosmic salt in a magnesic solution, the form in which magnesia is determined in chemical analysis.

Tricalcic Phosphate—Bone-earth, $3CaO.P_2O_5$.—This compound is the most important of the phosphorus compounds, and the source of all the rest. Information about it has already been given under the heads of BONE, CHEMICAL COMPOSITION OF, and OSSEINE.

Superphosphate of Lime, which is so important an artificial fertilizing material, is prepared by treating ground bones with a somewhat diluted sulphuric acid. It contains, mixed with sulphate of lime, an acid calcic orthophosphate, probably $CaO.2H_2O.P_2O_5$. The density of pure tricalcic phosphate appears as yet to be unascertained. Mineral phosphate of lime, *apatite,* is not pure tricalcic phosphate, but a compound of three molecules thereof with one molecule of *chloride of calcium.*

Phosphate of Alumina occurs in nature as the mineral *wavellite,* which is the *dodecahydrate* of *trialuminic diorthophosphate; turquoise,* another mineral, is *pentahydrate* of *dialuminic orthophosphate,* stained to the peculiar green color with cupric phosphate.

Phosphates of Iron occur native. The mineral *vivianite* is *trihydrate of triferrous orthophosphate.* Magnificent crystals are found in the greensand formation of New Jersey. *Cacoxenite* is a hydrated *diferric orthophosphate,* and there are several others. The orthophosphates of iron and alumina, with phosphate of lime, are almost universally diffused, in more or less minute proportion, throughout all rocks and soils.

Phosphate of Lead occurs native, in combination with *chloride of lead,* in the beautiful mineral species *pyromorphite,* three molecules of *triplumbic orthophosphate* to one molecule of *plumbic dichloride.*

The phosphates of *silver, uranium,* and some others have much scientific interest, but for information about these and others the reader must be referred to the textbooks of chemistry.

In view of the fact that the animal framework or skeleton is built mainly of *tricalcic phosphate,* phosphates become almost of paramount importance as mineral constituents of the food of man, and within the last two decades great, and doubtless praiseworthy, efforts have been made, chiefly under the inspiration and through the energy of our distinguished American chemist, Horsford—to whom the original idea is due—to introduce phosphates as ingredients of human food. The forms selected and the modes of incorporation with the food are such as to favor the assimilation of the phosphates. HENRY WURTZ.

Phosphat'ic Diath'esis, a name given by some physicians to a condition of the general system in which the salts of phosphoric acid are found in abnormal abundance in the urine. These salts occur normally in the proportion of 12½ parts in 1000, in the form of the phosphates of soda, potassa, magnesia, and lime; but, unless they are present in superabundance, the urine is capable of holding them in solution when acid. However, when the proportion is abnormal, although held in solution in acid urine at the temperature of the body, they are precipitated when the temperature is raised to the boiling-point, and show themselves throughout the liquid either as granular or crystallized phosphate of lime or crystals of phosphate of ammonia and magnesia. We may even find them in perfectly healthy urine after decomposition has set in. As soon as the excretion becomes alkaline from this cause, the granular phosphate of lime, being only soluble in acid fluids, is precipitated. The next change produced by decomposition is by the action of the carbonate of ammonia on the phosphates of soda and magnesia, giving rise to the phosphates of magnesia and ammonia and of soda and ammonia. Under certain circumstances the urea of the urine is altered in the kidneys or bladder; carbonate of ammonia is formed, which unites with the phosphate of magnesia and gives rise to the triple phosphate. The tendency to the formation of this salt is very often accompanied by some disease in the urinary passages, most commonly inflammation of the bladder. Independently of this, we generally find the deposit in the urine of persons suffering from general debility; also in those who have overworked themselves or have been depressed by over-anxiety, insufficient nourishment, or sexual excesses. In them the complexion is sallow and the circulation poor. They generally suffer from cold hands and feet. The treatment for this condition should be strict attention to the mode of life of the patient, which will generally need correction. A generous diet, plenty of exercise in the open air, cold bathing, and tonics will do a great deal in a short time. If indicated, opium may be given to relieve the anxiety.
EDWARD J. BERMINGHAM. REVISED BY WILLARD PARKER.

Phosphines, bases corresponding to amines, bearing the same relation to PH_3 that amines do to NH_3. Triethyl phosphine is $P(C_2H_5)_3$. (See AMINES.)

Phosphores'cence, a term applied to a very wide range of chemical or physico-chemical phenomena, including all those in which *light,* resulting from some process within the body that emits it, is unaccompanied by heat, or at least by an amount of heat perceptible to the sense of touch. The word is derived from *phosphorus,* but the phosphorescence of phosphorus itself is truly slow chemical combustion, proceeding only in the presence of oxygen, accompanied by the absorption of the latter and the formation of definite and well-known oxides, the heat produced also being readily detected by delicate thermoscopes; whereas in the great majority of cases classed under this name no oxygen—or at least no aërial oxygen—is involved, many occurring *in vacuo,* and often no heat can be detected. Moreover, it has been shown that in many cases the light evolved is of a different nature from the light evolved from ordinary combustion, being screened or arrested, for example, by media which are transparent to normal light. No more interesting, and at the same time more obscure, kinds of phenomena are known than those that are vaguely classed under this name *phosphorescence.* These phenomena are exhibited by bodies belonging to all the three kingdoms of nature—mineral, vegetable, and animal—and by the two latter in both life and death, and during both growth and decay. In the mineral kingdom so-called phosphorescences appear under a great variety of circumstances. The discussion of the subject would go far beyond our limits, and for the vast mass of facts belonging under this head the reader may be referred to Gmelin's *Handbook of Chemistry,* chapter on "Light," in vol. i.
HENRY WURTZ.

Phosphor'ic Ac'ids. Phosphoric pentoxide or anhydride combines with water in a number of different proportions; and there is this peculiarity about several of these hydrates, that when the water in them is displaced by a metallic oxide to form a salt, the nature of the salt varies with the hydrate, its basicity being in proportion to the number of equivalents of water in the latter. No other acidogenic oxide has this character so far as known. The pentoxide of *nitrogen,* which stands next to phosphorus as a member of the triadic series of elements, forms a series of hydrates, but these all form, with bases, ordinary *monobasic* nitrates, under ordinary circumstances; and as for arsenic pentoxide, which also stands next—on the other side of phosphorus—in the triadic series to phosphoric pentoxide, though this forms definite solid hydrates corresponding with those of the phosphoric compound, they all dissolve in water as trihydric arsenate, and all form *tribasic* salts with bases. There are three of these peculiar phosphoric hydrates that have been well investigated, though others are believed to exist. The three referred to are—

1. Metaphosphoric acid, or monohydric phosphate, $H_2O.P_2O_5$.
2. Pyrophosphoric acid, or dihydric phosphate, $2H_2O.P_2O_5$.
3. Orthophosphoric acid, or trihydric phosphate, $3H_2O.P_2O_5$.

It is evident, from the behavior of these three compounds with bases, that they contain the elementary phosphorus molecules in different allotropic forms, possessing, therefore, different molecular *volumes;* but so little have they been looked at from this point of view by their investigators that the *density* of one only of the three, the common or trihydrate, has been determined, the densities of the

other two, and therefore their molecular volumes, being as yet unknown. (See VOLUMES, MOLECULAR.)

1. *Metaphosphoric Acid*, $H_2O.P_2O_5$.—This compound was discovered by Graham. It is produced by heating either of the other two hydrates to redness, or by combining the anhydrous pentoxide with water in the cold. It is a transparent glass, which dissolves slowly but largely in cold water. It coagulates solutions of *albumen*, and forms with *silver* and *barium* insoluble precipitates. *Molybdate of ammonia* does not react with it as with the ordinary trihydrate. (See MOLYBDENUM.) Even at ordinary temperatures slowly, but on boiling quickly, it passes into the form of the ordinary or orthohydrate. Its density is unascertained.

2. *Pyrophosphoric Acid*, $2H_2O.P_2O_5$.—Discovered by Dr. Clark of Aberdeen. It is formed from the trihydrate at 215°, but not quite pure. Pyrophosphate of lead, decomposed in admixture with water by a current of sulphuretted hydrogen, and the filtrate boiled down till the temperature rises to 215° C., yields pure pyrophosphoric acid as a soft, glassy mass. Ignited, it becomes metaphosphoric acid; and boiled with water, it passes to the trihydrate. In acid solutions, unlike metaphosphoric, but like orthophosphoric acid, it does not precipitate *albumen*, *baryta*, or *silver*, but in neutral solutions it does throw down the two latter. Its density also is unknown.

3. *Orthophosphoric* (or *Ordinary Phosphoric*) *Acid*, $3H_2O.P_2O_5$.—This hydrate doubtless contains the phosphoric pentoxide in its *natural* molecular form or volume; that is, as it exists in natural phosphates, including bones, vegetable tissues, and mineral phosphates. It must not be supposed that this is the same volume as that of the uncombined pentoxide (see PHOSPHORIC ANHYDRIDE), as this is very improbable. Common phosphoric acid is preparable by two chief methods. The first from elementary phosphorus, by the action of nitric acid, which gives a chemically pure product, suitable for laboratory use: 1 part of phosphorus requires 15 parts of nitric acid of density 1.2. Much effervescence occurs. The second, from bone-ash, furnishes it only in approximate purity. The tricalcic phosphate is first decomposed with sulphuric acid, and by a tedious process of repeated evaporations, dilutions, and filtrations all but a trace of the lime is removed. The magnesia and part of the soda will also separate as a crystalline double phosphate on heating the concentrated solution for some time to 315° C. Orthophosphoric acid may be obtained in hard, transparent crystals, prismatic in form, by evaporation over oil of vitriol. Density of these, according to Schiff, 1.88. Its solutions do not coagulate *albumen* nor precipitate *argentic*, *baric*, or *ferric* solutions, though *neutral* solutions of *orthophosphates* do precipitate the three latter. The fused or "glacial phosphoric acid" of commerce is generally an indefinite mixture of the dihydrate and trihydrate, but on boiling a solution of it in water for some time, pure trihydrate results.

(For compounds of the acids of phosphorus see PHOSPHATES.) HENRY WURTZ.

Phosphor'ic Anhy'dride (*Phosphoric Pentoxide*), P_2O_5. This substance is the product of the burning of phosphorus with flame in the air. It appears as a white smoke. To procure it in quantities a large glass flask having three tubulures is provided, with a straight glass tube descending to about its centre through one of the tubulures, open at both ends, and having a small cup suspended to its lower end to hold the burning phosphorus, which may be dropped down through this tube into the cup in small fragments as it burns away, the upper end of the tube being kept closed with a cork. Through the other two tubulures a current of dry air—dried by passage through chloride of calcium—is led in and out constantly, passing into a bottle or series of bottles, by which the phosphoric anhydride that does not settle in the large flask will be caught. The phosphoric pentoxide thus obtained is a snow-white amorphous powder, which sublimes at a moderate heat below redness. Its density, according to Brisson, is 2.387. It is highly deliquescent, and when added to water combines with it with great heat and explosive violence. If the water is boiling, or allowed to become so from the heat developed, there is generated by this combination ordinary tribasic phosphoric acid or trihydric phosphate; if the water is kept cold, the hydrate generated is the metaphosphoric acid or monohydric phosphate. (See PHOSPHORIC ACIDS.) HENRY WURTZ.

Phosphor'oscope, a device invented by E. Becquerel for showing the phenomenon of phosphorescence in bodies which shine but for a very minute portion of time after their insulation. By suitable perforations in a disk revolving over a box in which is the substance to be examined, sunlight is allowed to fall upon it and to be cut off before the observer can see it through another aperture. By giving to the disk a sufficiently rapid rotation observations may be made after an interval of less than $\frac{1}{400}$th of a second after light has ceased to shine upon the substance. In this way it has been discovered that many substances are phosphorescent (*i. e.* capable of emitting light) which have never before been known to be so. But there are still a large number of bodies which have no appreciable phosphorescence.

Phos'phorous Anhy'dride and Phos'phites. Phosphorus trioxide, P_2O_3, is formed when phosphorus undergoes *slow* combustion, without flame, at the ordinary temperature in perfectly dry air. It forms volatile white flakes having an alliaceous odor and highly deliquescent. It combines with water, with a hissing noise, to form—

Phosphorous Acid, $3H_2O.P_2O_3$.—This compound is obtainable also by several other methods, as by the action of phosphorus on cupric sulphate, according to Schiff, and by the action of trichloride of phosphorus on oxalic acid, according to Hurtzig and Geuther. It may be made to form very deliquescent crystals. When heated it is decomposed into phosphoric acid and phosphuretted hydrogen gas. Phosphorous acid is a powerful reducing agent in metallic solutions, precipitating gold, silver, and mercury in metallic forms. It is a *dibasic* acid, and forms two series of salts, neutral and acid. The neutral phosphites are remarkable in being sparingly soluble, except those of the alkalies. *Phosphite of lead* is almost insoluble in water, and even but slightly soluble in excess of the acid. The phosphites have been somewhat well investigated, but present as yet no special *practical* interest. HENRY WURTZ.

Phos'phorus [Gr. φῶς, "light," and φορός, "bringing," fr. φέρειν, to "bring"], one of the most important and interesting of the elements of matter, and one of those most essential to animal life. It was discovered more than 200 years ago, in 1669, by Brandt of Hamburg, who obtained it in experimenting on the distillation of extract of urine with charcoal. In 1740, Marggraf identified phosphoric acid as a peculiar acid, Stahl having previously examined it, and supposed that he had proved it to be *phlogisticated muriatic acid!* Gahn in 1769 proved that bones contain this acid, and Scheele discovered how to prepare it from them. Phosphorus is now manufactured by first making from bones a soluble acid phosphate of lime through the agency of sulphuric acid, and mixing and distilling this with charcoal in earthen retorts at a red heat. Bone-ash contains nearly 20 per cent. of phosphorus, this being the precise proportion in pure *tricalcic phosphate;* but the amount of phosphorus obtained in practice is only from 8 to 11 per cent. The process is also expensively consumptive of fuel and destructive of apparatus, as well as of the health of the operatives, these facts much enhancing the cost of phosphorus. The importance of this product to man is, however, so great—chiefly as a material for making matches—that the production is carried on on a very large scale and with great skill in all civilized countries, and phosphorus is a comparatively cheap and quite abundant article of commerce. Common commercial phosphorus is a slightly yellowish body of wax-like consistence, and translucent. It is generally cast into the form of sticks, which, on account of their dangerous inflammability, must be preserved under water. It melts at 44° C. or 111° F. to a liquid of oily consistence, which may be cooled if undisturbed much below the melting-point again without solidifying, but then at once solidifies on agitation. Although flexible and highly sectile at ordinary temperatures, it becomes brittle and breaks with a crystalline fracture at the freezing-point of water. It may be crystallized from bisulphide of carbon, in which it is soluble, the crystals belonging to the regular system. It boils between 250° and 290° C. (482° and 554° F.), forming a transparent vapor nearly four and a half times as heavy as air. Phosphorus is slightly soluble in ether and in fixed oils, considerably so in benzole, and in many essential oils, including oil of turpentine, largely so in bisulphide of carbon. The solution in the latter, if applied to paper, causes it to take fire spontaneously as soon as the solvent has evaporated—a circumstance that has led to the proposition to use such a solution in offensive warfare for incendiary shells. Phosphorus may be finely granulated by agitation while melted with a solution of *urea*, as observed by Böttger. Blondlot states that solutions of salt and sugar will effect the same object.

Special chemical interest attaches to phosphorus, by reason of the curious and interesting character of its allotropic modifications. Of the existence of *five* such modifications, at least, distinct and well characterized, there can be little or no doubt. These are *common*, *white*, *red*, *black*, and *metalloidal* phosphorus. Much study of the molecular nature of these has enabled the present writer to discover the following figures for the true densities of these and other modifications at melting ice, from which their varying molecular volumes are computable in the usual way:

	True densities, H. Wurtz.	Other authorities.
Opaque white phosphorus	1.516	1.515, Watts's *Dictionary*.
Common phosphorus, including three modifications, based on figures of Berzelius, Playfair and Joule, and Pisati and De Franchis	1.764 1.832 2.105	1.77, Berzelius. 1.837, P. & De F. 2.09, P. & J.
Red phosphorus of Schrötter	1.984	1.964, Schrötter.
Crystals of Brodie	2.242	2.23, Brodie.
"Metallic" phosphorus of Hittorf	2.336	2.34, Hittorf.
Black phosphorus	Undetermined.	

The white opaque modification forms from common phosphorus under water spontaneously. Red, generally called *amorphous* phosphorus, is prepared by heating to near its boiling-point for some time. (See ISOMERISM.)

HENRY WURTZ.

Phosphorus Bases. See PHOSPHINES.

Phosphorus Bronze. This term is used to designate a bronze or alloy of tin and copper with which a small amount of phosphorus—less than 2 per cent.—has been combined. The discovery was made about the beginning of 1871 by MM. Montefiori, Levi, and Keuzel. It was stated that a phosphorus bronze containing the proper proportion of phosphorus was more lasting, had fewer cavities in it, had a more homogeneous fracture, with a steely grain, had its elasticity increased 80 per cent., and its absolute tensile strength 170 per cent. While the fusing-point is not changed, the fused metal is more liquid and makes sharper casts. It resists oxidation where iron and steel quickly rust. The Prussian government has since experimented with cannon of phosphorus bronze, but the results were not as satisfactory as had been hoped. The guns cracked after sixty or seventy rounds. The claims made for the material must be regarded as still subjects for experiment. HENRY WURTZ.

Phosphorus, Medicinal Uses of. Pure phosphorus is locally an intense irritant and caustic to animal tissues, and taken internally is a virulent poison, whether in large single dose or in repeated administration of small quantities. Even in a single fatal dose, however, the symptoms may not begin till several hours after swallowing the poison, and death does not generally occur till after several days. There are the usual signs of irritant poisoning—viz., nausea, vomiting, and sometimes purging, with abdominal pain, but the latter symptom is not so severe as with other corrosive poisons. Then a peculiar feature of phosphorus poisoning sets in—namely, jaundice, from fatty degeneration of the liver. A garlicky breath; luminosity of the eructations and sometimes of the secretions; profound disturbances of the nervous system, such as delirium, convulsions, coma, with extreme general prostration, follow, and the individual may die suddenly from collapse and syncope, or more slowly after sinking into coma. After death there is found profound structural disintegration of the tissues, with special tendency to fatty degeneration of many of the organs, and extravasations of blood into their tissue. In chronic poisoning the symptoms are essentially similar, only more gradually induced. Sometimes, however, no symptoms occur except a profound general debility, in which condition the subject may sink away and die. Before the introduction of allotropic phosphorus in the making of matches, workers at that trade were apt to suffer from a peculiar form of poisoning through inhalation of phosphorus fumes, of which caries of the teeth and necrosis of the jaw were prominent symptoms. The antidotes in phosphorus poisoning that seem to be of most use are some soluble salt of copper, and *impure, acid* oil of turpentine. The pure rectified oil is of no use. Given medicinally in doses of a minute fraction of a grain, phosphorus is sometimes of benefit in conditions of nervous debility, and especially in neuralgias. Under its use the patient's general state may improve and the special morbid symptoms abate. A hypothetical explanation of these therapeutic effects is based on the existence of a phosphorized fat as a normal ingredient of nerve-substance. In nervous exhaustion this is supposed to be deficient, and the giving of phosphorus is assumed to supply the want. Phosphorus is most commonly given in pill form, the minute dose being dissolved by warmth in some form of fat which concretes on cooling. It may also be given in solution in appropriate fluid mixture, but most of these solutions have an excessively offensive taste. As slow poisoning by phosphorus is very insidious, the drug should only be taken under the observation of a physician.

EDWARD CURTIS. REVISED BY WILLARD PARKER.

Pho′tius, the date and place of whose birth are unknown, as are also the circumstances of his early life, held a high position in the civil service of the Byzantine government, and was distinguished for his learning and literary taste, when in 858, on the deposition of Ignatius, he was hurried through all the grades of the ecclesiastical order in six days, and on the seventh installed by the emperor, Michael III., as patriarch of Constantinople. A council of 318 bishops, held at Constantinople in 861, confirmed the election, but a quarrel having arisen between the Roman and the Constantinopolitan sees concerning the jurisdiction over the newly-converted Bulgarians, Pope Nicholas I. objected to the irregularities of Photius's election, and convoked a council at Rome in 862, which deposed and excommunicated him. For the sake of self-defence, Photius now gave the conflict a doctrinal turn, and the Council of Constantinople (867) condemned and excommunicated Pope Nicholas I. because he held heretical views, thereby laying the foundation of the schism between the Eastern and Western churches. In 867, when Basilius the Macedonian succeeded Michael III., Photius was bereft of his office and sent into exile, and Ignatius was reinstated; but after the death of Ignatius he returned to Constantinople and was once more placed on the patriarchal throne. In 886, Leo the Philosopher again exiled him, and he d. a few years after in an Armenian monastery. Of his works, the *Myriobiblon* or *Bibliotheca*, a collection of extracts and reviews of 279 Greek authors (edited by I. Bekker, 1824), the *Lexicon* (edited by Porson, 1822), the *Nomocanon*, a collection of acts and decrees of councils up to the seventh œcumenical council, and his letters are of great interest. A collected edition is found in Migne's *Patrologiæ Cursus Completus*.

Pho′togen [Gr. φῶς, "light," and γεννάειν, to "produce"], the German term for the portion of shale, coal, or petroleum oil suitable for burning in lamps. (See PETROLEUM.)

Photographic Engraving. See PHOTOGRAPHY.

Photog′raphy [Gr. φῶς, "light," and γράφειν, to "write"]. This art dates back to the beginning of the present century, although the fact that light affects various substances had long been familiar through the fading of dyed stuffs, the blackening of organic matter, like paper, hair, etc., when moistened with silver solutions, and the darkening of chloride of silver on exposure to light. In 1802, Thomas Wedgwood, an Englishman, first produced photographic pictures by exposing paper impregnated with nitrate of silver to sunlight under a silhouette or similar dark object. The result was a dark copy of the silhouette on a light ground, and this was very imperfectly fixed by washing away the unaltered silver salt. Davy succeeded in obtaining copies of objects by combining the solar microscope with a camera obscura, but the paper used by Wedgwood was not sensitive enough for the ordinary camera. In 1814, Nicéphore Niepce of Châlons began to experiment, and finally succeeded in taking pictures in a camera by exposing for hours a silvered plate of copper coated with asphaltum dissolved in oil of lavender. The parts acted on by the light remained insoluble when the rest of the coat was dissolved off with volatile oils. In 1826 he exhibited some of his heliographs, and is said to have taken impressions from them by printing. In 1833 he died, and Daguerre, his associate for some years, perfected his well-known process, exhibiting its results publicly in 1838, and making known his secret in Aug., 1839, in return for a pension of 6000 francs. Niepce's son also received one of 4000 francs from the French government. Daguerre exposed a polished silver plate, coated with iodide by means of iodine vapors, to the light in a camera; no image was visible until the plate was exposed to vapors of mercury, when that metal was precipitated upon the parts most affected by the light. The superfluous silver iodide was removed with hyposulphite of soda. Daguerre's idea, which is the basis of all successful processes, was *development* of the latent image. It is said to have been the result of accident, the silver plate having been left in a closet with some mercury. Dr. J. W. Draper of New York first took portraits from life in America.

In 1841, Talbot succeeded in obtaining a paper negative in the camera by using paper prepared with iodide of silver, solution of nitrate of silver, and gallic acid, and developing with a mixture of the two latter agents. These paper *Calotype* or *Talbotype* negatives were too rough in outline, and in 1847, Niepce de St. Victor substituted glass coated with albumen containing iodide of potassium. This gave a very sharp picture, but the film of albumen was too destructible. In 1850, Legray attempted, and in 1851 Archer and Fry of England made a more successful effort, to replace the albumen with collodion, a solution of pyroxyline in alcohol and ether. Pyroxyline is prepared from cotton by the action of sulphuric and nitric acids, is chemically the same as gun-cotton, and is frequently called by

the same name, but true gun-cotton, used for firearms, is not soluble in alcohol and ether. (See COLLODION.)

The paper used for positives was improved by being coated with albumen; the time of exposure, which Daguerre had reduced to minutes, was reduced to seconds by Petzval's double objective lens; mixtures of bromide with iodide of silver were found to be more sensitive than iodide alone; Fizeau introduced toning with gold solutions to improve the color and durability of positives; Herschel some time before had proposed hyposulphite of soda as a *fixing* agent; Russell discovered the tannin *dry process*; and thus photography became well established as an art. Fizeau in 1844 deposited a film of copper by galvanism on the daguerreotype plate, obtaining a plate from which he got rough impressions, and Barreswil, Lemercier, Niepce de St. Victor, and others introduced processes for using lithographic stone and steel plates coated with asphaltum, exposed under negatives, treated with solvents to remove the unaltered asphaltum, and then with acids to etch the plates so that they could be used with ink for printing impressions. Mungo Penton observed that gelatine containing bichromate of potash was altered by the action of the light, and Talbot, Pretsch, and Poitevin, following up his discovery, laid the foundation for some of the most important photographic processes. Lubeck in 1810 showed that chloride of silver assumes different colors in different parts of the spectrum, and Becquerel in 1847 found that a plate of silver, immersed in metallic chlorides and exposed under colored glasses, receives an impression which it retains while kept in the dark. *Heliochromy*, or the production of colors by sunlight, is therefore possible, but no way of fixing these colors is known.

In some cases the action of the light may be physical. If a polished glass or metal surface is exposed to the sunlight for some time under a perforated shield, not in contact with it, and the surface is then breathed upon, the vapor will condense most abundantly on the spot exposed to the light. This is analogous to the condensation of the mercury vapors on the daguerreotype plate, and is only one of many physical effects of light. If a ray of sunlight or any ordinary artificial light is passed through a triangular prism, it will be decomposed into several rays of different-colored light, arranged as in the rainbow. This constitutes the well-known *spectrum*, and it has been found that chloride of silver is most rapidly darkened by the violet and certain rays beyond the violet called ultra-violet rays, while the chemical action of the rays rapidly diminishes toward the other end of the spectrum, until it is almost imperceptible in the yellow rays. It is on this account that pure colors photograph differently; yellow and red, which have little effect on the prepared plate in the camera, coming out dark in the positive picture, for reasons which are explained by the action of the chemicals used in obtaining the negative picture, while blue and violet would give a white spot in the positive; but if the colors are the result of mixing other colors, the effect produced by them will depend on the proportions and nature of the original colors, and also on the nature of the colored surface. Silk stuffs reflect more pure light than woollen, and would therefore give darker positives even if of the same color. Bromide of silver is more sensitive to green, yellow, and red rays than iodide, and hence is useful as an addition to iodized collodion for general use. Vogel has found that the sensitiveness of the silver bromide, etc., is increased for different-colored rays by adding to it bodies which absorb those rays; as coralline for yellow light, aniline green for red light. It is a mistake to suppose that the interposition of blue glass increases the chemical effect of light, for it not only absorbs the rays of slight energy, but is not even perfectly transparent to the most active. Acids retard the chemical effect of light on bromide, iodide, and chloride of silver; solution of nitrate of silver aids it, especially in the case of iodide and bromide. This is due to the absorption of bromine and iodine by nitrate of silver solution; and the same explanation can be given for the accelerating effect of other substances, as tannin, pyrogallic and gallic acids, etc. Organic substances, like paper, also exert a *sensitizing* effect, especially on chloride of silver. Thus, the paper used in the positive process is impregnated with chloride and nitrate of silver; the chloride is decomposed, metallic silver deposited on the paper, and the nitrate of silver decomposed by the chlorine thus set free, so that fresh chloride is formed, and the paper made much darker than by chloride of silver alone.

When a plate prepared with iodide, bromide, or chloride of silver is exposed a short time to the light, no result is apparent until the plate is covered with a silver solution containing a reducing agent, when the silver is reduced and forms a dark pulverulent precipitate wherever the light had acted. This process is called "developing," and the developers used are sulphate of iron, gallic acid, pyrogallic acid, etc., with solution of nitrate of silver.

The first step in the ordinary photographic process is to obtain a negative. The cameras used consist of a dark box, capable of being drawn out, so that a prepared plate at the rear can be brought into the focus of a lens in the front. This lens for portraits must, first of all, be able to concentrate a strong light on the plate; it must, however, also give as perfectly flat and sharp a picture as possible. For landscapes the light is less important, and it is therefore possible to secure greater depth of focus, so that near and distant objects may alike be thrown sharply on the plate. For copying flat objects perfect flatness is desired in the image produced on the plate. The glass plate being thoroughly cleansed with acid, and then with ammonia or otherwise, is coated with collodion, sometimes receiving a previous coating of albumen. This collodion is made by immersing cotton or paper in sulphuric and nitric acids and then washing it thoroughly. Then it is dissolved in alcohol and ether, and *sensitized* by addition of salts of iodine and bromine. The salts generally used are iodides of ammonium, potassium, sodium, and cadmium, and the corresponding bromides. Upon the length of time the cotton was immersed in the acids, the strength of the acids, the proportions of alcohol and ether, and the nature of the sensitizing agents, will depend the fluidity, clearness, sensitiveness, and durability of the collodion, and the qualities of the negative produced with it. These points require very large experience. The collodion plate is then immersed in a bath of solution of nitrate of silver, previously saturated with iodide of silver, to prevent the solution of the iodide of silver formed during the immersion on the collodion plate. This bath is generally acidified with a few drops of nitric acid, and contains for ordinary purposes 1 part by weight of nitrate of silver to 10 of distilled water. The sensitizing must be done in a room lighted by very faint candle or gas light, or by light admitted through yellow glass. The wet plate is now enclosed in a dark case and placed in the camera, where it is exposed as long as necessary to the light. The length of time for exposure must be determined by experience, and will depend on the intensity of the light and the nature of the object; the longer the time, the more intense will be the negative, within certain limits; but overexposure renders the details indistinct by destroying the contrast of light and shade. The plate is removed to the dark room and a developer poured over it, and left until the details of the picture are all visible, when it is washed off. The developer is usually a solution of sulphate of iron, containing acetic acid, and a little alcohol if the silver bath is old. Generally, a negative is not intense enough, and then it is intensified by pouring over it some more of the sulphate of iron solution with a little acetic acid and very dilute solution of nitrate of silver. It is then washed, and *fixed* in a solution of cyanide of potassium, which dissolves the unchanged iodide and bromide of silver. Hyposulphite of soda is less frequently employed to fix negatives. Vogel recommends for intensifying the negative, after washing it, a mixture of pyrogallic acid dissolved in alcohol, with water, nitrate of silver, and citric acid. The fixed negative is dried and varnished, and is then ready for furnishing the *positive*. To obtain the positive picture the negative is placed upon albumenized paper, previously impregnated with solution of chloride of sodium, then floated in solution of nitrate of silver, and dried. The two are exposed to the light, and the silver salts on the paper are darkened by the light which passes through the transparent parts of the negative. The result is a picture in which the lights and shades are in their proper places, and it is now necessary to fix this picture by dissolving the superfluous silver salt with hyposulphite of soda. By this operation the purplish-brown color of the positive is changed to a disagreeable yellowish-brown, which is remedied by *toning* in a gold bath before fixing. The picture thereby acquires a better color, and is more durable on account of the gold surface obtained. Chloride of gold, generally combined with chloride of potassium or sodium, is used for toning, and the color produced will vary according to the acidity or alkalinity of the bath. After being fixed, the positive is well washed, mounted, and calendered. Slight modifications of this process are adopted by different photographers. The negative is generally retouched before using it for obtaining a positive, as thereby spots and defects can be concealed; the positive paper is sometimes exposed to ammonia vapors before it is used; the fixed picture may require to be retouched, and frequently it is polished by putting some solution of wax in ether upon it and rubbing it with a woollen cloth. By using developers with nitrate of potash, nitrate of silver, and nitric acid, with a suitable collodion and short exposure, positives can be taken at

once in the camera, either on glass, afterward coated on the back with black varnish, or on plates of dark glass or of iron faced with black varnish. These are called ambrotypes and melainotypes. Transparent positives on glass can be made by substituting for the paper a plate of glass properly prepared with sensitized collodion. They can also be made by the Woodbury process. If the transparent positive is to be of a different size from the negative, recourse is had to the camera obscura. Positives on glass can also be transferred to ivory, porcelain, etc., by causing the collodion to adhere to the new surface by means of suitable adhesive preparations. Life-size pictures are obtained by concentrating the light with a large lens on a small negative, and then forming an enlarged image of this negative by passing the rays from it through a second lens and receiving them on prepared paper. Stereoscopic pictures are taken with cameras having two lenses, about two and a half inches apart, or by moving the single-lens camera a little to one side after taking the first picture. Negatives of very minute objects in enlarged size are taken with the microscope by inserting the eyepiece of the instrument into the camera and throwing the image of the strongly-illuminated object on the prepared plate without the intervention of the usual camera objective. Photographs of astronomical objects are taken by substituting for the eyepiece of the telescope a prepared plate, which receives at once the image thrown on it by the object-glass, or this image enlarged by the intervention of a lens of short focus. Microscopic photographs are obtained by again photographing a negative with a lens of very short focal distance. Photography has also been made to record meteorological observations and to aid in physiological researches.

Among the tricks of photography are the spectre photographs, where a faint image of an object was made to appear dimly on a plate by a very short exposure, while the main object was exposed for the usual time. Moonlight effects are really produced by sunlight by a very short exposure; the ostensible moon in the picture being really the sun. Magic photographs are paper photographs dipped in chloride of mercury solution, which bleaches them by forming white chloride of silver and subchloride of mercury. These, covered with paper impregnated with hyposulphite of soda, are turned black by the formation of sulphide of mercury. The subchloride of mercury can also be blackened by the ammonia of tobacco-smoke, as in the magic cigar-holders. Instantaneous photographs are simply the result of using powerful lenses, a strong light, good collodion, and a strong developer and intensifier. The artificial lights used are the electric, calcium, and magnesium lights. Sometimes sunlight is introduced into dark places with mirrors. The dry collodion process is very convenient for use on expeditions. As the nitrate of silver solution present on the plate in the camera in the wet collodion process must be washed off before drying the plate, it becomes necessary to use some agent that will increase the sensitiveness of the plate. Substances which absorb iodine do this, and, according to Vogel, this explains the action of the tannin and other agents used in this process. Russell's process consists essentially in using albumenized or gelatinized plates to receive the collodion, and in immersing these when sensitized and dried in a solution of tannin in water. The plate is developed by washing it, pouring on a solution of pyrogallic acid, and subsequently adding nitrate of silver to this solution. Bartholomew's excellent process consists in coating the sensitized plate with solution of acetate of morphine.

By re-photographing a negative in the camera, so as to obtain a positive on glass, and intensifying this with pyrogallic acid and silver solution, the effect of which was augmented by using chloride of mercury and iodide of potassium, Scamoni succeeded in obtaining so high a relief that it could be successfully used to obtain, by the galvanic battery, a copper plate suitable for producing impressions —a valuable process for copying maps and drawings. Some of the most important accessory processes of photography depend upon the following facts: If gelatine impregnated with bichromate of potash or ammonium is exposed to the light, it loses its properties of swelling in cold water and of dissolving in warm water. Talbot discovered this, and employed it to produce steel engravings, by coating the steel with chromatized gelatine, exposing it under a negative, dissolving out the unchanged gelatine, and etching the plate where it was thus exposed. Pretsch by copying under a positive obtained a film in relief, which he reproduced with copper by the galvanic battery, and used for printing. The process is very useful for reproducing maps, etc., but shows the half-tones very imperfectly. Pigment prints are made by coating paper with chromatized gelatine, colored with any desired pigment, and exposing it under a negative. The gelatine film is then dampened, placed on a smooth zinc plate, and when dry immersed in warm water. This removes the paper, and the gelatine film is then transferred to glue-paper. If it is not desired thus to reverse it, it is at once transferred to albumenized paper, which is pressed upon it, and the whole plunged into hot water. As the gelatine is affected to a greater or less depth according to the intensity of the light, the half-tones are preserved. Monochromatic pictures are thus reproduced in their original colors, sketches of the old masters being especially so copied. By exposing a simple chromatized gelatine film, resting on collodion, under a negative, dissolving out the unchanged gelatine with hot water, allowing the relief thus obtained to become very hard by drying, and then placing it on a lead plate under a strong press, Woodbury obtains a printing plate. On this is poured warm colored gelatine solution, upon which is placed calendered paper, and the gelatine adhering to this in layers of different thickness produces a perfect representation of the half-tones. This process, called "relief printing," is very valuable where many copies are required, and it can be used to print on glass also. After exposure to light, a chromatized gelatine film will receive a coating of lithographic ink, but will not become moist when rubbed with a wet sponge. By exposing such a film under a negative, brushing it with a wet sponge, and then passing over it an inked roller, an inked plate is prepared from which an impression can be taken. This constitutes the basis of the Albertype process, which has been perfected by Obernetter, and yields results surpassing those of the Woodbury process in sharpness, but not in delicacy of shading. These two processes are nearly equal to the silver positives in their results. Asser and Osborne obtain photo-lithographs by exposing under a negative chromatized gelatine paper, which then only absorbs lithographic ink where the light has worked; the paper is then washed and applied to a lithographic stone, which absorbs the ink and can be used for printing. The same thing can be done with zinc, giving photo-zincographs, but the copies obtained are decidedly wanting in sharpness in both cases, although valuable where cheapness is desired.

Pictures burnt in on porcelain and glass surfaces were obtained by Grüne, who transferred the collodion film to these surfaces, after replacing the silver on it with other metals, by means of solutions of their salts. Joubert has perfected a pyro-photographic method, proposed by Poitevin, which consists in exposing, under a positive, a glass coated with gum-arabic and sugar or honey and chromate of potash. This plate when dried loses its stickiness after exposure to the light, and if it is powdered with any fine powder, this will stick to it only where the film was protected from the light. By using appropriate colors and transferring it, if necessary, to curved surfaces, the pictures can be burned in on glass or enamel. H. B. CORNWALL.

Photolithography. See PHOTOGRAPHY.

Photom'eter [Gr. φῶς, "light," and μέτρον, "measure"], an instrument for comparing the intensity of any light with that of another assumed as a standard. In 1833, Arago constructed a photometer based upon principles involved in the laws of the polarization of light. The principle, however, upon which most photometers are constructed depends upon the law that "the intensity of light emanating from a point varies inversely as the square of the distance of the light from the object illuminated." Among those deserving consideration are the following:

Masson's Electro-photometer, especially adapted for comparing lights of different colors. It consists of a circular disk divided into black and white sectors which is revolved by clockwork at the rate of 250 to 300 turns per second. When illuminated by a constant light, it appears gray, but when illuminated by the electric spark, the sectors are plainly visible as if it were at rest. If the intensity of the light from the spark is diminished, or the illumination from the constant source of light is increased, a point is finally reached at which the light from the spark ceases to make the sectors of the disk visible. By a comparison of the distances at which two lights prevent the appearance of the sectors when the electric spark is passed, the relative intensities of the two lights may be calculated. Recent experiments have shown that certain modifications of selenium show an increase in their capacity for conducting electricity in accordance with the extent to which they are illuminated, and it has been proposed to make this property the starting-point for photometrical tests. (*Pogg. Annalen*, No. 10, 1875.) The other photometers which have been proposed and more or less used may be distinguished as (1) those in which the lights compared are on the same side of the screen upon which their intensities are compared; of this class Rumford's photometer may be taken as the type. (2) Those in which the lights compared are

on opposite sides of the screen upon which their intensities are compared; the type of this class is the ordinary Bunsen photometer.

Rumford's Photometer consists of a wooden cylinder with a small white screen behind it, upon which its shadow is thrown. With two lights there are of course two shadows, each shadow being illuminated only by one of the lights. The lights are so arranged that the shadows are brought close together without overlapping, and the lights are moved independently nearer to or farther from the screen until the shadows are equally illumined. The intensities of the lights are then inversely as the squares of their distances from the screen. *Ritchie's Photometer* is a modification of this, where the lights are cast upon a screen of oiled paper in a box enclosed in a dark chamber, the shadows of the sides of the box being brought together, and the relative intensities of the lights determined in the same manner. Various other modifications of this mode of testing have been made by different experimenters as regards the material forming the screen and the mode of inspecting it. *Foucault's modification* of Rumford's photometer, arranged by Dumas and Regnault with starched glass plates, has been extensively used in France. Other experimenters have used ground-glass plates and other translucent materials. These "shadow tests," so called, require much practice in the experimenter, and even with expert manipulators it is claimed that the error is from 5 to 10 per cent.

Bunsen's Photometer consists of a bar 80 to 100 inches long, supporting a small disk of paper in a frame, the paper being oiled all over with the exception of a spot in the centre, or in some cases the centre being oiled while the remainder of the paper is left in its natural state. At one end of this bar is placed the standard light, at the other the light to be tested. The disk is moved along the bar until it is seen to be equally illuminated on both sides. The bar is usually graduated so that the readings may be made directly, without elaborate measurements and calculation. *Letheby's modification* of Bunsen's photometer has the disk enclosed in a box, with mirrors at each side so placed that the observer can see both sides of the disk at a glance. Dr. Letheby has also substituted for the oiled disk a disk of thick white paper from which a star has been cut, with bits of thin paper on each side of it. This form of photometer is the one most generally used. The maximum error is stated to be about 5 per cent.

Lowe's Jet Photometer is another form of photometer which is much used, and depends upon an entirely different principle. It is used exclusively for testing illuminating gas. Mr. George Lowe, an English gas-engineer, discovered that "the height of a flame of gas burning under a well-regulated and constant pressure from an aperture of unalterable dimensions depends upon the illuminating power of that gas. The apparatus therefore consists essentially of a jet with a single opening, made at first of porcelain, but at present usually constructed of steatite (the so-called lava), connected with suitable apparatus for regulating the flow and pressure of the gas to a nicety. The jet of gas is made to burn in a box, the front of which is of glass on which is engraved a scale, while on the opposite side of the box is another scale corresponding, so that the point to which the top of the flame attains may be observed accurately. This instrument affords good comparative indications for gas made from the same materials at different times, but as the rate of efflux of gas from an aperture depends upon its specific gravity, it cannot be relied upon for the comparison of gases where the specific gravities differ materially.

Naturally enough, photometers are used chiefly in the determination of the illuminating power of substances used as artificial illuminants, principally coal-gas. The standard measure of luminous intensity is therefore a subject of great importance, and great difficulty has been experienced in fixing it. In acts of Parliament the light from sperm candles six to the pound, and consuming 120 grains per hour, has been assumed as the standard. An elaborate series of experiments was made on the standard candle in England in 1869, the results of which went to show that the average rate of consumption of sperm candles six to the pound was 135 grains per hour. (*Brit. Jour. of Gas-Lighting*, 1869, p. 390.) However, up to this time no change has been made in the requirements of the act. Differences in the manufacture of the candles make considerable differences in the rate of burning and the amount consumed per hour. The sperm in itself is too friable, and requires the addition of small amounts of wax to give it the requisite toughness. The mode of plaiting the wick and the materials of which it is composed also have considerable influence. (See Suggs's *Manual of Gas Manipulation*.) Candles entirely of wax have been found to give a very variable light compared with sperm. The use of paraffine has been proposed. Dr. Faulkland prefers a composition candle; Dr. Fyfe prefers wax. Some have used a mixture of 9 parts of hydrogen with 1 part of olefiant gas to give the standard light, but its use is attended with considerable inconvenience in many ways. Crookes (*Chem. News*, No. 450, p. 25) proposes a lamp with wick of platinum wires in which is burned a mixture of 5 volumes of alcohol of sp. gr. 0.805 and 1 volume of pure benzol boiling at 81° C., the wires to be 0.01 inch in diameter, and the liquid in the lamp to be kept at a constant level by a suitably-arranged apparatus. Hartley examined numerous standards proposed, and gave the preference to that of Keats, which is a moderator lamp of peculiar construction consuming 750 grains of sperm oil per hour. The light from this lamp is equal to that of ten standard candles. (*Journal of Gas-Lighting*, Mar. 16, 1869.) The standard used in France has been the light of a colza-oil lamp (Carcel) consuming 42 grammes = 648 grains per hour.

In testing the gas the style of burner and the rate at which the gas is burned are also important elements in the test. The French use an argand burner, called by them the *bec Bengel*, having thirty holes for the escape of the gas and provided with a chimney. All the dimensions of the burner are fixed by special statute. The English standard from 1852 to 1863 was an argand of metal with sixteen holes, the chimney seven inches in height, and the gas to be tested was to be consumed at the rate of 5 cubic feet per hour. From 1863 to 1869 another burner was used, which differed from the old one in that the gas was caused to burn at a lower pressure, and the burner, instead of metal, was of steatite. In 1869 another argand burner of improved form, invented by Sugg, with also a steatite burner, was adopted as the standard. In all cases the amount of gas and the pressure at which it should be passed through the meter was the same (5 feet per hour). A comparison of these three standards by Dr. Letheby resulted as follows: Calling the intensity of light from the old test-burner 100, that from the second standard burner, under the same conditions, was equivalent to 111.1, and that from the present standard to 128. A higher illuminating power is now required, however, than was formerly demanded, so that in effect the illuminating power of the gas is maintained at essentially the same point as at first. (*Engineering*, Nov. 12, 1869, p. 328.)

In photometrical experiments the operations are usually conducted in a room the walls of which are blackened to prevent as far as possible any reflections which would tend to affect the observations. Some few photometers are constructed with a view to dispensing with the so-called "dark room," but the results are considered more reliable when the observations have been made in an apartment prepared for the purpose by having the walls colored a dead black.

An apparatus for gas photometry usually consists of a bar carrying the Bunsen or Letheby disk, with the gas-fixture at one end and the place for the candles at the other, a balance and weights for weighing the candles before and after the operation, a meter recording thousandths of a foot, a seconds clock to time the experiment, and a pressure-gauge. Suggs's latest improvement is a combination "clock-meter," in which a hand moved by clock-work moves around the face of the meter, and if the gas is burning at the right rate, the clock-hand and meter-hand travel around the face of the meter together. Two candles instead of one are now frequently used, in the expectation that the irregularities of the one in burning will counteract those of the other. Readings are taken sometimes once and sometimes twice a minute for ten to fifteen minutes, and the results are averaged. If the candles or gas, one or both, have not been burning at exactly the prescribed rates, corrections are made by means of a simple proportion. If the gas-rate or candle-rate, however, varies very widely from the prescribed rates, but little reliance can be placed on the results. The temperature of the gas in the pipes has a marked effect on its illuminating power. (*Jour. Gas-Lighting*, Dec. 7, 1869, p. 930.) It is ordinarily tested, however, at ordinary temperatures, and no correction made for variations of the thermometer.

Illuminating Quality of Gas, etc.—The following table shows the illuminating quality of the gas consumed in various towns in Great Britain, as determined by Prof. Frankland in accordance with the government test:

London	12	candles.	Birmingham	15	candles.
Carlisle	16	"	Manchester	22	"
Liverpool	22	"	Inverness	25	"
Edinburgh	28	"	Glasgow	28	"
Greenock	28.5	"	Harwick	30	"
Paisley	30.3	"	Aberdeen	35	"

In Paris it is 12.3; Berlin, 15.5; and in Vienna only 9. In addition to the standard, as above, for London, which is for the common gas, there is one manufactured from cannel coal, the standard of which is never below 20

candles. This gas is used in the public buildings, the dwellings of the wealthy, etc. So far as ascertained, the illuminating power of gas in this country varies from twelve to eighteen candles, taking the English standard as a measure. E. WALLER.

Photo-Relief Printing. See PHOTOGRAPHY.

Phran'za, or **Phran'zes,** the last, and one of the most important, of the Byzantine historians, b. in 1401; was educated at the court of Constantinople; appointed chamberlain to Manuel II. Palæologus in 1418, and employed with success in many diplomatic missions. After the death of Manuel II., he attached himself to Constantine, the brother of the reigning emperor, John VII., and distinguished himself as a soldier. At the siege of Patras he saved the life of Constantine, but was taken prisoner himself and subjected to cruel sufferings in a Turkish dungeon. On the accession of Constantine Palæologus to the throne in 1448, he was promoted to the highest positions, but after the capture of Constantinople in 1453 he and his wife and two children were made slaves. He escaped with his wife to Sparta, but his daughter died and his son was murdered in the sultan's harem. From Sparta he fled to Corfu, was still active for some time in diplomatic negotiations, but retired finally to the monastery of Tarchaniotes, where he wrote his *Chronicon*, and d. after 1477. His *Chronicon* gives the history of the Byzantine empire from 1259 to 1477, and is interesting and reliable; it was not printed until 1796, when it was edited by Alter in Vienna.

Phrase, in music, a short series of sounds, not complete in itself, but ending with a pause or an imperfect cadence. (See RHYTHM.)

Phrenol'ogy [Gr. φρήν, "mind," and λόγος, "discourse"]. This term, properly signifying the science of faculty, in distinction from psychology, the science of the soul, was first applied by Gall and Spurzheim to a group of psychological theories arising partly from the discovery that the animal brain is a very complex congeries of organs, and partly from empirical observations as to the existence of a certain correspondence, or series of correspondences, between the configuration of the cranium and the special aptitudes exhibited by its possessor. During the progress of the group of doctrines designated as phrenological the main propositions of Lavater's system of physiognomy and the discoveries of Sir Charles Bell, developed in his work on the *Anatomy of Expression*, have been incorporated as elementary principles; so that phrenology may be regarded as a development, partly scientific and partly purely empirical, of the general idea that a minute correspondence exists between the physical structure and the psychical and mental traits of every individual man or animal. The special bias that gave direction to Dr. Gall's investigations was due, in the first instance, to empirical data, such as that the crania of artists are distinguished by swelling in the region of the temples, those of philosophical thinkers by great development in the upper frontal region, and those of accurate observers of facts by projection in the region of the eyebrows. He had prosecuted his observations in this field for several years before he hit upon the idea of hardening the brain in spirits of wine or by boiling it in oil in such a manner as to unfold its filamentous structure, and to give scientific value to his system by harmonizing it with cerebral anatomy. Previous to the celebrated dissections of Gall and Spurzheim, the principal idea of which was the expanding filamentous structure of the brain from below upward, that organ had been regarded by anatomists as a semi-structureless mass, exhibiting certain constant ganglia, such as the striated bodies, the optic thalami, the quadrigeminal bodies, and the pineal gland, but, on the whole, as a single organ rather than as a group of organs; and the method of dissection practiced in medical institutions was to examine it in successive slices from the vertex downward. Indeed, so extraordinary was the discovery of Gall in its bearings on the current theory of cerebral structure that it required several years and many verifications to convince professors of anatomy that the filamentous view was well founded; and the great developments in anatomical science, particularly as respects the nervous system, which have taken place during the last fifty years, must now be considered as due to the investigations of two men who have become widely celebrated as the founders of phrenology, but who have really high claims to be remembered as anatomical discoverers.

Gall's view of the physiology of the brain may be described as follows: The convolutions are distinct nervous centres, each having its special activity. As concerns the lobes, the frontal are occupied by the perceptive group of centres; the superior by the moral and æsthetic groups; the inferior by a group mainly concerned in the nutrition and adaptation of the animal to external conditions; the posterior by the social instincts; and the cerebellum is supposed to have the function of presiding over the procreative activity, of endowing it with passion and psychic significance, and thus lifting it within the sphere of sentiment and feeling. As concerns all these propositions, with the exception of the last, recent experiments in vivisection have verified their general accuracy; the most decisive evidences thus far recorded having been contributed by Dr. Ferrier of King's College, London, in 1872–73. Their general result may be stated as furnishing an experimental demonstration in detail that the convolutions are separate and distinct nervous centres in all animals in which they occur, and that these centres are arranged into groups and lobes substantially as Gall and Spurzheim taught; while in brains that have no convolutions corresponding sections of the cortex are still the seats of special activities, although the eye fails to distinguish their boundaries. Dr. Ferrier's experiments were conducted in the same general manner as the less conclusive ones of Fritsch and Hitzig of Germany—namely, by exposing the cortex of the brain and exciting it in sections with the induced electric current. The difficulty that physiologists have experienced in verifying experiments of this special class appears to be due to the fact that a very trifling loss of blood in preparing for the operation may impair the excitability of the cortex to such a degree that the current elicits no responsive movements.

On the other hand, as respects the function of the cerebellum, Gall's theory not only lacks confirmation, but the general tenor of experiment leads to the adverse view that that organ specially co-ordinates the muscular movements concerned in locomotion. A very thorough review of the evidences *pro et contra* will be found in Dr. Austin Flint's work on the *Nervous System*, which should be perused, however, with the reservation that the author's bias in favor of regarding the cerebellum as one of the great centres of motion is so decided as to impair, in a measure, the scientific value of his conclusions. Again, the evidences of comparative nervous anatomy appear, in so far as they bear upon the question, to be adverse to the phrenological view. But, taking all the facts into consideration, it cannot as yet be asserted that either theory is conclusively established. The truth seems to lie midway between the two extremes, and may probably be formulated as follows: The cerebellum co-ordinates the movements concerned in locomotion in a primary and instinctive manner, as vivisection experiments and comparative anatomy indicate; but as these movements are partly identical with those concerned in coition, it is also materially concerned in the sexual instinct, which, if the evidences of comparative anatomy are permitted to have their proper weight, must be regarded as having its special centre in the abdominal section of the spinal column, since the relative complexity under which the sexual instinct manifests itself in the different orders of animals is always in direct ratio to the relative development of gray matter in the inferior section of the spinal marrow. Another important point, developed by the patient anatomical studies of Wagner and Huschke, presents itself here in opposition to the doctrines of Gall, which assume that the building or constructive instinct in animals is contingent on a development of the brain giving great apparent breadth just in front of the ears. Their view is that the constructive instinct, as exhibited in the bee, is primarily due to the higher complexity of the sexual process that results from the more complex nervous development of the abdomen in that insect, as compared, for illustration, with the spider. In other terms, the wonderful constructive capacity displayed by certain animals is a response in faculty to the instinctive prompting to build a home for the protection of their young. This is the comparative-anatomy view of the question as interpreted by two of the ablest representatives of that science, and one that Dr. Jacoby of Berlin adopts as the basis of his volume on the *Evolution of Society*.

While, then, so far as respects the physiology of the brain, many of the leading positions of Gall and Spurzheim have been verified by later specialists, and have been absorbed into scientific psychology, the empirical parts of their work have remained without the pale of science. It is by the adoption and exposition of the latter that modern phrenologists are properly distinguished from cerebral psychologists as represented by Bain, Carpenter, Ferrier, Wagner, Huschke, and others. That is to say, phrenology superimposes upon certain established views of brain-physiology certain empirical doctrines, and groups them together under the general head of craniology, which, as a part of the system, rests upon the assumption that the relative development of the centres of the brain can be accurately determined by an external examination of the skull —by protuberances here as contrasted with depression in another quarter, and by other indications in their nature

unverifiable in any special instance without *post-mortem* examination, but having a certain degree of foundation in the general truths of physiology. It was this pretension of Gall and Spurzheim that led to the contemptuous rejection of their system in Germany, while its valuable results as respects brain-physiology were taken up by Wagner and Huschke and elaborated into the new science of psycho-physics. The same pretension debarred Spurzheim from popularity in England, led to his tour in America, and rendered this country the scene of the first real organization of phrenology into an intellectual movement. So that, while the science of psycho-physics in Germany and cerebral psychology in England are simply continuations of the inductive movement initiated by Gall and Spurzheim, it has been only in America that phrenology as such has obtained general currency or occasioned much discussion, and only here that it broadly assumes to delineate a man, mentally, morally, and psychically, with unerring precision, by examining his head, making a few measurements, and observing his special temperament. In the present state of science no serious discussion of this aspect of the subject can be attempted, since it rests purely upon empirical data, and in the hands of those who know it best and have practised it for years lays no claims to scientific exactness or to well-reasoned theory. That practised phrenologists are often quite correct in their descriptions of the inner life and the special aptitudes and biases of a person under examination, is generally conceded. That they are frequently in error, they themselves concede. The data being uncertain and general, such must be the conclusions. The cranium may be small, and yet, owing to the depth of the furrows, the cortex of the brain may be very large and ample. *Vice versâ*, a large skull, owing to the superficial nature of the furrows, may coexist with a very limited development of the thinking membrane (the cortex). In no aspect of anatomy, as every practical expert is well aware, is there a greater variation than exists between the dimensions of the skull and the development of the cerebral cortex. The thickness of the skull is also subject to considerable variation in different portions of its surface. These facts appear at first sight to militate very strongly against the assumption that the relative development of the cortex or the thickness of the skull can be determined, even proximately, by external examination; although, on the other hand, these variations themselves, upon which the uncertainty of practical phrenology depends, are subject to laws as yet but partly ascertained, that enable expert anatomists to predict with considerable certainty, in any given case, that the convolutions will be found deep or shallow, and the skull thick in certain quarters or the reverse, by superficial inspection of a subject submitted for dissection; and hence, though not yet formulated as science, a fundamental law of morphological development underlies the empirical observations of the craniologist. F. G. FAIRFIELD.

Phryg'ia [Gr. Φρυγία], an ancient, highly civilized, and flourishing kingdom, whose boundaries cannot be exactly determined, occupying the western central part of Asia Minor. The people (of Indo-European descent) were closely related both in race and history to the Bryges ("freemen") of Macedonia. But whether the original migration was from Asia to Europe, or from Europe to Asia, writers are not agreed. The alphabet of the inscriptions found in the valley of the Sangarius is much like the oldest specimens of the Greek. The national religion, at one time widely diffused, was a grossly naturalistic pantheism. The self-mutilated priests of Cybele, with their wild dances, were famous. The whole national character was highly enthusiastic and sensuous. The country was noted for its wool, its cheeses, and the excellence of its agriculture generally. Its great wealth is indicated by the fable of Midas turning everything that he touched into gold. The principal rivers were the Mæander and Sangarius; the principal cities were Apamea, Colossæ, Laodicæa, and Hierapolis. Phrygia was conquered by Crœsus of Lydia (558–544 B. C.), afterward by the Persians and Greeks, and, with the rest of Pergamum, fell into the hands of the Romans 133 B. C. The Roman province, however, was not identical with the ancient kingdom. Christianity was introduced by the apostle Paul. Papias the millenarian and Montanus the enthusiast were Phrygians.

R. D. HITCHCOCK.

Phryg'ian, in music, the name of one of the ancient ecclesiastical modes or scales. The Phrygian scale commences on E, and differs from the modern E minor in having for its second degree F♮, instead of F♯. The *cadence* commonly called Phrygian has already been described among other cadences in the article MUSIC.

Phry'ne, a Greek courtesan of surpassing beauty, was employed by Praxiteles as a model for his Cnidian Venus, and by Apelles for his Venus Anadyomene. She was b. at Thespiæ in Bœotia in humble circumstances, but when Alexander the Great destroyed the walls of Thebes she offered to rebuild them. When accused of profaning the Eleusinian mysteries, and summoned before the tribunal of the Heliasts, her defender threw off her veil, whereupon the judges immediately acquitted her, and the people carried her in triumph to the temple of Aphrodite.

Phryn'ichus, an Athenian poet who by ancient writers is ranked between Thespis and Æschylus as one of the founders of the Greek tragedy; gained his first tragic victory in 511 B. C., twenty-four years after Thespis and twelve years before Æschylus, and his last in 476 B. C., on which occasion Themistocles was his *choragus*, and recorded the event by an inscription. Of his personal life nothing more is known, though it is probable that he went to Sicily and died at the court of Hiero. The improvements for which the Greek tragedy was indebted to him were very considerable. The tragedies of Thespis were of a light and imitative character; those of Phrynichus were serious and imaginative. He took his materials from the poems of Homer, which had recently been collected by the care of Pisistratus; and when he chose to treat an event of contemporary history, it was always a sublime and impressive one. The character of his tragedies is strikingly indicated by the incident which Herodotus relates. He brought a tragedy on the stage representing the capture of Miletus, and the representation was so powerful that the whole audience burst into tears. But such a stirring up of their passions the Athenians would not allow to art, and they fined the poet 1000 drachmæ. It is self-evident that this transition from the ludicrous to the pathetic in the contents of the tragedy made corresponding modifications of the form necessary; and we find with the ancient writers many notices which indicate that with Phrynichus the light, mimetic choir of Thespis grew into the solemn, magnificent chorus which characterized the Greek tragedy when at its point of culmination. Of his works nothing has come down to us.

Phrynis'cidæ [*Phryniscus*, dim. of φρύνη, a "toad"], a family of anourous amphibians containing "toad-like frogs," for the most part confined to South America. As defined by Cope, it is distinguished by the absence of teeth on the jaws, the presence of epicoracoids, the distinction of sacrum from the coccygeal style, and the triangular diapophyses of the sacrum. By Cope seven genera have been referred to the family, one of which (*Calophrynus*) is represented in Borneo and China, and all the others are peculiar to South America. THEODORE GILL.

Phthalic Acid ($H_2C_8H_4O_4 = C_6H_4(COOH)_2$), **Alizaric Acid, Naphthalic Acid, Monocarbobenzoic Acid,** or **Dicarbobenzolic Acid,** a bibasic acid derived from benzene (C_6H_6) by the substitution of two carboxyl (COOH) for H_2. It is susceptible of three modifications, according to the relative position of two carboxyl-groups—(1) ortho-phthalic acid, or simply phthalic acid; (2) meta- or iso-phthalic acid is formed by the oxidation of meta-xylene or iso-xylene; (3) para- or terephthalic acid is produced by the oxidation of turpentine oil, cuminic acid or aldehyde, xylene, and other aromatic hydrocarbons. Phthalic acid (ortho-) is prepared by the action of nitric acid on alizarine, purpurine, munjistine, naphthalene, naphthalene dichloride, or naphthaquinone; by the action of manganese dioxide and sulphuric acid on naphthalene or benzene; of potassic dichromate and sulphuric acid on naphthalene; of chlorous acid on naphthalene; of potassic chlorate and hydrochloric acid on naphthalene dichloride; of potassic permanganate on an alkaline solution of orthotoluic acid. It crystallizes in white nacreous laminæ arranged in rounded groups; is slightly soluble in cold water, readily soluble in alcohol and ether. By distillation with an excess of lime it yields benzene and calcic carbonate; with a smaller proportion of lime, calcic carbonate and benzoate. This reaction is now employed on a large scale by P. and E. Depouilly (*Bull. Soc. Chim.*, 1864, i. 163) for the preparation of benzoic acid. It forms acid and neutral salts, and yields substitution products with bromine, chlorine, nitric acid, etc. By distillation it yields its anhydride, $C_8H_4O_3$, called also phthalide, and pyrophthalic acid. When phthalic anhydride is heated to 195° C. with resorcine, obtained by action of caustic alkalies on assafœtida, certain other gum-resins, or benzinodisulphuric acid from benzene, it produces fluoresceine, which crystallizes from alcohol in brown crusts. Fluoresceine heated with zinc-dust yields colorless fluoresceine. When fluoresceine is heated with strong sulphuric acid, it produces a red body, which gives with alkalies a blue solution. The red solution dyes wool blue; the color is not so fine nor so fast as indigo. Fluoresceine forms a red crystalline powder; crystallizes in yellow needles from methylic alcohol; and its ammonia solution exhibits a most beau-

tiful and intensely green fluorescence. It is $C_{20}H_{12}O_5 = C_6H_4(CO.C_6H_3.OH)_2O$. Nitric acid converts it into tetra-nitro-fluoresceine, an explosive body, which dyes wool an intense reddish-yellow. Fluoresceine has become of great industrial importance as a basis for the preparation of the new and beautiful dye called *eosine*, which rivals safflower and saffronine for dyeing rose-red. Eosine is the potassic salt of tetra-brom fluoresceine. (See papers on fluoresceine by A. Baeyer (*Ber. Chem. Ges.*, Berlin, iv. 658); E. Fischer (*Ber. Chem. Ges.*, vii. 1211, 2116); on eosine, Guehm (*Ber. Chem. Ges.*, vii. 1743); A. W. Hofmann (*Ber. Chem. Ges.*, viii. 62); A. Baeyer (*Ber. Chem. Ges.*, viii. 146); Bindschedler and Busch (*Chem. News*, xxxii. 198); Reimann's *Färber Zeit* (1875).) C. F. CHANDLER.

Phthisis. See CONSUMPTION.

Phycol′ogy [from φῦκος, a "seaweed," and λόγος, a "discourse"] is the name applied to that department of botany which treats of the Phycæ, or Algæ, as they are more frequently called. Algæ may be defined as thallogens, or flowerless plants having no proper distinction of stem and leaf; which always grow in water or very wet places; which have green coloring-matter; and which are never truly parasitic. This definition, it will be observed, is a little vague, and it is probable that before long the term "Algæ" will fall into disuse; at present it is still retained by the majority of writers, inasmuch as it is convenient, although not well defined scientifically. The Algæ constitute a large group of plants, although not by any means so rich in species as the Fungi. They are most abundant in the ocean, of which, with very few exceptions, they form the entire vegetation, and are generally known under the name of seaweed, sea-moss, etc. They are also very abundant in fresh water, where, however, they by no means present so striking or varied forms as in the ocean, but are generally composed of green thread-like structures of a more or less slimy consistency. In size, shape, and color Algæ vary exceedingly. Some are no larger than dust, and consist of a single cell. (Some of the more interesting of these simple forms are described in the article on DIATOMACEÆ.) From small species consisting of a single cell there is a regular series of forms until we reach the gigantic species found in the Antarctic and Pacific oceans, which excel all land-plants in length, if not in size. *Macrocystis pyrifera* attains a length of 1000, and some writers even say of 1500, feet; and the very slender stems of *Nereocystis Lütkeana* are not unfrequently 200 feet long, and are used by the Indians of the North-west coast for fish-lines. Some species of *Lessonia* and *Durvillæa* also attain enormous dimensions, but the majority of Algæ are but a few inches long, and are either thread-like or form small membranous expansions.

The substance of the Algæ varies from that of a jelly to that of stone. Many of the fresh-water Algæ are mere masses of jelly, and some, as the *Nostocs*, swell up into more or less shapeless masses after a rain, and afterward dry up into almost imperceptible crusts. Some of the devil's aprons, particularly *Laminaria dermatodea*, are coriaceous, and many species, found more especially in the tropics, are covered or infiltrated with a calcareous deposit. The coating of the diatomes is silicious.

The Algæ vary in color from almost black to a beautiful rose-color. The color depends to a great extent on the position in which any species grows, but it is so constant in different species that it has been used as a means of classification by some writers. Nearly all fresh-water Algæ are green, the *Nostochineæ* being slightly tinged with blue. The red or purple Algæ are almost all marine, and grow at or below low-water mark. The brown-colored Algæ are marine, and are found principally in what is known as the littoral region, or the tract between high and low tide marks. All Algæ, whether green, brown, or red, contain a certain amount of chlorophyl, although in the red and brown seaweeds the chlorophyl is obscured by the presence of one or more red and yellow coloring-matters, to which various names have been given by chemists, and of which the two most common forms are phycoxanthine and phycoerythrine. Some species of seaweeds are beautifully fluorescent. A familiar example is the common Irish moss, *Chondrus crispus*. Fluorescence is very marked in some Mediterranean species, as *Chylocladia Mediterranea*, and some species of *Cystoseira*.

As has been said, the Algæ are never parasitic, although frequently epiphytic. They fasten themselves by suckers or fibrils to stones, woodwork, or other Algæ, or form floating patches of variable extent. Some are furnished with bladders, which help them to float. Although they absorb their nourishment directly from the water about them, they are prone to decay when torn from their attachments. They all contain large quantities of water, and when dried they shrink very much, and are afterward easily affected by changes of moisture. Many of the seaweeds contain iodine in considerable quantities, and some species, as *Laminaria saccharina*, contain mannite, which covers the surface of the Algæ as it dries.

The species of Algæ are widely distributed, many fresh-water species, as well as some marine, being found all over the world. Species which inhabit brackish water seem to be particularly widely distributed. The marine species, if we except the diatomes, seem to be all limited to a rather narrow belt extending along the shore, while the ocean-bed is, as far as seaweeds are concerned, a desert. The Sargasso Sea, as it is called, consists simply of an immense floating mass of the Gulf-weed (*Sargassum bacciferum*), which covers an area of many miles—according to Humboldt six or seven times as large as the area of Germany—lying W. of the Azores. The greatest depth at which Algæ grow cannot be ascertained with exactness, but we have good reason to believe that few seaweeds occur below 70 or 80 fathoms, and even the enormously long species do not grow very deep, but expand over the surface. Strange to say, the deepest-growing species are generally of the brightest rose or purple color. The greatest number of species is found in the tropics, but the luxuriance of the marine vegetation is probably greater in those temperate regions where there is a great rise and fall of the tide. The forms of Europe and the E. coast of North America closely resemble one another. The species of Australia are very numerous and beautiful, and, as in the case of the flowering plants, offer many types not found elsewhere. The seaweeds have usually a definite season of growth and fruiting, and grow quite as well in winter as in summer. Some species, as *Ceramium rubrum*, seem to flourish at all seasons, but most are limited either to summer or winter, or at least fruit at a definite period of the year.

Of the Algæ growing in fresh water there is no species directly useful to man. Of the seaweeds there are several edible species, although, as far as taste is concerned, they all resemble one another. The Irish moss of commerce is the common *Chondrus crispus* of Europe and Eastern North America. In the East Indies, *Gracilaria lichenoides* is much eaten, and the Chinese are particularly fond of laver, *Porphyra vulgaris*. *Schizymenia edulis*, *Rodymenia palmata*, the common dulse, and *Alaria esculenta*, are also eaten. The larger seaweeds, rock-weeds, devil's aprons, etc., are used extensively for manure and also for the manufacture of iodine.

The classification of Algæ is of too complicated a nature to admit a full explanation in these pages. The father of modern phycology was C. A. Agardh, bishop of Carlstad, Sweden, whose *Species Algarum* appeared in 1821. Previous to his time it was the custom to call all the larger Algæ, Fuci, and all the smaller, thread-like species, Confervæ. The science was further extended by his son, J. G. Agardh, professor at Lund, who published his *Algæ Maris Mediterranei et Adriatici* in 1842, and more recently his *Species Algarum* in two parts—the most extensive systematic work on sea-weeds yet published. It, however, does not include fresh-water species or the green marine species. Since the publication of J. G. Agardh's *Species Algarum* our knowledge of the nature and development of Algæ has been much increased by the observations of Naegeli, Pringsheim, Derbes, Solier, but more especially by the researches of Thuret and Bornet. The results of their studies will be found scattered through various publications, but there is no good summary of the modern state of phycology. Among the older systematic writers on Algæ may be mentioned Lyngbye, whose classic *Tentamen Hydrophytologiæ Danicæ* appeared in 1819, and compared favorably with Agardh's work; and Dawson Turner, whose work in 4 vols., entitled *Historia Fucorum*, was superbly illustrated by Sir W. J. Hooper. More recently numerous illustrated works have been published by Greville, Kützing, Harvey, Zanardini, Rabenhorst, and others. (For an account of the marine species of the U. S. the reader is referred to the *Nereis Am. Bor.*, by Prof. W. H. Harvey, published in three parts by the Smithsonian Institution. An account of the fresh-water species will be found in a monograph by Prof. H. C. Wood, also published by the Smithsonian Institution. For illustrations of many of our common marine species the reader is referred to the *Phycologia Britannica* of Prof. W. H. Harvey.) Harvey divided all Algæ into three groups: (1) Melanospermæ, including all that were of an olive-brown color, as Gulf-weeds, rock-weeds, devil's aprons, etc.; (2) Rhodospermæ, including all red and purple Algæ; (3) Chlorospermæ, including all those of a green color, which comprise nearly all fresh-water species. (For a detailed explanation of Harvey's system the reader is referred to the introduction of the *Nereis Am. Bor.*, above referred to.) A partial summary of Thuret's system is given in the *Liste des Algues marines*

de Cherbourg, by A. le Jolis. More detailed accounts of the orders are given in the *Annales des Sciences naturelles*, 3me Série, tome iv.; 4me Série, tome iii.; 5me Série, tome iv. W. G. FARLOW.

Phylac'teries [Gr. φυλακτήριον, a "guard," a "charm"], properly, amulets worn to protect the person from evil influences. In the New Testament the name is given to the leathern cases containing on fine parchment certain passages of Scripture. They are fastened by leathern straps to the forehead and the arm, and also to doorposts and the like. This custom has been maintained from very ancient times to the present day by the Jews.

Phylæ [Gr. φυλή, a "tribe"] designated the tribes into which ancient Attica was divided. Their number was originally four, but after the expulsion of the Pisistratidæ it was raised to ten by Cleisthenes; two more were afterward added in honor of Antigonus and his son Demetrius. At the head of each tribe was a phylarch, who superintended the registering of the members of the *phyle*, organized the choirs for the festivals, presided over the communal assemblies, and commanded the contingent of cavalry. Afterward, however, the office was divided, the phylarch retaining only the military duties, while the civil duties were transferred to a new office, that of the epimeletes. To the Athenian senate each phyle sent 50 members. (See Kutorga, *Essai sur l'Organisation de la Tribu dans l'Antiquité* (1839), and Haase, *Die athenische Stammverfassung* (1857).)

Phylar'chus, a Greek historical writer, b. at Naucratis in Egypt, lived chiefly in Athens, and was a contemporary of Aratus. He wrote several historical works, of which the principal one was a history, not only of Greece, but also of Macedonia, Egypt, Cyrene, etc., from the expedition of Pyrrhus to Peloponnesus, in 272 B. C., to the death of Cleomenes in 220 B. C. Of this, as well as of his other works, there exist only a few fragments, but he has been severely blamed by Polybius for being partial to Cleomenes. (See Lucht, *Phylarchi Historiarum Fragmenta* (Leipsic, 1836).)

Phyllostom'idæ [*Phyllostoma*, φύλλον, "leaf," and στόμα, "mouth"], a family of bats, so named from the leaf-like appendages with which the nasal region is furnished. The ears are moderately large, and each has a distinct tragus; "nostrils in the front part of the cutaneous nasal appendages, or opening by simple apertures at the extremity of the muzzle;" the tail perforates the interfemoral membrane, and appears on the upper surface, or is produced considerably beyond the membrane when the latter is truncated; the intermaxillary bones are entire and contiguous; the true molars developed; upper incisors four; the middle digit of the wing has three phalanges; the stomach is sacciform, and its extremities curved toward each other. The family is limited to America, and as here limited has still numerous representatives, which are distributed by recent authors (Peters and Dobson) among three sub-families, which may be called Phyllostominæ, Glossophaginæ, and Stenoderminæ. These are distinguished from each other by the condition of the outer side of the molars, the tongue, the lower lip, and the muzzle. One species (*Macrotus Californicus*) extends into the south-western portions of the U. S. THEODORE GILL.

Phyllotaxy. See BOTANY, by PROF. A. GRAY, LL.D.

Phyllox'era [from φύλλον, a "leaf," and ξηρός, "parched"]. This name was first proposed in the year 1834 by a French entomologist, Fonscolombe, for a genus of plant-lice, the type being *Phylloxera quercus*, a species found in Europe on the under side of oak-leaves, to which its punctures give a parched or withered appearance. Though first characterized in Europe, North America seems to be the home of the genus; for while there are but two well-defined species so far known as indigenous to Europe, sixteen distinct species have already been described from the U. S. These are—

1. *P. vastatrix* Planchon. Forming galls on the leaves and swellings on the roots of *Vitis*. Introduced into Europe, and well known as the grape phylloxera.
2. *P. Rileyi* Lichtn. Living on the under side of the leaves and hibernating on the stems of *Quercus alba*, *obtusiloba*, and *bicolor*.
3. *P. Caryæ-foliæ* Fitch. Forming conical galls, which open at the summit, on the upper side of the leaves of *Carya alba*.
4. *P. Caryæ-caulis* (Fitch). Forming elongate, rather irregular, but generally ellipsoid, smooth, green swellings of large size on the petiole of the leaf of *Carya glabra* and *amara*; the gall subsequently cracking open and becoming black and contracted.
5. *P. Caryæ-venæ* (Fitch). Forming plaits in the veins of the leaves of *Carya alba*, which plaits project up from the surface in an abruptly elevated keel upon the upper surface of the leaf, and with a mouth opening on the under side, the lips of which are woolly.
6. *P. Caryæ-semen* (Walsh). Forming fuscous, minute, subglobular, seed-like galls on leaves of *Carya glabra*, the galls opening in a small nipple on the under side.
7. *P. Caryæ-globuli* Walsh. Forming hemispherical galls about 0.25 inch diameter on the upper surface of the leaves of *Carya glabra* and *alba*, the galls rather flat below, where they open in a slit.
8. *P. spinosa* (Shimer). Forming large, irregular galls, covered with spines, on the petiole of the leaf of *Carya amara*, the galls opening beneath in an irregular, sinuate slit.
9. *P. Caryæ-septa* (Shimer). Forming flattened galls with a septum, on the leaves of *Carya alba*, the galls opening both above and below.
10. *P. forcata* (Shimer). Forming galls much like those of No. 6, but larger.
11. *P. depressa* (Shimer). Forming depressed galls on leaves of *Caryæ alba*, the gall opening below with a constricted mouth fringed with filaments.
12. *P. conica* (Shimer). Forming galls similar to No. 11, but without the fringe. Probably the same.
13. *P. castaneæ* (Haldeman).
14. *P. Caryæ-gummosa* Riley. Forming pedunculated, ovoid, or globular galls on the under side of the leaves of *Carya alba*; the gall white, pubescent, and gummy or sticky, and opening below in a fibrous point.
15. *P. Caryæ-ren* Riley. Forming numerous, more or less confluent, mostly reniform galls on the petiole of leaf and stems of *Carya glabra*; the galls varying from 0.2 to 0.7 inch in diameter, pale green and densely pubescent, and opening in a slit the whole of their length, transversely with the axis of the petiole.
16. *P. Caryæ-fallax* Riley. Forming conical galls thickly crowded on the upper surface of the leaves of *Carya alba*. Strongly resembling No. 3 (*Caryæ-foliæ*), but the height one-third greater than the basal diameter, and opening below, instead of above, in a circular fuzzy mouth.

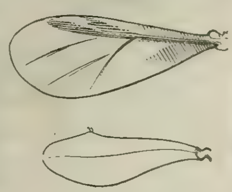
From the foregoing synopsis it is manifest that the habit of the genus is essentially gall-inhabiting. It is structurally distinguished from the other genera of the Aphididæ, principally by the three-jointed antennæ (the third joint much the longest), by the simple venation of the wings, and by these being carried flat on the back, and not roof-fashion, as in the more typical Aphides. The genus is interesting to the entomologist as occupying an osculant position between the plant-lice and the more degraded bark-lice (Coccidæ), though agreeing with the former in all the more important characters.

For a long time the term *Phylloxera* was known and of interest only to the naturalist; but during the past six or seven years the grape Phylloxera, or *Phylloxera vastatrix* Planchon, a species which injuriously affects the grapevine, has attracted so much attention, particularly in North America and parts of Europe, that it has come to be known as *the* Phylloxera. This insect, while it occasionally acquires the gall-making habit so characteristic of the genus, normally dwells underground upon the roots of its food-plant. Indigenous to that portion of North America lying E. of the Rocky Mountains, it is found from Canada to the Gulf wherever the grapevine grows, and has doubtless existed on our wild vines from time immemorial. Early in the history of grape-culture in the U. S. the gall-making type was observed on the leaves of certain varieties, and more especially on the Clinton; and in 1856 this type was briefly described by Dr. Asa Fitch, State entomologist of New York, by the name of *Pemphigus vitifoliæ*. The more normal root-inhabiting type was not suspected, however, till discovered by the writer in 1871. Meanwhile, about the year 1865 a peculiar grape-root disease began to attract attention in France, where the grape interest is of such vast importance that anything which affects it is sure to receive particular attention. Time passed, and the disease, which was at first confined to a few restricted localities, extended in augmenting ratio, and attracted more and more attention until the grape interest was so threatened that the minister of agriculture offered a premium of 60,000 francs for a remedy; and this sum two years ago was increased to 300,000 francs. The study and investigation which this premium and the importance of the subject induced soon brought to light the facts that the insect producing the disease is identical with that which is indigenous on American vines, and that it was imported into France from America, probably during our civil war, and on our vines sent to French nurserymen. First noticed in the lower valley of the Rhone upon the plateau of Pujault, in the department of Gard, it had in 1866 already spread to several localities in the department of Bouches-du-Rhône. In 1868 it extended along the whole of the left bank of that river, and in 1869 it invaded the departments of Var and Hérault. Since then it has continued to spread, and has now obtained a foothold in restricted localities in Spain, Portugal, Switzerland, Austria, and Prussia, widening its area not only by natural means, but by commerce in vines and cuttings, on which it is carried from infested to non-infested districts.

Natural History of the Insect.—The species, as already intimated, presents itself in two types—the one (*gallicola*) gall-inhabiting, the other (*radicicola*) root-inhabiting. The former is easily distinguished from the latter (see ac-

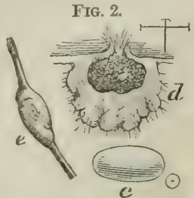
companying figures) by lacking the tubercles or warts on the back. On carefully opening one of the galls we find the mother-louse diligently at work surrounding herself with pale-yellow eggs, scarcely (.01) the one-hundredth part of an inch long, and not quite half as thick. She is about .04 inch long, of a dull orange color, and looks not unlike an immature seed of the common purslane. The eggs begin to hatch when six or eight days old into active little beings, which differ from their mother in their brighter yellow color and more perfect legs. Issuing from the mouth of the gall, these young lice scatter over the vine, most of them finding their way to the tender terminal leaves. Here they commence pumping up and appropriating the sap, forming galls and depositing eggs, as their immediate parent had done before. This process continues during the summer until the fifth or sixth generation. Every egg brings forth a fertile female, which soon becomes wonderfully prolific. By the end of September the galls are mostly deserted, and those which are left are usually infected with mildew, and eventually turn brown and decay. The young lice attach themselves to the roots, and thus hibernate. It is an important fact that the gall-inhabiting insect occurs only as an agamic and apterous female form. It is but a transient summer state, not at all essential to the perpetuation of the species, and does, compared to the other or root-inhabiting type, but trifling damage. It flourishes only on the *Riparia*, and more especially on the Clinton and Taylor. A few of its galls have been noticed on some other varieties, and abortive attempts are often made to found them on others. In some seasons it is even difficult to find a few galls on the very vines on which they were very abundant the year before.

FIG. 1.



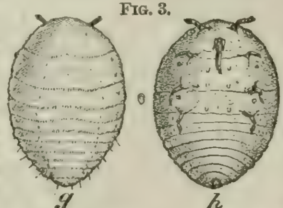
Upper and under wings of Phylloxera.

FIG. 2.



c, egg; *d*. section of gall, showing mother-louse and eggs; *e*, swelling of tendril; dot and lines showing natural size.

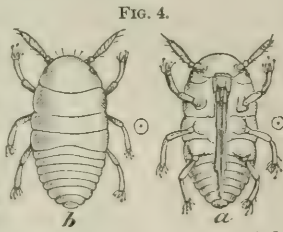
FIG. 3.



Mother gall-louse: *g*, dorsal; *h*, ventral view; natural size indicated between them.

The more normal or root-inhabiting type presents many more forms and many interesting biological traits. The newly-hatched lice are precisely like those which hatch in the galls, but, as they develop, rows of tubercles appear on the back where only minute short hairs were observed before (Fig. 5). During winter these young are found, somewhat dulled in color, adhering closely to the roots. As vegetation starts in spring they become active, rapidly enlarge, and soon commence laying unimpregnated eggs, for there are at that time no males. These bring forth females, which in their turn develop and lay unimpregnated eggs; and this virginal reproduction continues for five or six generations, the development increasing in rapidity with the heat, but the prolificacy or the number of eggs laid decreasing. In July some of the individuals show little wing-pads at the sides, and begin to issue from the ground and to acquire wings. These winged individuals become very numerous in August, and continue to appear in diminishing numbers thereafter till the leaves have all fallen. They are all females, and carry in the abdomen from three to eight eggs of two sizes, the larger ones about $\frac{2}{100}$ths of an inch long, and half as wide; the smaller, three-fourths as long. These eggs are also unimpregnated, and are laid by preference on the under side of the more tender leaves, attached by one end amid the natural down. They increase somewhat in size, and give birth in about ten days to the true sexual individuals, the larger producing females, the smaller males. Anomalous as it may seem, these individuals are born perfect, though without mouth and with no other than the reproductive function. A most remarkable fact, discovered by Balbiani, is, that some of the females that never acquire wings, but always remain on the roots, also produce the few different-sized eggs from which these true, mouthless males and females hatch. The sexes pair soon after hatching, and the female is delivered

FIG. 4.



Newly-hatched larva: *a*, ventral; *b*, dorsal view; natural sizes in circles at sides.

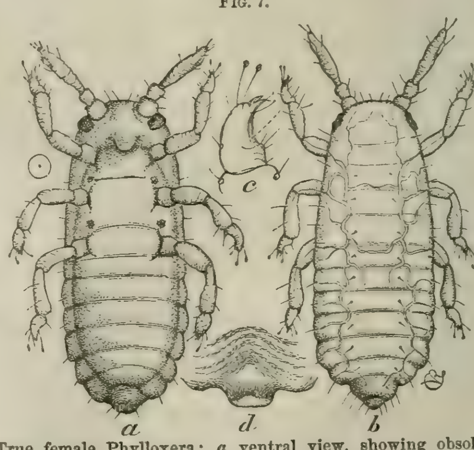
FIG. 5.

Wingless mother root-lice: *f*, dorsal; *g*, lateral view; natural size indicated at side.

FIG. 6.

a, healthy root; *b*, root on which the lice are working, showing the knots and swellings caused by their punctures; *c*, root deserted by them, on which the rootlets have begun to decay; *d d d*, lice on the larger roots, natural size; *e*, female pupa, dorsal view; *f*, winged female, dorsal view, greatly enlarged.

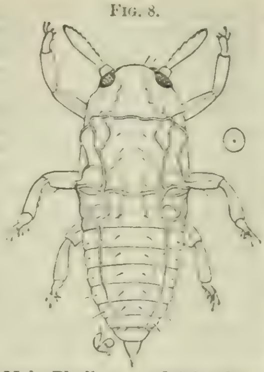
FIG. 7.



True female Phylloxera: *a*, ventral view, showing obsolete mouth and solitary egg occupying nearly the entire body; *b*, dorsal view; *c*, tarsus; *d*, contracted anal joints after the egg is laid; dot in circle showing natural size.

on the third or fourth day of a solitary egg, and then perishes. This impregnated egg is somewhat more ellipsoidal than the others, and soon becomes olivaceous. It is within a few millimètres as long as the egg was when first laid from which the true, mouthless female originally came. This egg is never laid on the leaf, but always on the wood, either under the bark or in sheltered situations above ground, or on the roots underground. The young hatching from it is the normal agamous mother, which, with increased vigor and fertility, lays a large number of eggs, and recommences the virginal reproduction and the cycle of the species' curious life. The impregnated eggs laid early in the season doubtless hatch the same year, though some of the later-deposited ones may pass the winter before hatching.

FIG. 8.



Male Phylloxera: dot in circle showing natural size.

To recapitulate, the insect presents itself in the following distinct forms, exclusive of slight variation to which some of these forms are subject:

1. The gall-inhabiting type (*gallicola*), forming galls on the leaves, and presenting—
   - *a*, The ordinary egg (Fig. 2, *c*), with which the gall is crowded;
     - *b*, The ordinary larva (Fig. 4);
       - *c*, The swollen parthenogenetic mother, without tubercles (Fig. 3).
2. The root-inhabiting type (*radicicola*), forming knots on the roots, and presenting—
   - *aa*, The ordinary egg, differing in nothing from *a*, except in its slightly larger average size;
     - *bb*, The ordinary larva, also differing in no respect from *b*;
       - *d*, The parthenogenetic, wingless mother, the analogue of *c*, but covered with tubercles (Fig. 5);
       - *e*, The more oval form, destined to become winged;
       - *f*, The pupa (Fig. 6, *e*);
       - *g*, The winged, parthenogenetic female (Fig. 6, *g*).
   - *h*, The sexual egg deposited by *g*, being of two sizes, and giving birth to the true males and females;
     - *i*, The male (Fig. 7);
     - *j*, The true female (Fig. 8);
   - *k*, The solitary impregnated egg deposited by *j*;
     - *bbb*, The larva hatched from *k*, which, so far as known, does not differ from the ordinary larva, except in its greater prolificacy;
     - *l*, The hibernating larva, which differs only from *b* in being rougher and darker.

Appearance of the Phylloxera Disease.—A vine attacked by Phylloxera has the more fibrous roots covered with little nodosities or swellings; and a careful examination of the swellings during the growing season will disclose numerous yellowish lice of different ages, and groups of brighter yellow eggs barely visible to the naked eye. The swellings in course of time rot, and the lice settle on to the larger roots. Vines that are more susceptible to the disease generally show external signs the second year of attack in a sickly, yellowish appearance of the foliage and in stunted growth; while the third year they frequently perish, when on examination the lice are no longer to be found—they have left or died—and all the finer roots have decayed and wasted away.

Spread of the Disease.—The wingless Phylloxera travels over the surface of the ground from vine to vine, or beneath the ground where roots interlock; while in the winged form it may fly or be carried as many as 15 or 20 miles, and, under exceptional conditions, even more. Through man's agency, by commerce in plants and cuttings, it may be carried to indefinite distances. Hence the importance of precautionary measures in grape-producing countries still free from the scourge, and the wisdom of laws—such as have been enacted by Australia, Algiers, Italy, Germany, and other countries—prohibiting the importation of vines from infested regions. The writer drew attention in 1872 to the danger which threatened the grape interest of California from the possible introduction of the pest. Active preventive measures then adopted by the State might have avoided a calamity which now threatens the grape-growers of the Pacific slope; for the insect has been introduced, and is now making headway and causing much alarm.

The Disease more virulent in Foreign Countries than where it is indigenous.—A certain harmony or mutual adaptation exists between the autochthonous fauna and flora of a country, the result of a long-past "struggle for existence," as Darwin has so forcibly put it. Plants and animals suffer most from diseases which they have not been accustomed to. American vines, though showing a varying power of resistance to the attacks of Phylloxera, are less susceptible than the European vine, which has been so long under cultivation and which is more highly developed and more tender. The disease spreads more rapidly also in countries where the grapevine is grown to the exclusion of almost every other plant; for the winged females can scarcely fail to settle where their offspring may live and thrive. In countries, on the contrary, where vineyards are few and far between, hosts of these winged mothers get wafted away and settle on to vegetation where their offspring must needs come to naught, as the species is incapable of living on anything but the grapevine.

Practical Considerations.—Of the many remedies that have been proposed, none are universally practicable or satisfactory. Such an underground enemy is measurably beyond man's reach. Submersion, where feasible, is a sufficient protection. Coal-tar and sulpho-carbonate of potassium have given some satisfaction, but the limits of this article will not permit a proper consideration of the multifarious remedies that have been proposed. The literature of the subject is very extensive, and the American reader desiring further information may consult the *Missouri Entomological Reports* from 1870, on. Having discovered that our cultivated American vines possessed a varying degree of resistance to the disease, the writer recommended the least susceptible to be used in the French vineyards as stocks on which to graft their own vines. In consequence, there has been an increasing demand for cuttings of such American vines, until the present year the demand has exceeded the supply. The varieties most employed are Clinton, Taylor, Concord, and those more particularly belonging to the species *æstivalis*, as Cunningham, Norton's Virginia, Herbemont, Cynthiana, etc. All other remedies are being abandoned in France, and by means of the American vines there is hope of restoring the blighted vineyards. America unwittingly gave the disease to that country: she also gives the remedy. The French have already learned to appreciate our vines, that had before been ignored or despised by them; and the experience, science, and system of Europe which will be brought to bear on the improvement of these American vines and the manufacture of their wine are already redounding to the good of American grape-culture, and must inevitably enure to its great advantage and stimulate its development. C. V. RILEY.

Physalis [Gr. φυσαλίς, a "bladder"], a genus of annual or perennial herb of the family Solanaceæ or nightshades, embracing above fifty species, several of which are found in the U. S. The *P. Peruviana*, otherwise known as strawberry tomato, ground cherry, winter cherry, yellow alkekengi or Cape gooseberry, is cultivated in gardens in England, France, and the U. S., and bears an edible fruit enclosed in a balloon-shaped netted angular calyx. The *P. alkekengi*, probably a native of Spain or N. Africa, bears a brilliant scarlet berry, and is an ornamental garden-plant. An American species, *P. Philadelphica*, or purple alkekengi, has a dark-purple berry an inch in diameter, which is sometimes preserved.

Physeter'idæ [Gr. φυσητήρ, a "blowpipe or bellows"], a family of toothed whales (*Cete, Denticete*), including the gigantic sperm whales and small porpoise-like forms agreeing in anatomical characters. They vary in form as well as in size, the head being in the sperm whales disproportionately large and blunt in front, and with a subterminal blowhole, and in the small species small and conical, and with a more posterior blowhole; the snout, however, always projects forward, and the mouth is consequently inferior; the cervical vertebræ are all ankylosed together in the sperm whales, and differentiated into an atlas and posterior coalesced six vertebræ in the smaller species; the hinder ribs lose their tubercles, and are only connected by their heads with the transverse processes of the vertebræ; the costal cartilages which connect the ribs with the sternum retain more or less of their original cartilaginous condition; the skull has the bones upraised toward the periphery, so as to form a more or less retrorsely convex margin; the nares, the supraoccipital, and parietals together extend forward on the sides, and present a convex border projecting forward high above the temporal fossæ and forward beyond the vertex; the frontal bones have an extended surface deflected downward and produced upward, exposing to view a triangular or retrorsely falciform wedge between the maxillaries and supraoccipital; the nasal bones are very disproportionately developed relatively to each other, the left being very much reduced, and the right greatly enlarged and twisted to the left side; the jugal is well developed and projects downward or backward; the orbit is small or of moderate size; the pterygoid bones are thick, produced forward, and enter largely into the bony roof of the mouth over and behind the palatine bones, not contig-

uous at the middle; they have low ridges on the oral surface, which diverge more or less outward and backward, and the sides are involuted so as to form the outer wall of the postpalatine air-sinus; the lower jaw has its rami connected by a more or less elongated symphysis; teeth are functionally developed only or chiefly in the lower jaw. By these characters the forms of the family, which differ so much in external appearance, are combined together and distinguishable from all others. The family naturally falls into two sub-families: (1) Physeterinæ, including the gigantic species; and (2) Koginæ, including the pigmy forms. The former are at once recognizable by their enormous truncated head, while the latter have a superficial resemblance to the porpoises, and are distinguishable by the projecting snout. Of the sperm whales only one species is certainly known, the *Physeter macrocephalus*, which extends into almost all seas; of the Koginæ, five species have been based upon forms found in the Australian seas, on the coast of the Madras presidency, and that of California. (See also SPERM WHALE.) THEODORE GILL.

Physical Education. See FENCING and GYMNASTICS.

Physical Geography, or **the Geography of Nature.** See GEOGRAPHY, by PROF. A. GUYOT, LL.D.

Physi′cian [Fr. *physicien*], one whose vocation is the alleviation and cure of disease by therapeutic agencies. In its broad acceptation it includes the surgeon who conducts any surgical operation or treatment essential to life or comfort—the healing of wounds, correction of deformities, removal of tumors and unnatural growths, the amputation of injured or diseased members. Although surgery has as its chief requirements accurate anatomical knowledge and precision and nerve in operations, surgical diseases and conditions are often secondary or associated with constitutional disease, and the surgeon must also possess knowledge and judgment in the broad field of medicine. The medical knowledge of the physician has had many transitions—beginning with ignorance, traditions, superstitions, religious rites; later acquiring a value by the accumulation of facts established by experience; and in modern times replacing mere empiricism by rational and scientific practice, founded upon correct anatomy, physiology, and pathology, and the careful study of causes and symptoms of disease, and their early diagnosis. The physicians of remote antiquity were deemed superhuman. In Egypt the first physicians were deities—Isis and Horus her son, Taaut (the Hermes of the Greeks), and Serapis, to whom temples were dedicated by Egyptians and Greeks. Later, the Alexandrian school of priest-physicians had many learned and skilful men, especially Herophilus the anatomist. In Greece, Æsculapius was deified, and in temples dedicated to him the healing art was long exercised by an exclusive order of physicians, the Asclepiadæ, who were sworn by Apollo, Æsculapius, Hygieia, Panacea, and all the gods not to profane the mysteries of medicine, and to divulge them only to the children of their masters or those bound to them by oath. This order was replaced by the Pythagorean physicians, who were philosophers, and freely divulged and explained their views of health and disease. Hippocrates (460–370 B. C.) studied and described disease, and treated it with great success. Rome first had only Greek physicians—at first the keepers of baths and sanitariums, later a few philosophers but little in favor. The Roman legions were attended by surgeons. Asclepiades, Celsus, and Galen were eminent—the first for dietetic treatment, the second as scholar and surgeon, the third as physician and writer on medicine. The knowledge of the ancients was preserved chiefly by the Arabian and Saracen physicians of Spain; they were careful observers and original discoverers of many valuable curative methods and means. The Italian school of physicians of the twelfth and fifteenth centuries inaugurated the study of minute and internal anatomy and physiology. But medicine was pursued chiefly by the priesthood. So in France and Germany, physicians were chiefly of religious orders. Surgery was practised by barbers. The great Ambrose Paré was a barber-surgeon, but the order was steadily elevated, and incorporated with the faculty of medicine in 1795. In England the barber-surgeons were abolished, but a distinction exists to this day between general practising physicians, who assume the title of M. D., and surgeons, who are designated by the affix F. R. C. S. (Fellow of the Royal College of Surgeons). On the continent of Europe and in this country medicine and surgery are requisites in medical study, and but one title (doctor in medicine) is conferred. The study of medicine abroad occupies five years. In this country the prescribed course is at present three years, but efforts are making to extend it. The departments of study required are anatomy, physiology, chemistry, materia medica, practice of medicine, surgery, and midwifery. But in the larger medical schools many special branches have been added—hygiene, microscopy, pathology, medical jurisprudence, and the specialties of diseases of the eye, ear, larynx, and skin.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Phys′ick (PHILIP SYNG), M. D., b. at Philadelphia July 7, 1768; graduated at the University of Pennsylvania 1785; studied medicine in Philadelphia, London, and Edinburgh, where he took his medical degree in 1792, having been previously the pupil and intimate friend of John Hunter; became one of the ablest surgeons and physicians of Philadelphia, in whose hospitals and public charities he was for many years a prominent official; became in 1805 professor of surgery in the University of Pennsylvania, and was (1819–31) professor of anatomy there; was an exceedingly popular instructor; was chosen in 1825 a member of the French Institute, and in 1836 honorary member of the Royal Medical and Chirurgical Society of London. D. at Philadelphia Dec. 15, 1837.

Physics. See DYNAMICS and MECHANICS, by PROF. W. P. TROWBRIDGE, A. M., M. N. A. S.

Physics of the Earth [Fr. *physique du globe*], or **Terrestrial Physics,** a term often employed to designate the study of the globe as a unit, irrespective of its surface, comprising its general form as given by geodesy, its density, its magnetism, its specific temperature, etc., forming a special portion of physical geography. (See GEOGRAPHY, by PROF. A. GUYOT, LL.D.)

Physiog′nomy [Gr. φύσις, "nature," and γιγνώσκειν, to "know" or "discern"], the art of interpreting the character of man—the temperament, quality, and strength of intellect, and the relative development of the several mental faculties—by facial conformation and expression. It was first presented as a systematic study by Lavater in 1775. It was included in the systematic phrenology of Gall and Spurzheim. While much has been, and is still, claimed for physiognomy inconsistent with the facts of natural history of man and the laws of physiology, the face may be regarded as an index, by facial expressions developed both voluntarily and involuntarily, of the prominent characteristics of intellect, emotion, and will. The physiognomy of infants, while the intellect is latent, expresses only happiness and pain or sorrow. With the training of the tongue and lips in phonation, and the development of the language of expression by the control of the muscles of the eye, the nostrils, and mouth, combinations of facial lines and individuality of features become established. Such facial signs are most marked in the races of sanguineous temperament and in persons of spare habit. The inert brain of the idiot is indicated by a facial blankness. But the man of finest intellect may by facial paralysis wear a mask which conceals all trace of his character. Reversely, by electrical excitation of muscles and groups of muscles of the face, the various expressions of mirth, sorrow, impotency, power, etc. may be produced irrespective of the mental condition—expressions which the subject's character had never developed. The size and prominence of the eye, state of the pupil, the action of the nostrils, the contraction and attenuation of the lips in moments of mental concentration, are the results of involuntary and unconscious control by mental and emotional states, and develop permanent facial exponents of the æsthetic and moral nature. Marked lineaments and activity of facial expression are indicative of force of will and intellect, rather than of quality, and often by persistent exercise are a false guide to cover an inconsistent and false character. The various involuntary facial conditions—the dilating pupil, the expression of the eye, its suffusion and lachrymation, the blush and pallor—are controlled by the sympathetic nervous system. Facial expressions, dependent upon habitual use or the education of certain muscles, are derived chiefly from the motor oculi and facial nerves and the independent or combined action of the analogous muscles of the two sides of the face. The patheticus nerve supplies a marked expression of the eye—sympathy and grief.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Physiog′raphy [Gr. φύσις, "nature," and γράφειν, to "write"], a newly-adopted term for a description of the natural features of a country, and more especially of the climate and groups of plants and animals which characterize it, or its organic geography. (See GEOGRAPHY, by PROF. A. GUYOT, LL.D.)

Physiol′ogy [Gr. φύσις, "nature," and λόγος, "discourse"], that department of natural science which treats of the laws, processes, and phenomena of organized life. The prominent features of the physiology of human physical being are vital force and nutrition. Vitality is the first condition of animal existence—the condition determining growth and maintenance; nutrition supplies the mate-

rial of the germinal and incipient stages of organism, the mature growth of the body, and constant renewal and regeneration which counterbalance the waste of cell and tissue metamorphosis.

The blood is the circulating nutritive fluid of the body—one-eighth of the entire weight, or about eighteen pounds. It is alkaline, and has a sp. gr. of 1.052. It consists of the plasma, or water with albumen, fibrine, and salts in solution, and the solid elements, the red and white blood-cells. The blood-cells constitute about one-half of its volume. They are formed, according to some authorities, by genesis from the nutritive elements of the fluid blood. Others claim the origin of white corpuscles in the spleen or from the lymph, and their transition to the red. The white are the larger, but relatively few—one to several hundred of the red. The white have active amœboid movements, and probably migrate from the vessels under certain circumstances to form new cells and tissues or for processes of repair. Red corpuscles have but one known function—the carrying of oxygen from the lungs to the tissues, and possibly the return of carbonic acid gas. Spectroscopic analysis of red globules reveals oxygen, salts of potash, and iron. The heart is the centre of the circulation, propelling the blood into the arteries with a force of 51½ pounds—a force steadily decreasing as the arteries subdivide and approach the capillaries. Capillary circulation is effected partially by a remaining element of cardiac force, chiefly by vital relations of the blood to their capillary channels and the chemico-vital processes they subserve. The veins return the blood to the heart. The veins are more numerous than the arteries—have double their capacity; hence, the venous blood circulates with but half the rapidity of the arterial. Venous return is aided by the compression of the integuments, exercise, and the presence of valves in the veins. In 1553, Servetus discovered the circulation of the blood through the lungs. In 1603, Fabricius demonstrated the valves of the veins; he was Harvey's preceptor at Padua. In 1616, Harvey demonstrated the general circulation of the blood, publishing his researches in 1628. In 1661, Malpighi discovered cells in the blood; in 1673, Leeuwenhoeck determined these anatomical elements more definitely; in 1770–75, William Hewson discovered the white blood-cells. Respiration is a double act of inspiration and expiration, expansion and contraction of the lung. Freshly-inhaled air parts with oxygen in the vesicles of the lung, which is taken up by the red corpuscles of their vascular walls, and expired air is loaded with carbonic acid gas, received from venous blood. Respiration is an involuntary act; formerly regarded as reflex from the presence of impure air in the lung, now established as emanating from the cognizance which the medulla oblongata takes of the nutritive demand of all parts of the body for a constant supply of oxygenated red blood. Certain lower animals have no lungs, but receive the oxygen by direct surface absorption. The materials of the blood are supplied by food after preparation by the processes of digestion. Appetite and hunger are also sensations of centric origin, indicative of the nutritive demands of the tissues. Food must be varied in character, and include both nitrogenous substances and hydrocarbons, as well as water and a proportion of salts. The preliminary steps of digestion are mastication, insalivation, and deglutition. Albuminoid substances are digested by the gastric juice; starchy, saccharine, and fatty substances by the secretions of the small intestine, pancreas, and liver. Emulsioned food is absorbed from the stomach and bowels by the lacteals, and emptied by the thoracic duct directly into the blood. The lacteals are a part of the general lymphatic or absorbent vessels distributed throughout the body, discovered by Eustachius and Asellius in the sixteenth century. Secretion is the action of special glands in the body, which elaborate elements of the blood for special purposes, as the serum bathing the pleura and peritoneum, the synovial fluid lubricating joints, mucus to moisten the air-tubes and intestines, saliva, gastric and intestinal juices to digest food. Excretion is glandular separation from the blood of effete products—the urine, fæces, perspiration, and bile. Fæcal matter is partially débris of digested food. Bile is to be regarded secretory so far as it aids digestion. Certain ductless glands—the spleen, suprarenal capsules, thymus, thyroid, pituitary, and pineal glands—have no known function. Nutritive waste and supply and glandular activity evolve heat, and determine the normal temperature of the body—in the healthy adult, 98.5° F., with little variation.

The nervous system was divided by Bichat into the cerebro-spinal and the sympathetic. The first comprises the brain, spinal cord, motor and sensory nerves, and nerves of special sense. The second controls the functions of the large internal organs, the capillaries, and the equilibrium of the circulation. The brain and cord have gray and white substances; the gray is ganglionic, composed of cells which originate force or receive impressions; the white is tubular, nerve-tracts which transmit motor stimulus from the brain to the muscles or sensory impressions from the body to the brain. The rapidity of nerve-action is 111 feet per second. Motor nerve-fibres terminate in neural plates upon the surface of the muscular fibre. Sensation is received by the Pacinian tactile bodies of the hands and feet, the sensitive papillæ of the skin, taste-buds of the tongue, etc. The brain comprises the cerebrum—the seat of the mind—the cerebellum, pons varolii, and medulla—controlling vital functions. The spinal cord is a column of nerves connecting the brain with their distributions throughout the body. It possesses certain ganglionic cells, and is the seat of independent reflex action; it also has a partial control of co-ordinated action of groups of muscles in the extremities. The "cranial nerves" proceed from the brain to their destination without entering the cord. They are partly nerves of special sense—sight, hearing, smell, and taste; the "facial" nerve gives expression to the face; the pneumogastric nerve controls the rhythmic action of the heart and lungs and influences the digestive process.

Speech is produced by movements of the larynx, tongue, teeth, and lips, methodically trained to create sounds, which, by custom, are representative of ideas; it is an artificial method, the invention of man, and slowly developed and perfected. Sight is the impression received by the brain of light and the images of objects, transmitted through the optical media of the eye to the sensitive retina and optic nerve. Hearing is a transmission of sound-waves to the tympanum, and, by the system of ossicles and resonating canals and cavities, to the filaments of the auditory nerve. Generation, or reproduction of definite species and of individual characteristics, is the result of predetermined law. Conception begins with the fecundation of germinal elements, which develop vitality, motion, and nutritive growth; by successive steps—cellular multiplication, nutritive membrane, nerve-canals, primitive blood-vessels, heart, lungs, glands, lateral walls of the body, enclosing cavities, budding of the extremities, and facial conformation—the embryo progresses to the perfect human being.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Physiology, Vegetable. See Vegetable Physiology.

Physoclis'ti, a name formed by Müller, and used for various groups of teleostean fishes, all of which agree in the absence of a duct between the air-bladder and intestinal canal, and consequently the closing of the air-bladder, whence the name. (1) As applied by Müller it embraced nearly the same forms as were united by Cuvier in his order of Acanthopterygians and Jugular Malacopterygians, but excluding the Pharyngognathi; (2) by Lütken (in 1871) it was also used as an ordinal name for the fishes included therein by Müller, and also the Pharyngognathi, the Lophobranchiates, and Plectognaths; (3) by Cope (also in 1871) it was employed as the name of a "tribe" of his "sub-class Actinopteri," with the same limits as by Lütken for his order. It is scarcely a natural combination, although the forms to some extent make a natural series and include the most specialized of fishes.

Theodore Gill.

Physos'tomi [φῦσα, "wind"—*i. e.* "air-bladder"—and στόμα, "mouth"], a term, also devised by Müller, for those teleostean fishes which are provided with a duct connecting the air-bladder with the intestine as by a mouth, in allusion to which the name has been given. (1) Müller used the name as an ordinal one for the abdominal and apodal Malacopterygians of Cuvier, exclusive of the Ganoids and the Scomberesocidæ; (2) Lütken also used it as an ordinal name, but included in the group so designated by him not only the forms recognized by Müller, but also all the Ganoids and Dipnoans (*Lepidosiren*, etc.); (3) Cope has employed the name for a "tribe" of his "sub-class Actinopteri" and included therein the Ganoids with completely bony skeletons in addition to the Physostomi of Müller. The character upon which these groups are based is, however, simply indicative of generalized organization, and the forms combined therein are very dissimilar in other respects. The most correct combination is apparently that of Müller. Theodore Gill.

Phytelephas. See Vegetable Ivory.

Phyth'ian (Robert L.), U. S. N., b. Feb. 6, 1837, in Pennsylvania; graduated at the Naval Academy in 1856; became a lieutenant in 1861, a lieutenant-commander in 1862, a commander in 1870; served in the Lehigh in several actions with Forts Sumter and Moultrie, and in the Ironsides at the capture of Fort Fisher. Commended for "ability and gallantry." Foxhall A. Parker.

Phyto-Chem′istry [Gr. φυτόν, "plant"], the chemistry of plants. It treats of the proximate principles of plants, the nutrition of plants, and the formation and metamorphoses of their constituents. (See AGRICULTURAL CHEMISTRY.)

Phytography, or **Descriptive Botany.** See BOTANY, by A. GRAY, LL.D.

Phytozo′on, pl. **Phytozo′a** [Gr. φυτόν, "plant," and ζῶον, "animal"], a term sometimes applied to zoöphytes, also to certain parasitic animals inhabiting plants. But at present it designates the antherozoids, small and often ciliated cells, which are set free by the bursting of the antheridia of some cryptogamous plants. After moving about spontaneously for a time, some of them appear to blend with the archegonia (or pistillidia), the contained spores of which they are believed to fertilize. These cells sometimes curiously resemble the spermatozoa of animals.

Piacen′za [anc. *Placentia*], chief town of the Italian province of the same name, situated (lat. 45° 3′ N., lon. 9° 40′ E.) on the right bank of the Po, a little below the mouth of the Trebbia. The position is of the greatest military importance. Piacenza is surrounded by ramparts, trenches, and other works common to modern fortifications, and forms a part of the line of defence extending from Ancona to Alessandria. The streets are broad, the Stradone Farnese being the finest, and the principal square, the Piazza de' Cavalli, in which are two famous equestrian statues in bronze, has a busy aspect. The city in general, however, has a decayed and sombre look, owing partly to the mediæval character of so many of the public and private buildings. The cathedral, begun in 1122 on the foundations of a much earlier church, is Lombardo-Gothic in style, and is especially remarkable in its interior. The numerous frescoes are mostly by Guercino and L. Caracci, and are of very great merit. Among other noticeable churches are—Sant' Antonio, once the cathedral, built in 324 (on the spot, it is said, where St. Barnabas first preached to the people), but much altered by restorations. The Palazzo Farnese, called La Cittadella, was a splendid structure, but is now a barrack. The Palazzo del Comune (1221) is a fine but now ruined monument of the prosperous republican days of Piacenza. The private palaces contain some rare pictures. This town, of Gallic origin, served the Romans as a strong point of defence against Hannibal, and the construction of the great military road of M. Æmilius Lepidus and various large canals raised it to great prosperity. Under the Goths it was allowed to govern itself; under the Lombards and Franks it had a feudal lord, and was occupied by the French in 1796. On the fall of the First Napoleon, Piacenza was given to Maria Louisa, after whose death Austria held it (1848 excepted) till 1859, when it was united to Piedmont, and consequently now forms a part of the kingdom of Italy. The little trade of Piacenza is chiefly in the products of the rich neighboring country—grain, wine, cheese, etc.; the manufactures are silks, linens, etc. P. in 1874, 35,000.

Piacenza, DUKE OF. See LEBRUN (C. F.).

Pi′a Ma′ter [Lat., "tender mother"], the innermost of the meninges or membranes covering the brain and spinal cord. It is so named because it serves in nourishing the nerve-centres. It is a fine plexus of blood-vessels covering the brain, dipping down into its convolutions, forming the velum interpositum in the third and the choroid plexus in the fourth ventricle. A small part, over the crura and pons, is not very vascular, but tough and fibrous. It is abundantly supplied with nerves and lymphatics. The pia mater of the spinal cord is less vascular than that of the brain, with which it is continuous. It is partly composed of longitudinal fibrous bundles. It is intimately connected with the cord, of which it is the neurilemma. The tunica vasculosa of the testes is also called pia mater.

Pianel′la [*Castrum Planellæ*], town of Southern Italy, province of Teramo. It contains an old church with some interesting monuments, and was a fortress under the Lower empire. P. in 1874, 6353.

Piankatank, tp., Matthews co., Va. P. 2024.

Pia′no de′i Gre′ci, town of Sicily, province of Palermo, on the skirts of Monte Pizzuto, about 12 miles from Palermo. The church dedicated to the Greek rite contains some very fine frescoes. The Latin church has some good statues. This town was colonized by Greco-Albanians, driven from their country by the Mohammedans, and the inhabitants still preserve their primitive language and customs. P. in 1874, 7714.

Pia′no di Sorren′to, town of Southern Italy, province of Naples, 8 miles S. W. of Castellamare di Stabia. It has a small harbor, and coasting-trade. P. in 1874, 8265.

Pia′nofor′te [It. *piano*, "soft," and *forte*, "loud"], a musical instrument played by a double row of keys upon a finger-board, each key being a species of hammer connected with an elastic steel string. The principle of the key-board was applied to a musical instrument, the clavichord, as early as the fourth century, and other instruments of the same class, as the cithara, the harpsichord, and the spinet, were popular down to the eighteenth century. The invention of the pianoforte has been claimed for Germany, Italy, France, and England. The best evidence seems to assign it to Bartolommeo Cristofali, a harpsichord-maker at Padua, Italy, about the year 1710. Marius claimed a similar invention in Paris in 1716, and Christoph Gottlieb Schroter in Germany in 1717. It was not until 1760 that the instrument was manufactured in England by German mechanics. The firm of Broadwood & Stodart soon took a leading position as English manufacturers, and improvements were rapidly made, the instrument attaining a speedy popularity. The grand piano seems to have been first made in 1781, the upright in 1795. Few pianos had been brought to the U. S. when, in 1822, Jonas Chickering began their manufacture at Boston, being thus the pioneer of an important industry in which American genius has achieved signal triumphs.

Piano′ra, town of Southern Italy, province of Bologna, on the Savena, about 12 miles S. of the city of Bologna. This town is of uncertain but very ancient origin. P. in 1874, 5534.

Pi′arists [Lat. *pius*, "pious"], called also the **Pauline Congregation,** and popularly known as **Scolopins,** a congregation of regular clerks of the Roman Catholic Church, founded in 1599 by St. Joseph Calasanctius (1556–1648) for the purpose of spreading education. They were confirmed by Paul V. (1617) and by Gregory XV. (1621), when they received the official title of "Regular Clerks of the Pious Schools." The congregation was suppressed by Innocent X., and again confirmed by Clement IX. Their work is supplementary to that of the Jesuits. They are chiefly found in Europe.

Pias′sava Fibre, a coarse substance used for making brushes and brooms for street-sweeping. It is brought from Brazil, and is produced chiefly from the palm trees called *Leopoldinia Piassaba* and *Attalea funifera.*

Pias′tre [akin to the words "plaster," "flat," and "plate," applicable as well to any coin], the Spanish and Spanish American dollar, *peso*, or "piece of eight," once so called because it contained eight reals. In the Levant there are piastres whose value is about five cents.

Pi′att, county of Central Illinois. Area, 475 sq. m. Level, fertile, and contains coal; is traversed by the N. fork of Sangamon River and by several railroads. Live-stock, grain, and wool are leading products. Cap. Monticello. P. 10,953.

Piatt, tp., Lycoming co., Pa. P. 493.

Piatt (DONN), b. in Cincinnati, O., in 1829; graduated at St. Xavier College; studied law, and was made judge of the court of common pleas for Hamilton co., O.; was appointed secretary of legation at Paris by Pres. Pierce, and for nine months, during the illness of Minister Mason, acted as chargé d'affaires. When the civil war broke out he enlisted as a private; was elected captain; served through the war as assistant adjutant-general on the staff of Gen. Robert Schenck, and came out with the title of colonel. After the war he served one term in the Ohio legislature; acted as Washington correspondent of the Cincinnati *Commercial;* was engaged in starting the New York *Sun*, and subsequently founded the Washington *Capital*, which he now controls. J. B. BISHOP.

Piatt (JOHN JAMES), b. at Milton, Ind., Mar. 1, 1835; was educated at the Columbus (O.) High School and Kenyon College; joint author, with W. D. Howells, of *Poems by Two Friends* (1860); with his wife, wrote *Nests at Washington* (1863); sole author of *Poems in Sunshine and Firelight* (1866), *Western Windows* (1868), *Landmarks*, etc. (1871), and many fugitive pieces of marked originality and much poetic merit.—His wife, SARAH MORGAN BRYAN PIATT, b. at Lexington, Ky., 1835, is also distinguished as a writer of verse.

Piauhi′, province of Brazil, bordering N. on the Atlantic, and bounded W. by the Parnahiba, comprises an area of 94,500 sq. m., with a population estimated at 232,000. The surface is an elevated plain or series of plateaus sloping down toward the Atlantic and the Parnahiba, and affording good pastures. Useful minerals are found, but mines are not worked. There is very little agriculture, though in many places the soil is well adapted to cotton-cultivation. Rearing of cattle is the only occupation of the inhabitants.

Piaz′za Armeri′na, town of Sicily, province of Caltanissetta, situated on a high hill surrounded by an undu-

lating country of the greatest fertility. Its churches are numerous, containing some valuable pictures, and the episcopal palace is worthy of notice. There are also several not insignificant libraries, and considerable efforts are now making in the way of schools and of education generally. Piazza Armerina is a very ancient town, settled, tradition says, by a colony of Greeks from Platææ. Under the Normans it rose to importance, but suffered greatly under the Angiovine dynasty. Its prosperity depends entirely on the abundance of grain, wine, oil, chestnuts, walnuts, produced in the vicinity. P. in 1874, 20,310.

Piaz'zi (Giuseppe), b. at Ponte, on the Valtelline, in 1746. His master was the mathematician Father Giambattista Beccaria, and he himself joined the order of the Theatines. After being professor of philosophy in several of the large Italian universities, he was appointed in 1780 professor of mathematics at Palermo, where he promoted the establishment of an observatory, and finally went to France and England to obtain instruments for it. This observatory was opened in 1791, and there Piazzi compiled his famous *Catalogue of the Stars*. On Jan. 1, 1801, he discovered the planet or asteroid Ceres, which opened the way for the discovery of so many others. Piazzi revised the plan of the new observatory at Naples, of which he was afterward for some time the director. On occasion of the erection of a monument to Piazzi at Ponte, B. E. Maineri published his biography. D. in 1826.

Piaz'zola sul Bren'ta, town of Italy, province of Padua, situated on the Brenta, about 12 miles N. of Padua. It contains some fine buildings, among which may be specially noticed the parochial palace, the Palazzo Contarini, now Camerini. P. in 1874, 5102.

Pi'broch [from the Gaelic for "pipe-music"], the war-notes of the Highland bagpipe. There are numerous compositions of this kind, scarcely distinguishable from each other by the untrained ear. The use of this pipe in Scottish warfare has been traced back no farther than 1594.

Pic'amar [Lat. *pix*, "pitch," and *amarus*, "bitter"], an oily body found in wood-tar.

Picard' (Jean), a French astronomer, b. at La Flèche, department of Sarthe, France, July 21, 1620; accomplished the first exact measurement of a degree of the meridian, between Amiens and Malvoisin; made a number of valuable improvements in the instruments of observation and methods of calculation; was the real founder and constructor of the Observatory of Paris; is noted for the noble disinterestedness with which he aided other astronomers, such as Ole Römer the Dane, Cassini the Italian, etc., and wrote among other works *La Mesure de la Terre* (1671) and *Voyage d'Uranibourg, ou Observations astronomiques faites en Danemark* (1680). D. at Paris Oct. 12, 1682.

Picard (Louis Benoit), b. at Paris July 29, 1769; studied law and medicine; in 1789 wrote for the stage *Le Badinage dangereux;* became an actor in 1797; was director of the grand opera from 1807 to 1816, afterward of various other Parisian theatres, and published at the same time a number of romances. D. at Paris Dec. 31, 1828. His novels made no great impression, but his light comedies, *Médiocre et Rampant* (1797), *Les Marionettes* (1806), etc., and comic operas, *Les Visitandines* (1792), etc., reigned for a long period in France, Germany, and Scandinavia, and are distinguished by freshness, vivacity, and a certain gracefulness.

Pic'ardy, an old province of France, bordering on the English Channel, is now divided into the departments of Somme and Pas de Calais; parts of it belong to the departments of Aisne, Oise, and Yonne.

Picci'ni, or **Piccin'ni** (Nicolò), b. at Bari, Italy, in 1728; received his musical education in the conservatory of Naples; made in 1754 his début as a composer with the opera *Le Donne dispettose;* achieved in 1760 an almost unprecedented success by his opera, *Cecchina, ossia la buona figliuola;* went in 1776 to Paris, and engaged in that musical contest with Gluck which, continued through several years, forms one of the most interesting chapters in the history of music. He composed during this period *Roland, Phaon, Atys, Iphigénie en Tauride*, etc., in all fifteen operas; but, although most of them were received with great enthusiasm, Gluck was victorious, and other troubles being added to the defeat, Piccini left Paris for Naples in 1791. In Italy he composed several successful operas, *Griselda, Il Servo Padrone*, etc., but the government suspected him of sympathizing with the French Revolution, and in the musical arena rivals and coteries harassed him. In 1798 he returned to Paris, where Bonaparte gave him a position as inspector of music at the National Conservatory. D. at Passy May 7, 1800. Although by no means a genius of high order, he was a respectable and even talented representative of the Italian music of that period, and his productivity was truly enormous; from 1754 to 1775 he composed 133 operas, besides many pieces of church music, etc.

Piccolom'ini, a celebrated family of Italian nobles, still flourishing, from which sprang the popes Pius II. (1458–64) and Pius III. (1503), and the Austrian general Octavio Piccolomini, b. 1599; d. at Vienna 1656; became very famous for the counterplot by which he frustrated Wallenstein's plot against the emperor and overthrew him. Schiller's *Wallenstein* contains a somewhat softened and modernized, but essentially true and very vivid, portrait of him; he was childless, however, and Schiller's Max is a fiction.

Piche'gru (Charles), b. at Arbois, department of Jura, France, Feb. 16, 1761; was a teacher of mathematics at the military school of Brienne while Bonaparte was a pupil there; entered the artillery service of the Revolutionary army in 1790 and rose rapidly; was commander-in-chief of the army of the Rhine in 1793, of the army of the North in 1794; conquered Holland and organized the Batavian republic in 1795; resumed the command of the army of the Rhine, but entered into negotiations with the Bourbons; became suspected and was deprived of his command in 1796. In 1797 was elected a member of the Council of Five Hundred, and chosen its president, but his plottings with the *emigrés* and the royalist party being discovered, he was arrested, Sept. 4, 1797, and transported to Cayenne. In 1798 he escaped to England, where he formed a conspiracy with Cadoudal, the Polignacs, and others against Napoleon's life. He repaired secretly to Paris, but the conspiracy had in the mean time become known to the police; he was captured, imprisoned, and found strangled in his cell Apr. 5, 1804.

Pich'urim Beans, or **Sassafras Nuts,** the seed-lobes of *Nectandra Puchuri*, a South American lauraceous tree. They are used by chocolate-makers and others for flavoring. They have a strong taste, resembling nutmeg as well as sassafras.

Pic'idæ [from *Picus*, a "woodpecker"], a family of birds including the woodpeckers, wrynecks, etc. In these birds the bill is moderately elongated—in the typical forms

The Great Spotted Woodpecker.

more or less nearly straight and compressed toward the tip, which is produced into a truncated vertical or chisel-like edge, but in aberrant species somewhat decurved and with a pointed tip; the nostrils are near the base, lateral, and generally concealed by overarching plumes or bristles; the wings are moderate and pointed, with ten primaries, the first of which is very short; the tail has twelve feathers, the external very small, which generally are more or less rigid and cuneate, but sometimes (in Picumninæ and Yunginæ) are soft; tarsi covered in front with large plates, behind with small ones; toes opposed in two groups, the second and third being directed forward, the first and

fourth backward (the first rarely wanting). The skeleton exhibits a number of peculiarities, and the relations of the palatovomerine and maxillaries have some resemblance to those of the Saurians, for which reason the family has been taken as the type of a primary group of carinate birds, for which the name *Saurognathi* has been proposed by Parker. Species are distributed throughout all parts of the world, but most abundantly in tropical wooded regions; they live upon the worms and insects which are found in holes in trees, and which they obtain by pecking at and enlarging the holes by means of their chisel-like bills; the structure of the feet enables them to run with great dexterity along the trunks of trees, even on surfaces inclined downward. They also make their nests in trees, in which they deposit generally from four to six white eggs. The species are very numerous, G. R. Gray admitting 341, differentiated among six sub-families: (1) Picumninæ, with 2 genera and 34 species; (2) Picinæ, with 7 genera and 135 species; (3) Gecininæ, with 6 genera and 87 species; (4) Melanespinæ, with 4 genera and 70 species; (5) Colaptinæ, with 2 genera and 20 species; and (6) Yunginæ, with 1 genus and 5 species. The family has been the subject of an elaborate monograph by Malherbe (*Monographie des Picidées, ou Histoire naturelle des Picidées, Picumninés, Yunginés ou Torcols,* etc., etc., par Alf. Malherbe, 4 vols. folio). THEO. GILL.

Pick'ard (HUMPHREY), D. D., b. at Frederickton, N. B., June 10, 1813; graduated at Wesleyan University, Middletown, Conn., in 1839; entered upon the Wesleyan ministry in New Brunswick; was president of the conference of Eastern British America 1862 *seq.*, and again 1870; president of the college at Sackville, N. B., 1866–69, when he became editor of the *Provincial Wesleyan* and book steward for the conference at Halifax, N. S.

Pick'away, county of Central Ohio. Area, 525 sq. m. It is undulating and very fertile, producing great amounts of wool, grain, broom-corn, live-stock, etc. The county is traversed by Scioto River and Cincinnati and Muskingum Valley R. R. Cap. Circleville. P. 24,875.

Pickaway, tp., Shelby co., Ill. P. 728.

Pickaway, tp., Pickaway co., O. P. 1632.

Pick'ens, county of Alabama, bounded W. by Mississippi. Area, 900 sq. m. It is uneven and very fertile. Cotton and corn are staple products. The county is traversed by Tombigbee River. Cap. Carrollton. P. 17,690.

Pickens, county of N. Georgia. Area, 300 sq. m. It is high and mountainous, with picturesque and fertile valleys, producing corn, cotton, and tobacco. The mineral wealth is unexplored. Cap. Jasper. P. 5317.

Pickens, county of N. W. South Carolina, bounded N. by North Carolina. Area, 420 sq. m. The Blue Ridge extends along the N. border. It is uneven and fertile, with great mineral wealth, and produces corn, wheat, and cotton. Cap. Pickens Court-house. P. 10,269.

Pickens, tp., Edgefield co., S. C. P. 1559.

Pickens (Gen. ANDREW), b. at Paxton, Bucks co., Pa., Sept. 13, 1739, of Huguenot descent; went with his parents to the Waxhaw Settlement, S. C., in 1752; was a volunteer in Grant's expedition against the Cherokees 1761; was a captain of militia at the beginning of the Revolution; soon rose to the rank of brigadier-general, and shared with Marion and Sumter the honor of the heroic resistance made in South Carolina to the overwhelming numbers of the British and Tory forces. After the war he was for many years a member of the legislature; served in Congress 1793–95; was frequently commissioned to make treaties with the Indians; settled at Hopewell in the Pendleton district, which he had purchased from the Indians by the Hopewell treaty. D. there Aug. 17, 1817. —His son, ANDREW PICKENS, JR., was governor of South Carolina 1816–18. D. at Pontotock, Miss., July 1, 1838.

Pickens (EZEKIEL), an eccentric jurist of Dallas co., Ala., was a judge of the State circuit court 1835–47, and again for some years after 1850, but removed to Mississippi. Many curious anecdotes regarding his eccentricities are current in the South-west. D. in Mississippi.

Pickens (FRANCIS W.), son of Andrew, b. at Togadoo, S. C., Apr. 7, 1807; was educated at South Carolina College, and in 1829 became a lawyer of Edgefield district; was prominent in 1832 as a nullifier in the State legislature; was in Congress 1835–45; opposed the Bluffton secession movement of 1844; U. S. minister to Russia 1857–60; governor of South Carolina 1860–62, and as such had important connection with the early secession movements of his State. D. at Edgefield, S. C., Jan. 25, 1869.

Pickens (ISRAEL), b. in Cabarrus co., N. C.; was in Congress 1811–17; register of land-office, Mississippi Territory, 1817; governor of Alabama 1821–25; U. S. Senator 1826. D. near Matanzas, Cuba, Apr. 23, 1827.

Pickens Court-house, p.-v., cap. of Pickens co., S. C., on Keowee River, has 1 weekly newspaper, fine water-power, and is situated in a mineral region.

Pickens, Fort. See FORT PICKENS.

Pick'ensville, p.-v., Pickens co., Ala., on Tombigbee River. P. 1111.

Pickensville, p.-v. and tp., Pickens co., S. C. P. of v. 1223; of tp. 3164.

Pick'erel [dim. of *pike*], a name given in England to the young of the pike of that country (*Esox lucius*), but in the U. S. variously applied. In many parts of the country it is given to the small Esocidæ, and in some places (*e. g.* the interior lakes of the North-western States) to the *Esox lucius* (= *E. estor*, Les.). The species so called of most of the great Northern lakes, and especially in the markets, are, however, Percids or Lucioperæ—*i. e. Stezistedium americanum*, etc.

Pickerel Lake, tp., Freeborn co., Minn. P. 337.

Pick'ering (CHARLES), M. D., b. in Susquehanna co., Pa., Nov. 10, 1805; took his medical degree from Harvard University 1826; practised medicine in Philadelphia eleven years; was naturalist to the Wilkes expedition 1838–42; travelled in India and Africa. Author of *Races of Man* (1848), *Geographical Distribution of Animals and Man* (1854), *Geographical Distribution of Plants* (1861), and scientific papers. D. Mar. 17, 1878.

Pickering (EDWARD CHARLES), b. at Boston, Mass., July 19, 1846; graduated at the Lawrence Scientific School 1865; taught mathematics at Cambridge 1865–67; was shortly afterward elected Thayer professor of physics at the Massachusetts Institute of Technology; was a member of the *Nautical Almanac* party which observed the total eclipse of Aug. 7, 1869, in Iowa, and of the Coast Survey party sent to Spain with a similar object in 1870; has conducted extended observations in optics, and especially in regard to the polarization of glass and of the sky, on which subjects he has contributed papers to several scientific journals; and has successfully carried out the laboratory method of teaching physics upon a system exhibited in his work entitled *Physical Manipulation* (1874). His system has been largely adopted in other institutions. Prof. Pickering is a great-grandson of Col. Timothy Pickering of Revolutionary fame, and is married to a daughter of the late Jared Sparks. In 1873 he was elected a fellow of the National Academy of Sciences.

Pickering (HENRY), son of Timothy, b. at the Hasbrouck House, Newburg, N. Y., the recent head-quarters of Washington, Oct. 8, 1781; received a careful education at Philadelphia, where his father was a member of Washington's cabinet; went to Salem, the former home of the family, with his parents 1801; engaged in mercantile pursuits, and acquired a moderate fortune, which he employed in a liberal manner; met with serious losses in 1825; removed to New York, but being unsuccessful in business, settled at Rondout, on the Hudson, and devoted his remaining years to study and writing. D. in New York May 8, 1838. Author of graceful poems, chiefly on natural objects, of which a volume appeared at Boston in 1831.

Pickering (JOHN), LL.D., son of Col. Timothy, b. at Salem, Mass., Feb. 17, 1777; accompanied his father in his visits to the Six Nations of Central New York, deriving from that circumstance his fondness for American philology; graduated at Harvard 1796; studied law in Philadelphia; was attached to the U. S. legations in Lisbon and London 1797–1801; a lawyer of Salem, Mass., 1801–27; city solicitor of Boston 1829–46; was much in the State legislature, and assisted in revising the statutes; declined the Greek and Hebrew professorships at Harvard; was a laborious philological student and familiar with many languages; president of the American Academy of Arts and Sciences; founder and first president of the American Oriental Society; maintained a correspondence for many years on philological topics with P. S. Duponceau and Wilhelm von Humboldt, the originals of which are carefully preserved by his family; author of valuable legal, archæological, and philological papers, including an *Essay on a Uniform Orthography for the Indian Languages of North America* (1820), in which he proposed the alphabet adopted by American missionaries in reducing to writing not only Indian but Polynesian languages; *Remarks on the Indian Languages of North America* (Philadelphia, 1836); of a useful *Vocabulary of Americanisms* (1816), and of a *Greek and English Lexicon* (1826; 3d ed. revised and enlarged, 1846). D. at Boston, Mass., May 5, 1846. He is deservedly considered the chief founder of American comparative philology. PORTER C. BLISS.

Pickering (OCTAVIUS), LL.D., b. in Wyoming Valley, Pa., Sept. 2, 1792; graduated at Harvard 1810; became a lawyer of Boston, Mass., 1816; was State reporter 1822–

40; lived in Europe 1841–48. D. in Boston, Mass., Oct. 29, 1868. Author of an unfinished *Life of Timothy Pickering*, his father (1867), of 24 vols. of law-reports, and of some other legal writings.

Pickering (TIMOTHY), LL.D., b. at Salem, Mass., July 17, 1745; graduated at Harvard 1763; became a lawyer of Salem 1768; was prominent in resistance to British aggressions; in 1775 became judge of the maritime and common pleas courts, and published *An Easy Plan of Discipline for a Militia*, which was made the official textbook in Massachusetts; commanded the Essex regiment raised in 1776; served through the Revolution as colonel with valor, energy, and disinterestedness; became in 1777 Washington's adjutant-general, serving as such at Brandywine and Germantown, and member of the board of war in the same year; quartermaster-general 1780; became a commission merchant at Philadelphia at the close of the war; was sent in 1786 by the Federal government to quiet the difficulties arising from a conflict of jurisdiction in the Valley of Wyoming, Pa.; acquired a large tract of land in that region and settled at Wilkesbarre, and strove with much wisdom to harmonize the conflicting elements, but was seized and imprisoned for twenty days; was a delegate from Luzerne co. to the Pennsylvania constitutional conventions of 1787 and 1790; negotiated treaties with the Six Nations of New York in 1790, 1791, and 1794, and with the Ohio Indians in 1793; postmaster-general 1791–94; secretary of war 1794–95; U. S. secretary of state 1795–1800; returned to the forests of Wyoming and built a log house for his family, when by sale of a portion of his lands to friends in Massachusetts, he was induced to return to Salem; was made a judge of common pleas 1802; was U. S. Senator 1803–11; one of the war-board of Massachusetts 1812–15; in Congress 1815–17; was author of able political pamphlets; devoted much attention to agriculture, being president of the Essex Agricultural Society; was an ardent Federalist, and in religion an Unitarian. He published several occasional addresses and pamphlets. D. at Salem, Mass., Jan. 29, 1829. (See his *Life*, commenced by his son Octavius, and completed by Rev. Charles W. Upham, 4 vols., 1867–73.) PORTER C. BLISS.

Pick'ering's Isle, tp., Hancock co., Me. P. 3.

Pick'erington, p.-v., Violet tp., Fairfield co., O. P. 195.

Pick'ersgill (HENRY WILLIAM), b. in London, England, Dec. 3, 1782; was distinguished as a portrait-painter; became a member of the Royal Academy 1826, and its librarian 1856. D. in London Apr. 25, 1875.—His nephew, FREDERICK RICHARD, b. in London in 1820, has become celebrated for historical paintings, especially *The Death of King Lear* and *The Burial of Harold*, both of which received handsome prizes; and was chosen a member of the Academy in 1857.

Pick'ett (ALBERT JAMES), b. in Anson co., N. C., Aug. 13, 1810; removed in 1818 to Autaga co., Ala.; acquired wealth; studied law; was A. A. G. in the Creek war, and aide to Gen. Clay in 1836, and published in 1851 a valuable *History of Alabama*. D. at Montgomery, Ala., Oct. 28, 1858.

Pick'ett (GEORGE E.), b. in Richmond, Va., Jan. 25, 1825; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of infantry July, 1846; engaged in the war with Mexico from Vera Cruz to the capture of the City of Mexico; brevet first lieutenant and captain for gallantry at Contreras, Churubusco, and Chapultepec; on frontier duty 1848–61, when (June 25) he resigned, and in September was appointed colonel in the Confederate army, and brigadier and major general in 1862. In the Virginia Peninsular campaign of 1862 he led a brigade, and was severely wounded at Gaines's Mill. Continuing thereafter with the Army of Northern Virginia, he participated in the battles of that army, and was conspicuous for his bravery and intelligence. At Gettysburg his division led the assaulting column which suffered so severely July 3, 1863; also commanded in North Carolina, at the capture of Plymouth. In the campaign of 1864–65 he made the final stand at Five Forks, where his division was surrounded and broken up after a desperate resistance. D. at Norfolk, Va., July 30, 1875.

Pickett (JOHN R.), b. in Fairfield district, S. C., Apr. 2, 1814; joined the South Carolina conference (M. E.) Feb., 1835. He was great both in body and mind. By dint of close application he became a fine linguist and a profound metaphysician. He was remarkable for independence, geniality, generosity, and a dash of eccentricity. D. in Chester, S. C., Mar. 15, 1870. T. O. SUMMERS.

Pick'ettsville, v., Stephens co., Tex. P. 115.

Pi'co, one of the AZORES ISLANDS (which see), belonging to the central group, comprises an area of 254 sq. m., and consists of one single mountain, whose highest peak, Pico, rises 7613 feet, and still emits smoke and lava. It is fertile and well wooded, and produces an excellent wine, of which 25,000 pipes are annually exported. P. 36,000.

Pic'oline [Lat. *pix*, "pitch"], or **Odorine** (C_6H_7N), an oily base found in the tar obtained by exposing bones and other animal substances, bituminous coal, shale, peat, beans, cinchonine, etc. It is produced by the decomposition of the acroleine-ammonia formed during these distillations. (See Watts's *Dict.* and *Supplements.*) C. F. CHANDLER.

Picou' (HENRI PIERRE), b. at Nantes, France, Feb. 27, 1824; studied painting under Delaroche, and began to exhibit in 1847. The most celebrated of his pictures are—*Cleopatra and Antony* (1848), *Cleopatra and Octavius* (1853), *Sappho* (1863), *Inundation of the Loire* (1865), *Molière at Versailles* (1868), *The Night Watch* (1873).

Picric Acid. See CARBAZOTIC ACID and TRINITROCARBOLIC ACID.

Picrotox'ine [Gr. πικρός, "bitter," and τοξικόν (sc. φάρμακον), "arrow-poison"], a poisonous bitter principle found in the *cocculus indicus* of commerce, the berries of the *Anamirta cocculus*. Its chemical constituents are carbon, hydrogen, and oxygen.

Pic'ton, a port of entry, cap. of Prince Edward co., Ont., Canada, on the Bay of Quinté, 40 miles S. S. E. from Kingston. It is the seat of Ontario College, and has 3 weekly newspapers. P. of sub-district, 2361.

Picton (JOHN W.), M. D., b. in New Jersey in 1804; first graduated at West Point; served seven years in the army; graduated in medicine in Philadelphia; located in New Orleans, where he practised thirty-two years, and acquired distinction as a surgeon; was one of the founders of the New Orleans School of Medicine. D. in Louisiana 1858. PAUL F. EVE.

Pictor (FABIUS). See FABIUS PICTOR.

Pictou', county of N. Nova Scotia, has a very level and fertile surface. It has mines of iron and coal, the latter extensively wrought, besides valuable beds of sandstone and fictile clay. It is traversed by Nova Scotia Railway. Cap. Pictou. P. 32,114.

Pictou, port of entry, cap. of Pictou co., N. S., on a safe and commodious harbor. Its lighthouse stands in lat. 45° 41.5′ N., lon. 62° 40′ W. It is the terminal point of Nova Scotia Railway, which extends to Halifax, 113 miles distant. Steamers ply to Charlottetown, Quebec, and the ports of the Gulf of St. Lawrence. Bituminous coal is mined near by, and is quite extensively exported. A beautiful sandstone is also quarried here. There are considerable manufactures, an academy, court-house, and 1 weekly newspaper. P. of sub-district, 3462.

Picts, a Celtic tribe, the Caledonians of the Roman writers, inhabiting the lowlands and the eastern part of Scotland, are first mentioned under the name of the *Picti* in a speech addressed by the rhetorician Eumenius to the emperor Constantius Chlorus on his return in 296 A. D. after the victory over Allectus. They were divided into the southern and northern Picts by the Grampian Mountains. The southern Picts were converted to Christianity in the fifth century by St. Ninian—the northern in the sixth by St. Columba. In the ninth century they were subdued by the Scots, a kindred tribe which invaded the country from Ireland. Kenneth II. conquered the whole of Scotland, made it one kingdom, and took up his residence in the old Pictish capital, Forteviot, in Stratherne. Subsequently attacked on both sides—from the N. by the Scandinavian invaders, and from the S. by the Teutonic inhabitants of England—the Pictish language and nationality gradually disappeared. In details, however, almost every point of their history, from the origin of their name and their place in the family of nations down to their final amalgamation with the surrounding Teutonic race, has been the subject of much controversy. (See Innes, *Civil and Ecclesiastical History of Scotland*, and Pinkerton, *Inquiry into the History of Scotland*.)

Picts' Houses, a name applied in Scotland to various structures of the pre-historic period. Remains of this character are quite common in many parts of that country, and are of various construction. Tradition assigns them, with no great improbability, to the Picts.

Piedimon'te d'Alife, town of Southern Italy, province of Caserta, situated at the foot of Monte Cila, N. E. of Alife. It is one of the most industrious of Southern Italy, and has extensive cotton, woollen, and linen manufactures of excellent reputation. P. in 1874, 7000.

Piedimon'te Etne'o, town of Sicily, province of Catania, situated in the midst of wild volcanic scenery. Near this town is the famous chestnut tree known as the "castagno dei cento cavalli." P. in 1874, 5140.

Pied'mont, territory of Northern Italy, comprising an area of 11,777 sq. m., with 2,764,263 inhabitants, and bounded S. by the Maritime Alps, W. by the Graian and Cottian, N. by the Pennine Alps, and E. by the river Ticino. In the twelfth century it became a possession of the house of Savoy, and now it forms, with slightly altered boundaries, a large division of the kingdom of Italy, being subdivided into the four provinces of Turin, Cuneo, Alessandria, and Novara. The greater part of this country is mountainous, covered with spurs of the Alps, between which the numerous affluents of the Po, the Tanaro, Bormida, Clusone, Dora, Sesia, etc. form beautiful and fertile valleys. But towards the E. the country gradually opens into the plain of the Po, which belongs to the most fertile and best cultivated land of Italy. Rice, wheat, maize, wine, olive oil, and many varieties of the most delicious fruits are produced, and a very extensive dairy-farming and manufacturing industry is carried on. The method of the Piedmontese silk-culture is celebrated and very successful.

Piedmont, tp., Rappahannock co., Va. P. 1634.

Piedmont, p.-v. and tp., Mineral co., West Va., on N. branch of Potomac with Baltimore and Ohio and Cumberland and Pennsylvania R. Rs., 173 miles E. of Wheeling, has good schools, 3 churches, 1 bank, 1 newspaper, railroad shops, a public hall, and is situated in the great coal-region of Virginia. P. of v. 1366; of tp. 1785.

JOHN E. WOOD, ED. "INDEPENDENT."

Piegans, a sub-tribe of the Blackfeet nation of Indians in Montana, deriving their present name (*i. e.* "pheasant") from that borne by their chief at the time of their separation from the Blackfeet during the present century. They originally consisted of two bands, who lived on the Marias, Teton, and Missouri rivers, were the best known and most civilized as well as the bravest of their nation, were skilful bowmen, noted for their love of ornament, and were constantly at war with the Shoshones, Flat Heads, and Gros-Ventres, though generally friendly to the whites. An unprovoked massacre of 173 Piegans, chiefly women and children, at Red Horn's camp on the Marias River, perpetrated Jan. 23, 1870, by Lieut.-Col. Baker, was severely condemned throughout the country. Lands were ceded by them to the U. S. by treaties in 1868, and their reservation was diminished by act of Apr. 15, 1874, at which time they numbered 2450. A Catholic mission among them was commenced in 1846, but they are officially recognized as under the religious supervision of the Methodists since the beginning of Gen. Grant's administration. Their members have rapidly declined of late from epidemic diseases.

Pie'pape, de (NICOLAS JOSEPH PHILPIN), b. in 1731 at Langres, Haute-Marne, France: belonged to a family of great legal reputation; studied law himself; became lieutenant-general of the county of Langres, and was in 1787 called to Paris to work out a regulation of the expenses of the administration of justice. By the Convention he was arrested as a royalist, and confined in the prison of Langres, where he d. in 1793. He published in 1789–90 *Observations sur les Lois criminelles de France* (2 vols.), which still occupies a prominent place in the juridical literature of France.

Pierce, county of S. E. Georgia. Area, 500 sq. m. It is level, in part covered by swamps, and has extensive forests. Rice and corn are leading products. The county is traversed by Brunswick and Albany and Atlantic and Gulf R. Rs., and by Satilla River. Cap. Blackshear. P. 2778.

Pierce, county of N. E. Nebraska. Area, 540 sq. m. It is undulating and well adapted to stock-raising. Cap. Pierce. P. 152.

Pierce, county, Washington Territory, bounded N. by Green River, E. by Cascade Mountains, S. W. by Nisqually River, and N. W. by Puget Sound. Except in the W. it is very rough and densely timbered. Grain, wool, fruit, and lumber are leading products. It is traversed by Northern Pacific R. R. Cap. Steilacoom City. P. 1409.

Pierce, county of Wisconsin, bounded S. W. by Mississippi River, which separates it from Minnesota. Area, 550 sq. m. It has St. Croix River and Lake on the W. It is undulating, well wooded, and fertile, and is one of the leading counties of the State in its product of wheat and oats. Cap. Ellsworth. P. 9958.

Pierce, tp., De Kalb co., Ill. P. 1003.

Pierce, tp., Washington co., Ind. P. 1179.

Pierce, tp., Page co., Ia. P. 430.

Pierce, tp., Morrison co., Minn. P. 151.

Pierce, p.-v., Mount Pleasant tp., Lawrence co., Mo., on Atlantic and Pacific R. R., at the S. terminus of Memphis Carthage and South-western R. R. P. 432.

Pierce, tp., Stone co., Mo. P. 781.

Pierce, tp., Texas co., Mo. P. 366.

Pierce, p.-v., cap. of Pierce co., Neb., on the N. branch of Elkhorn River. P. 152.

Pierce, tp., Clermont co., O. P. 1773.

Pierce, tp., Kewaunee co., Wis. P. 1130.

Pierce (BENJAMIN), b. at Chelmsford, Mass., Dec. 25, 1757; served throughout the Revolution with valor; settled in New Hampshire, where he held various important positions, and was governor in 1827–29; father of Pres. Franklin Pierce. D. at Hillsborough, N. H., Apr. 1, 1839.

Pierce (FRANKLIN), b. at Hillsborough, N. H., Nov. 23, 1804, was a son of Gov. Benj. Pierce; graduated in 1824 at Bowdoin College, where he was the intimate associate of Nathaniel Hawthorne, his lifelong friend; was the law-pupil of Levi Woodbury; came to the bar in 1827, and practised law with great success in Hillsborough and Concord, N. H.; was in Congress 1833–37; in the U. S. Senate 1837–42; was heartily in favor of the union of Texas with the U. S.; twice declined positions in the cabinet of Mr. Polk; became colonel 16th U. S. infantry 1846; brigadier-general 1847; served in the Mexican war; was president of the New Hampshire constitutional convention 1850–51; was chosen President of the U. S. in 1852 by 254 electoral votes to 42 for Gen. Scott, the Whig candidate. Mr. Pierce's administration was a period of great political excitement. Prominent among its events were the Gadsden Purchase, the repeal of the Missouri Compromise, the beginning of the troubles in Kansas (during which the President opposed by every means in his power the organization of a Free State government), and the publication of the Ostend Manifesto. Mr. Pierce was an ardent advocate of what is known as the State Rights doctrine, and during the war of 1861–65 sympathized with the Southern States. D. at Concord, N. H., Oct. 8, 1869.

Pierce (GEORGE EDMOND), D. D., b. at Southbury, Conn., Sept. 9, 1794; graduated at Yale 1816, and at Andover Seminary 1821; was ordained pastor of a Congregational church at Harwinton, Conn., 1822; president of Western Reserve College 1834–55. D. at Hudson, O., May 27, 1871.

Pierce (GEORGE FOSTER), D.D., son of Lovick, b. in Green co., Ga., Feb. 3, 1811; studied law with his uncle, Hon. Geo. Foster; in 1831 joined the Georgia conference of the M. E. Church; performed important pastoral work in prominent places in Georgia and South Carolina, and presided over literary institutions (Emory College for six years) till 1854, when he was made bishop; was a prominent member of the General Conference of 1844 in New York, when measures were adopted for the division of the Church; was also a member of the General Conferences of 1846, 1850, and 1854; is an excellent executive officer, a laborious and successful preacher, and a brilliant orator of national reputation; has published *Incidents of Western Travel* and several sermons, addresses, etc., one being *Devotedness to Christ*, a sermon on the death of Bishop Capers, his attached friend. Resides near Sparta, Ga. T. O. SUMMERS.

Pierce (JOHN), D. D., b. at Dorchester, Mass., July 14, 1773; graduated at Harvard 1793; was tutor there 1796; was ordained pastor of the First Congregational church at Brookline 1797; remained sole pastor for above half a century; was a member of the Academy of Arts and Sciences and of the Massachusetts Historical Society; president of the Massachusetts Bible Society, and had a prodigious knowledge of genealogy and antiquities, on which subjects he filled 18 large volumes of MS. with his memoranda. D. at Brookline Aug. 24, 1849. Author of a *Half-Century Discourse* (1847) and of a *Sketch of Brookline*, in the *Mass. Hist. Coll.* (2d series, vol. ii.).

Pierce (LOVICK), D. D., father of Bishop Pierce, b. in Halifax co., N. C., Mar. 24, 1785. Early in life his parents moved to Barnwell co., S. C., where, with only six months' previous schooling, he entered the Methodist ministry in 1804; in 1809 moved to Greene co., Ga.; during the war of 1812 was a chaplain in the army; studied medicine, and graduated at Philadelphia; went to Greensboro', where he practised medicine and preached for several years, but has more recently devoted himself to the ministry alone. A. H. STEPHENS.

Pierce (Rev. REDDICK), b. in North Carolina Sept. 26, 1782. With his brother Lovick, the great Georgia preacher, he joined the South Carolina conference (M. E.) in 1805; was a man of gigantic intellect, weighty and slow in speech; preached powerfully, even after he became so deaf that he could scarcely hear his own voice. D. in South Carolina July 24, 1860. T. O. SUMMERS.

Pierce City, p.-v., cap. of Shoshone co., Id., on Oro Fino River.

Pierce'ton, p.-v., Washington tp., Kosciusko co., Ind., on Pittsburg Chicago and Fort Wayne R. R. P. 1063.

Pier′mont, v., White Pine co., Nev. P. 18.

Piermont, p.-v. and tp., Grafton co., N. H., on Connecticut River. P. 792.

Piermont, p.-v., Orangetown tp., Rockland co., N. Y., on Hudson River, the E. terminus of a branch of Erie R. R. Derives its name from a pier 100 feet long, built by the Erie R. R. Co. P. 1703.

Pier′pont, p.-v. and tp., Ashtabula co., O. P. 990.

Pierpont (John), A. M., b. at Litchfield, Conn., Apr. 6, 1785; graduated at Yale 1804; was an instructor in Connecticut and South Carolina; studied law at Litchfield, and in 1812 became a lawyer of Newburyport, Mass.; was afterward partner in an unsuccessful mercantile business with John Neal, the novelist, in Boston and in Baltimore; was pastor of the Hollis street Unitarian church, Boston, 1819–45; held pastorates in Troy, N. Y., 1845–49, and in Medford, Mass., 1849–56; was for a time chaplain in the 22d Massachusetts regiment 1861, and was later employed in the treasury department, Washington, D. C., 1861–64. D. at Medford, Mass., Aug. 27, 1866. Author of *Airs of Palestine* (1816 and 1840), *Poems* (1854), and a series of reading-books for schools (the *Little Learner*, 1839), and prepared a valuable *Digest* of decisions and rules regarding the collection of customs. Mr. Pierpont was a leading anti-slavery and temperance orator and writer, and late in life became a Spiritualist.

Pierre′pont, p.-v. and tp., St. Lawrence co., N. Y., on Racket River. P. 2391.

Pierrepont (Edwards), b. in North Haven, Conn., Mar. 4, 1817; graduated at Yale College in 1837, and a year later was admitted to the bar; practised law at Columbus, O., till 1846, when he removed to New York City; in 1857 was elected a judge of the superior court of New York, resigning that position three years later; was engaged by the national government in 1867 to conduct its case against John H. Surratt, indicted for complicity in the murder of Pres. Lincoln; in 1869 was appointed by Pres. Grant U. S. district attorney for the southern district of New York, but resigned that office in May, 1870. In 1875 was appointed attorney-general of the U. S., minister to England in 1876, resigned in 1877. He has received the degree of LL.D. from Columbian College, Washington, and from Yale College. J. B. Bishop.

Pier′son, tp., Vigo co., Ind. P. 1489.

Pierson, p.-v. and tp., Montcalm co., Mich., on Grand Rapids and Indiana R. R. P. 755.

Pierson (Abraham), b. at Lynn, Mass., 1641; graduated at Harvard 1668; was ordained in 1672 at Newark, N. J., as colleague to his father, Rev. Abraham Pierson (1608–78); was Congregational pastor at Killingworth, Conn., 1694–1707, and was the first president of Yale College 1701–07. D. Mar. 5, 1707.

Pi′etists, in Germany, Christians who never formed a sect nor professed distinctive doctrines, but were noted for their preference of practical religion. The first writers of importance who assumed this ground were Johann Arndt (*Vom wahren Christenthum*, 1605) and Johann V. Andreæ (*Invitatio Fraternitatis Christi*, 1617). The term was first applied in derision to a number of teachers at Leipsic in 1689, chief among whom was A. H. Francke, and was soon afterward employed chiefly as a designation of the followers of Philipp Jakob Spener. The combined influence of Spener and Francke led to the foundation of the University of Halle, which became a centre of the pietistic movement. The rationalism of the close of the eighteenth and beginning of the nineteenth century operated adversely to pietism, but since the overthrow of rationalism by the Straussian school, pietism has largely revived in Germany, its centres being Berlin, Silesia, and Würtemberg.

Pie′tra Du′ra [It. for "hard stone"], a name applied to the better kinds of cameo and Mosaic-work (which see).

Pietragal′la, town of Southern Italy, province of Potenza, in a mountainous but very fertile district. Oil of the best quality is produced in abundance, and the sulphur-mines are very rich. The neighborhood is also famous for its honey. P. in 1874, 5850.

Pietraper′zia, town of Sicily, province of Caltanisetta, in a mountainous district abounding in grain, almonds, pistachios, sulphur, plaster of Paris, lapis-lazuli, etc. N. of the town stands a grandiose old castle, interesting for its various styles of mediæval architecture and for its internal decorations, with inscriptions in the Sicilian dialect. P. in 1874, 10,150.

Pietrasan′ta, town of Central Italy, province of Lucca, situated on a hill about 2 miles from the Mediterranean and 20 N. W. of the city of Lucca. It is surrounded by a castellated wall with a strong citadel, and is entered by three gates, one of which opens almost directly upon the principal square, and here the noteworthy buildings are the Pretorio and the Palazzo Comunale. The streets are broad, straight, and well paved, and most of the churches and houses appear to have been built in the fourteenth and fifteenth centuries. The neighboring country, partly hill and partly plain, is in the highest degree fertile, producing the vine and olive in great luxuriance. Pietrasanta is the chief point from which the Serravezza marble is transported to market. P. in 1874, 13,227.

Piëzom′eter [Gr. πιέζειν, to "press," and μέτρον, a "measure"], an instrument for the measuring of the compression of water and of other fluids under pressure. The first successful piëzometer was that of Oersted, in which the pressure was gauged by the manometer, and the amount of compression of the water was indicated by the use of mercury in a glass tube. Regnault's piëzometer is in principle the same, but it also takes into account the expansion of the tubes under pressure, and consequently gives more accurate results.

Pig′eon [Fr.], a name applied primarily to the *Columbia livia* in its wild as well as domesticated races, and secondarily extended to all the species of the family Columbidæ. The *Columbia livia*, in its wild state, is an inhabitant of almost the entire extent of Europe. It belongs to a section of the genus in which the tarsi are as long as the middle toe. The wings are black at their outer margin, and have a black spot at the extremity of the secondaries, and a second on the great coverts; the rump is ashy; the tail is of a bluish ash at its basal two-thirds, black at its posterior third, with the lateral feathers at their basal half white externally. The length from tip of bill to end of tail is about fifteen inches, and the spread of wings nearly twenty-seven; the weight is about fourteen or fifteen ounces; the beak is about three-quarters of an inch long; the feet at middle toe about two and three-quarter inches long. Such are the characters of the wild pigeon, which is the stock from which have originated the numerous varieties of domesticated breeds. These have diverged in various degrees from the parent race, as many as 250 or even more, radiating in different directions and to diverse extents, being now existent. The principal features of the wild stock having been given, the consideration of the diverging races may be considered in the order of their specialization, but under the categories admitted by Darwin. Eleven distinct races (including many sub-races and minor varieties) have been recognized by that naturalist, distinguished by the following peculiarities—viz. (1) Essentially resembling in structure the wild form. (2) Tuft of feathers at the base of the bill curling forward; feet much feathered; voice very peculiar: trumpeter. (3) Feathers of the neck forming a hood; wings and tail long; bill moderately short: jacobin. (4) Feathers reversed and bill very short: Indian frill-back. (5) Bill generally short (sometimes excessively short and conical). The birds during flight tumble backward: tumbler. (6) Feathers divergent along the front of the neck and breast, and bill very short: turbit and owl. (7) Tail (generally with many feathers) expanded and carried upward: fantails. (8) Bill short, broad, and deep; naked skin round the eyes broad and coruncolated, and skin over nostrils slightly swollen: barbs. (9) Bill long and massive, and body of great size: runts. (10) Bill elongated, narrow, and pointed; much naked skin round the eyes, and generally coruncolated; neck and body elongated: carriers. (11) Œsophagus much enlarged and very distensible, and body and legs elongated: pouters. Mr. Darwin has further combined these as follows: the 1st and 2d in one group; the 3d to 7th in a second; the 8th to 10th in a third; and the 11th in a fourth. (See also Columbidæ.) Theodore Gill.

Pigeon, tp., Vanderburg co., Ind. P., exclusive of city of Evansville, 875.

Pigeon, tp., Warrick co., Ind. P. 1646.

Pigeon Berry, a name applied to the poke or Garget-root (which see).

Pigeon Cove, p.-v., Rockport tp., Essex co., Mass., on the Atlantic coast, is a picturesque spot recently become popular as a watering-place, and furnished the granite for the new post-office at Boston.

Pigeon English [from the Chinese mode of pronouncing the word *business*], an extraordinary and grotesque artificial dialect employed in the commercial cities of China as the medium of communication between foreign merchants and the Chinese. Its base is English, with a mixture of Portuguese and Hindostanee. It consists of but few words, chiefly nouns and verbs, without grammar or inflections other than a termination in *ee*, which is common to most verbs. It is never employed in print, or even in writing, but is taught in some Chinese schools; and though intrinsically a ridiculous and silly expedient, which

should be replaced by a correct use either of English or of Chinese, is still employed in all the business transactions of foreign merchants with the natives of China.

Pigeon (**Gyro**), an instrument patented in the U. S. in 1872, consisting of an apparatus for imitating the movements of pigeons when released from a trap, and recommended on humanitarian grounds as a substitute for pigeons in shooting-matches.

Pigeon Hill, p.-v. and tp., Union co., Ark. P. 236.

Pigeon Pea, a name applied to the pea-like pulse grown upon the leguminous shrubs *Cajanus flavus* and *bicolor*, which are extensively cultivated in many tropical countries, where they are highly valued. The better sorts are very palatable substitutes for the pea.

Pigeon River, p.-v. and tp., Lake co., Minn. P. 16.

Pigg River, tp., Pittsylvania co., Va. P. 2686.

Pig'ments, the coloring-matters which when mixed with oil, water, or gum form paint. They are either mineral or extracted from organic matter. (See PAINT, by PROF. C. F. CHANDLER, PH. D., LL.D.)

Pignerol. See PINEROLO.

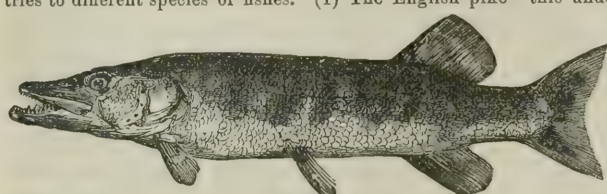
Pignot'ti (LORENZO), b. in 1739 at Figline, Italy; for awhile taught rhetoric at Arezzo, studied medicine at Pisa, and commenced practice in Florence. The University of Pisa then appointed him professor, and the grand duke afterwards made him his own historiographer. Pignotti published in 1813, in 9 vols., his *Storia della Toscana sino al Principato*, a well-written work, but wanting in critical ability. His *Favole*, in verse, do him much more honor. They have been often reprinted, and he has sometimes been called the "Tuscan La Fontaine." D. 1812.

Pignut. See HICKORY.

Pigweed. See CHENOPODIUM.

Pika, a name sometimes applied to the tailless hares, or LAGOMYIDÆ (which see).

Pike, a name applied in the English-speaking countries to different species of fishes. (1) The English pike



The Pike.

(*Esox lucius*) has been supposed to have been "so called either from the likeness of its nose to a pike or spear, or because it moves itself in the water like a spear thrown" (*Richardson*); or with greater probability because of the pointed or pike-like teeth. In the U. S. it is applied to the same or closely-related species (*Esox estor*), and in some places to the smaller species of the same genus—*e. g. Esox reticulatus*, *Esox niger* or *gasciatus*, etc. These are, however, generally called pickerel. The *Esox nobilior* is in most sections distinguished under the name muskellunge. All the species agree in the form familiar to most persons from personal acquaintance with some one or other of the species, or from the illustrations in angling books, and differ chiefly in the comparative length of the snout, the extension of scales on the cheeks and operculæ, the number of rays in the dorsal and anal fins, and color. The name "pike," either alone or in combination, is also perverted to species very different from those just considered. In some parts of the U. S., *e. g.*, the species of *Stizostedion* or *Lucioperca* (a genus closely related to *Perca* or the perches) are called walled-eyed pike, or simply pike. The species of *Centropomus*, a genus of fishes peculiar to the tropical American seas, are called sea-pike. (See ESOCIDÆ in APPENDIX.) THEODORE GILL.

Pike, county of S. E. Alabama. Area, 750 sq. m. It is a part of the great pine forest of the State, and has a sandy but very productive soil. Live-stock, cotton, and corn are leading products. Cap. Troy. P. 17,423.

Pike, county of S. W. Arkansas. Area, 650 sq. m. It is hilly and broken in the N., and generally level in the S. The county has great water-power, abundant and varied mineral wealth, is well timbered, and has a fertile soil. Live-stock, corn, and cotton are leading products. Cap. Murfreesborough. P. 3788.

Pike, county of Central Georgia. Area, 375 sq. m. It is uneven, generally fertile, and has beds of iron ore. Cotton and corn are leading products. Flint River bounds the county on the W. It is traversed by Macon and Western R. R. Cap. Zebulon. P. 10,905.

Pike, county of Illinois, bounded S. W. by Mississippi River and E. by Illinois River. Area, 750 sq. m. It is highly fertile, and contains beds of coal. Live-stock, grain, and wool are leading products. The county has manufactures of carriages, cooperage, flour, etc. It is traversed by several railroads. Cap. Pittsfield. P. 30,768.

Pike, county of S. W. Indiana, bounded N. by White River. Area, 300 sq. m. It is nearly level or slightly rolling, very fertile, and contains good coal. Tobacco, live-stock, grain, and wool are leading products. Cap. Petersburg. P. 13,779.

Pike, county of Kentucky, bounded S. E. by Virginia. Area, 300 sq. m. It is mountainous, with fertile valleys. Bituminous coal and iron ore abound. Live-stock and corn are leading products. The county is traversed by tributaries of Big Sandy. Cap. Piketon. P. 9562.

Pike, county of S. Mississippi, bounded S. by Louisiana. Area, 750 sq. m., level and highly fertile. Cotton and corn are leading products. It is traversed by affluents of Pearl River and by New Orleans Jackson and Great Northern R. R. Cap. Magnolia. P. 11,303.

Pike, county of N. E. Missouri. Area, 600 sq. m. Separated from Illinois by Mississippi River; somewhat uneven, well timbered, and with fertile limestone soil. Live-stock, wool, tobacco, and grain are staple products. Coal is found. Carriages and wagons are leading articles of manufacture. It is traversed by Chicago and Alton R. R. Cap. Bowling Green. P. 23,076.

Pike, county of S. Ohio. Area, 400 sq. m., hilly and fertile. Live-stock, grain, tobacco, wool, and lumber are leading products. It is traversed by Scioto River and Ohio and Erie Canal. Cap. Waverly. P. 15,447.

Pike, county of E. Pennsylvania, bounded E. by Delaware River, which separates it from New York and New Jersey. Area, 620 sq. m., uneven, and in parts hilly and elevated. Much of its surface is a wilderness covered with forests of beech, oak, hemlock, etc. A large part of this undeveloped tract is, after clearing, finely adapted to raising oats and hay and to sheep-pasturage. Lumber and leather are the leading products. It is traversed by Erie R. R. Cap. Milford. P. 8436.

Pike, tp., Livingston co., Ill. P. 847.

Pike, v., Atlas tp., Pike co., Ill., on Mississippi River, opposite Louisiana, Mo., at the junction of Chicago and Alton with Quincy Alton and St. Louis R. R.

Pike, tp., Jay co., Ind. P. 1585.

Pike, tp., Marion co., Ind. P. 2206.

Pike, tp., Ohio co., Ind. P. 921.

Pike, tp., Warren co., Ind. P. 941.

Pike, tp., Muscatine co., Ia. P. 740.

Pike, tp., Lyon co., Kan. Pop. 693.

Pike, tp., Stoddard co., Mo. P. 1421.

Pike, p.-v. and tp., Wyoming co., N. Y., contains a seminary, a bank, 3 churches, 3 factories, and 2 mills. P. of v. 551; of tp. 1730.

Pike, tp., Brown co., O. P. 1314.

Pike, tp., Clark co., O. P. 1582.

Pike, tp., Coshocton co., O. P. 773.

Pike, tp., Fulton co., O. P. 878.

Pike, tp., Knox co., O. P. 1301.

Pike, tp., Madison co., O. P. 394.

Pike, tp., Perry co., O. P. 2319.

Pike, p.-v., Pike co., O.

Pike, tp., Stark co., O. P. 1333.

Pike, tp., Berks co., Pa. P. 925.

Pike, tp., Bradford co., Pa. P. 1814.

Pike, tp., Clearfield co., Pa. P. 1138.

Pike, tp., Potter co., Pa. P. 184.

Pike (ALBERT), M. A., b. at Boston, Mass., Dec. 29, 1809, was the son of a poor shoemaker, who removed during Albert's early childhood to Newburyport; the son became a teacher, and studied at Harvard University, where he afterwards received the degree of M. A.; went in 1831 to Santa Fé, N. M., by way of St. Louis, going much of the way on foot; reached Fort Smith, Ark., in 1832 in a destitute state; was a journalist at Little Rock 1834–36, after which he became a successful lawyer and a prominent States Rights politician; served as a captain of Arkansas cavalry in Mexico; was brigadier-general in the Confederate service during the civil war; editor of *Memphis Appeal* 1867–68; author of *Prose Sketches and*

Poems (1834), 5 vols. of *Law Reports* (1840–45), *The Arkansas Form-Book* (1845), *Nugæ* (poems, 1854), a romance (1835), a volume of Masonic statutes and regulations (1859), *Morals and Dogma of Freemasonry* (1870), besides fugitive pieces in prose and verse; has thoroughly studied the origin and rituals of Freemasonry, and its connection with ancient mysteries and religion; and has been for years the head of the Ancient Accepted rite in the South.

Pike (Mrs. Mary H. **Greene**), b. at Eastport, Me., in 1827; married Mr. F. A. Pike, member of Congress from Maine 1861–69; published in 1854, under the *nom de plume* of "Mary Langdon," an anti-slavery novel, *Ida May, a Story of Things Actual and Possible*, of which 60,000 copies were sold within four years. The authoress obtained her knowledge of slavery during a residence for health at Aiken, S. C. She has since published other novels—*Caste, a Story of Republican Equality* (1856), *Agnes* (1858), *Bond and Free* (1858), *Entanglements* (1863), *Cumworth House* (1864), *The Cypresses* (1865), and *My Son's Wife* (Philadelphia, 1868)—and has contributed to the *Atlantic*, *Harper's*, and other magazines. Most of her recent works were published in London, where they were favorably noticed by the critical journals.

Pike (Zebulon Montgomery), b. at Lamberton, N. J., Jan. 5, 1779, son of a captain in the U. S. army; became a cadet in his father's regiment; was soon promoted to lieutenant; was appointed, on account of his skill in languages and mathematics, to conduct surveys of various parts of the newly-acquired territory of Louisiana; penetrated to the head-waters of the Mississippi in the autumn of 1805, and in the following year was charged with an exploration of the interior of Louisiana, in the course of which he discovered Pike's Peak in the Rocky Mountains and reached the Rio Grande; was detained by Spanish authorities, taken to Santa Fé for examination, and his papers seized. Being ultimately released, he arrived at Natchitoches July 1, 1807, received the thanks of the government for his services, was rapidly promoted, published in 1810 an account of his two expeditions, became brigadier-general 1813, and commanded the expedition sent against York (now Toronto), Canada, in the assault of which place he was killed, Apr. 27, 1813. (See his *Life*, by H. Whiting, in Sparks's *American Biography*, 2d series, vol. v.)

Pike Creek, tp., Shannon co., Mo. P. 155.

Pike's Peak, a summit of the Rocky Mountains, in El Paso co., Col., is 14,336 feet in height above the sea. It is 10 miles S. W. of Manitou, and from its summit there is a most noble prospect. The ascent is quite difficult. It is nearly in lat. 39° N., lon. 105 W., and received its name in honor of Gen. Z. M. Pike, who discovered it in 1806.

Pikes'ville, p.-v., Baltimore co., Md.

Pike'ton, p.-v., cap. of Pike co., Ky., on the W. fork of Big Sandy River.

Piketon, p.-v., Seal tp., Pike co., O., on Scioto River. P. 638.

Pike'ville, p.-v., cap. of Marion co., Ala., on Battahatchie River.

Pikeville, p.-v., Lockhart tp., Pike co., Ind.

Pikeville, v., Pike co., Ky. P. 140.

Pikeville, p.-v., Wayne co., N. C. P. 1720.

Pikeville, p.-v., Greenville tp., Darke co., O. P. 356.

Pikeville, p.-v., cap. of Bledsoe co., Tenn. P. 188.

Pilas'ter [Lat. *pila*, a "pillar"], a square pillar, usually attached to the wall, from which it often stands out but little. It sometimes has the taper of a column, and is sometimes of equal breadth from top to bottom. Its base and capital conform to those of the pillars or columns. The name pilaster is also given to the column of rough brick or stone standing on the inside of a wall, and designed to sustain the end of a sleeper for the floor above.

Pi'late (Pontius), the sixth Roman procurator of Judæa and Samaria (ἡγεμών in the Gospels; ἐπίτροπος with Philo Judæus; *procurator* with Tacitus; *governor* in King James's translation); entered his office in 25 or 26 A. D., residing partly in Cæsarea, partly in Jerusalem, where he inhabited the magnificent palace built by Herod the Great. In 36 he was arraigned by the Samaritans before the Syrian proconsul, Vitellius, on account of his unjust and cruel government, and Vitellius sent him to Rome to answer the accusations before the emperor. The issue is not known with certainty. According to Eusebius, he was banished to Vienne in Gaul, and committed suicide in 38. According to a widely-spread tradition, he was beheaded under Nero. A great number of legends, more or less fanciful, clustered naturally around his name. His singular behavior during the trial of Christ, as we read it in the Bible, excited from the earliest time a most vivid interest, and occasioned very different explanations. Tertullian calls him *jam pro sua conscientia Christianum*, and the Æthiopian Church declared him a martyr and a saint. Modern scholars, however, agree generally in considering him one of those frivolous characters which were the natural offspring of the Roman civilization in the Augustan period—by no means incapable of receiving a strong impression of the sublime, but utterly unable to act on such an impression. And the cruel massacre of the Samaritans at Gerizim, the nearest cause of his downfall, is not inconsistent with that kind of weakness of character which rises from moral indifference. The so-called *Acta Pilati* are spurious, but it is not improbable that he addressed a report of the trial of Christ to the emperor.

Pilat'ka, p.-v., cap. of Putnam co., Fla., on St. John's River, 30 miles S. W. of St. Augustine, has 1 weekly newspaper, and is situated in a fine sugar and cotton region. P. 720.

Pilchard. See Clupeidæ.

Pilcomay'o, a river of South America, is formed in lat. 21° 35′ S. by the junction of two streams, which both rise in the Bolivian Andes, the one near Potosi, the other near Chuquisaca. It flows S. E. through the territories of the Argentine Republic, and joins the Paraguay a few miles below Asuncion, after a course of about 1200 miles. It has yet not been thoroughly explored.

Pile (William A.), b. near Indianapolis, Ind., Feb. 11, 1829; became a Methodist preacher of Missouri; chaplain of a volunteer regiment 1861; captain of artillery 1862; colonel of infantry volunteers 1862; brigadier-general of volunteers 1863, serving with distinction to the end of the war; was chosen to Congress in 1866 from Missouri, and afterward became U. S. minister to Venezuela.

Piles, in engineering. See Bridge and Foundation.

Piles, or **Hæmorrhoids** [Gr. αἷμα, "blood," and ῥέειν, to "flow"], vascular and fibro-vascular tumors of the lower bowel or rectum—termed *external* piles when below the sphincter muscle and upon the verge of the anus; *internal* piles when above the sphincter. In structure they are due to congestion of the hæmorrhoidal veins, which are a part of the portal venous circulation, returning blood from the intestines through the portal vein and liver to the vena cava and the heart. Piles when chronic are varicose veins of the anus and rectum, with fibrous thickening of the tissues and mucous membrane investing them. Piles seldom afflict persons who are robust, abstemious, frugal, and engaged in active exercise. They result from excessive eating and drinking, congestion of the liver, alcoholic excesses, and constipation and costiveness. Sedentary occupation favors their development. Cavalry officers and railway travellers suffer from piles—in part from constipation, in part from the influence of incessant jarring and hypostatic congestion of the lower bowel. The abuse of harsh and powerful cathartics, drinking water impregnated with mineral substances, and too fine, non-laxative diet may develop piles. Pregnant women have piles from pressure of the gravid uterus upon the veins. Piles are often the result of overheated blood and plethora, and hence are a frequent disease in tropical countries and very hot seasons. Internal piles may increase in size, and in efforts of evacuation be protruded from the bowel. By this stretching the hæmorrhoidal tumors in time become pedunculated, and are forced out with every act of defecation. They require to be constantly returned: failure to do this may result in their strangulation, ulceration, bleeding, and even removal by gangrene. External piles when inflamed may also ulcerate and bleed. Hæmorrhoids when inflamed render evacuations of the bowels very painful, and cause suffering in sitting and walking. Patients with hæmorrhoids usually discharge mucus from the anus, and sometimes shreds and patches of organized lymph. They are to be prevented, and also treated in their milder forms and stages, by regulated, laxative diet, active exercise, and mild saline cathartics. When pedunculated they may be removed by the knife, ligature, or galvano-cautery. When piles are strangulated they must be reduced in size by ice or cold water, oiled, and returned. Ulcerated and inflamed piles are treated by cold applications, astringent and anodyne ointments, and free evacuation of watery stools by use of saline cathartics.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Piles'grove, tp., Salem co., N. J. Pop. 3385.

Pill [Lat. *pilula*], a spherical solid pharmaceutical preparation, smaller than the bolus and larger than the granule. Pills are convenient and easy of administration, especially when coated with sugar or isinglass in such a way as to conceal the taste of the drugs employed. Most pills contain, besides the active medicinal elements, one called the vehicle or excipient, which is commonly but not always inert.

Pillar. See COLUMN.

Pillar Saints, in the Eastern Church, chiefly in Syria, a class of ascetics who dwelt each on the top of a lofty pillar, after the example of ST. SIMEON STYLITES (which see). The practice began to prevail in the fourth century, and in the twelfth was not yet extinct.

Pillars of Hercules. See GIBRALTAR.

Pil'lau, the port of KÖNIGSBERG (which see), on the Baltic, at the entrance of the Frische Haff, fortified, and has 2909 inhabitants.

Pil'lory [Fr. *pilori*, from *pilier*, a "pillar"], an instrument of punishment, consisting of a wooden frame in which the offender's head and arms were inserted, he being then left exposed to public ridicule. Something of the kind existed in England previous to the Norman Conquest, and was known as the *halsfang*, or catch-neck. From the reign of Henry III., and especially during the sixteenth, seventeenth, and eighteenth centuries, the pillory was a statute punishment for perjurers, forgers, users of false weights, etc., and was not altogether abolished until 1837. In France a similar implement, called the *carcan*, was in use until 1832. The pillory existed on the statute-books of the U. S. until 1839, but it seems to have been rarely if ever employed.

Pil'low (GIDEON JOHNSON), b. in Williamson co., Tenn., June 8, 1806; graduated at the University of Nashville 1827; studied law; practised successfully at Columbia; was a delegate to the national Democratic convention of 1844, where he was influential in securing the nomination of James K. Polk for the Presidency; was appointed brigadier-general of Tennessee volunteers July 13, 1846; was at first with Gen. Taylor on the Mexican frontier, afterward joined Gen. Scott at Vera Cruz; took a prominent part in the siege of that city; was one of the commissioners to receive its surrender; commanded the right wing at the battle of Cerro Gordo, where he was wounded; was made major-general Apr. 13, 1847; took part in the battles of Churubusco, Molino del Rey, and Chapultepec, being severely wounded in the latter; came into collision with Gen. Scott in regard to the convention of Tacubaya, which he disapproved, and at his own request was tried by a military court upon charges of insubordination preferred by Gen. Scott, but was honorably acquitted; resumed the practice of law in Tennessee; was a member of the Nashville convention of 1850, where he opposed extreme measures; raised a large force of Tennessee volunteers for the Confederate service in 1861; was appointed major-general; commanded at the battle of Belmont, Nov. 7, 1861; was second in command at Fort Donelson in February; refused to take the chief command; escaped before the surrender, and afterward served under Gen. Beauregard in the S. W.

Pi'lot [Fr. *pilote*]. Pilots in the early days of navigation were assistants selected by the master, on account of their knowledge of seamanship and navigation, to advise with him on the management and keep the reckoning of the vessel. In the first voyage of Columbus the first day out a reckoning was ordered to be kept; on Sept. 10, four days out, Columbus's journal says "two reckonings kept;" Oct. 1, the admiral (Columbus) compares reckoning with his pilot, by which it appears the pilot was 580 leagues from Hierro. The admiral acknowledged 584, but his private reckoning was 707. In modern times pilots are trained to special duties, those of guiding vessels entering and departing from ports where the navigation is difficult and dangerous. Hence, all maritime countries have endeavored to maintain their efficiency by affording to them means of instruction and by punishing them for misconduct or incapacity. For these purposes, and for securing reciprocal benefits to shipowners, most systems of maritime law have made their employment compulsory. The duty of a pilot, as soon as he boards a vessel at sea, is to report himself to the master, and make inquiries as to the anchors and cables, to see that he has a leadsman at hand with his lead (in a large vessel, two), and that the signal-lights are ready for use. He should inform the master when he is ready to direct the piloting of the vessel, which, if the master wishes, may be as soon as he gets on board; but the New York pilot commissioners prefer that the master keep control until within 15 miles of Sandy Hook lighthouse, as the Sandy Hook pilots often board vessels 350 miles from that light, and the masters are supposed to be better navigators and know the qualities of their vessels better than the pilots do. If the master does not give up the control of the vessel at once, the pilot should place himself near the man at the wheel to see how the vessel minds her helm, steams or sails, and be ready to co-operate with the master in any advice or assistance which may be asked of him until he takes the direction of the vessel. But the master is in no case relieved of his command until the voyage is completed. His responsibility continues even after the pilot has taken the direction of the vessel. The duty of a pilot, strictly, is to keep her in the channel-way and conduct her safely to her anchorage or dock. It is not only proper, but necessary, that a pilot should be a good seaman, but the management of the vessel, whether moved by steam or sails, belongs to the master. He takes the orders from the pilot whether to go fast or slow, if under steam—if under canvas, to make or take in sail—and sees that they are executed. It is considered "a valid offer of service" on the part of a pilot that he hail the vessel when the pilot-boat is so near that the hail was heard on board of the vessel, or might have been if there had been a proper lookout kept. The pilot should always be informed by the master whether he is required to stay on board of the vessel after being anchored, to prevent dispute. The liability of pilots for their acts in a pecuniary point of view has not been settled in this country. The English law limits their responsibility to the amount of their bond. The New York pilot commissioners punish them by taking away their licenses and mulcting the pilotage. The Law of Oléron allowed the seaman or master to strike off the head of the pilot if he lost or even perilled the ship, providing he could not pay for her. The Danish law allowed him to be keelhauled thrice. The English law on the subject of responsibility is, that "no master or owner of any ship is to be answerable to any person whatever for any damage done by the fault or incapacity of any qualified pilot in charge of his ship within any district where the employment of such pilot is compulsory." The U. S. Supreme Court, in the case of the steamship China, has decided that the owner of the vessel in fault is liable for damages, although there was a licensed pilot on board at the time of the collision; also, that the taking of a pilot is compulsory. A master refusing to take a licensed pilot vitiates the insurance on the vessel, and makes himself and owners responsible for any loss to the owners of goods on board of the vessel which may be caused by this refusal. In the U. S. the States regulate the laws of pilotage by the acts of Congress of 1789, of 1837, and of 1866; in Great Britain by acts of Parliament.

A comparison of the pilots between the two greatest ports in the world is appended:

1873.	Liverpool.	New York.	New Jersey.
Number of pilots..........	270	176	43
Vessels piloted..............	17,186	10,307	2388
Accidents....................	106	29	
" investigated..	40	5	
Pilots punished............	7	4	2

GEORGE W. BLUNT.

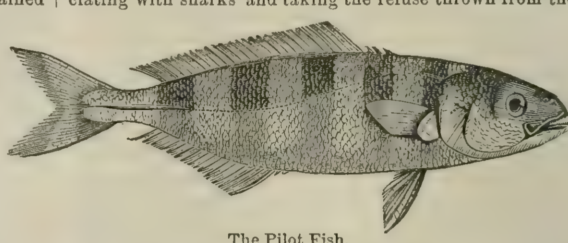
Pilot, tp., Kankakee co., Ill. P. 1140.

Pilot, p.-v. and tp., Vermilion co., Ill. P. 1332.

Pilot, tp., Iowa co., Ia. P. 623.

Pilot, tp., Surry co., N. C. P. 1311.

Pilot Fish, or **Pilot,** a name given because the fish in question was formerly supposed to act as a pilot to the mariner, and is still supposed to act as such to sharks; it is applied to certain carangoid fishes of the genus *Naucrates.* These are found in almost all tropical and temperate seas, and often follow in the wake of vessels, associating with sharks and taking the refuse thrown from the



The Pilot Fish.

ships. They are elongated, symmetrical, fusiform fishes of graceful form and with seven cross-bands of black, which, however, in part disappear in after life. They are remarkable for the changes which they undergo, and which have given rise to numerous nominal species. Thus, (1) in the very young a well-developed spinous dorsal fin of three to six spines exists, and the preoperculum is armed with large radiating spines; and to this stage the name *Nauclerus* has been given. (2) At a later period, but while the spinous dorsal fin still persists, the preoperculum loses in spines, and the form has been then confounded with the genus *Seriola* under the names *S. Dussumieri* and *S. succincta.* (3) Finally, the dorsal spines cease to grow, and the mem-

brane is almost lost, while the preoperculum has a perfectly entire margin, and thus the fish assumes the form of *Naucrates.* The common, and possibly the only distinguishable, species of *Naucrates* is *N. ductor.* It is rarely seen much more than a foot long. THEODORE GILL.

Pilot Grove, tp., Hancock co., Ill. P. 1217.

Pilot Grove, p.-v. and tp., Faribault co., Minn. P. 390.

Pilot Grove, p.-v. and tp., Cooper co., Mo. P. 1086.

Pilot Grove, tp., Moniteau co., Mo. Pop. 1024.

Pilot Knob, p.-v., Iron co., Mo., on Arkansas branch of St. Louis and Iron Mountain R. R., situated at the base of the celebrated Pilot Knob Mountain, much of which consists of iron ore.

Pilot Mound, p.-v. and tp., Boone co., Ia., on Des Moines River. P. 747.

Pilot Mound, p.-v. and tp., Fillmore co., Minn., on Root River. P. 945.

Pilot Mountain. See ARARAT.

Pilot Point, p.-v., Denton co., Tex.

Pilot Rock, tp., Johnson co., Ark. P. 164.

Pilot Rock, p.-v. and tp., Cherokee co., Ia., on Little Sioux River and Dubuque and Sioux City R. R. P. 280.

Pilpay. See PANCHATANTRA.

Pil'sen, town of Bohemia, at the confluence of the Mies and the Beraun, is surrounded with walls, and has good educational institutions, large breweries, manufactures of leather and pottery, and four annual fairs, which are much attended. P. 23,681.

Pim (BEDFORD CLAPPERTON TREVYLIAN), b. at Bideford, Devonshire, England, June 12, 1826; was educated at the Royal Naval School; went to India in the merchant service; was appointed on his return a volunteer of the first class in the navy; was employed for some years in coast survey duty; made a voyage round the world in H. M. S. Herald 1845–51; was engaged in the search for Sir John Franklin, both in Behring's Strait and in Baffin's Bay; saved the crew of the Investigator; was the first officer who passed from a ship on the eastern to a ship on the western side of the N. W. passage; saw active service in the Crimea and in China, where he received six wounds; became a commander in the British navy Apr. 19, 1858; visited the Isthmus of Suez and studied the question of an interoceanic canal 1859; was sent to the West Indies, and afterward to Western Africa, in command of the Gorgon; retired on half-pay 1861; visited Nicaragua 1862, in company with Dr. Berthold Seemann; devoted himself for several years to the project of an interoceanic communication across Nicaragua, and to the promotion of gold-mining in the same republic; wrote *The Gate of the Pacific* (1863) and (in connection with the late Dr. Seemann) *Dottings on the Roadside in Panama, Nicaragua, and Mosquito* (1869); was imprisoned and put in irons in Paris on a charge of fraud in connection with a loan to one of the Central American states, but soon obtained his discharge; was made captain Apr. 16, 1868; placed on the retired list Apr., 1870; was admitted to the bar at the Inner Temple Jan. 27, 1873, and was chosen to Parliament as a Conservative for the borough of Gravesend at the general election of Feb., 1874. Author of numerous geographical pamphlets, of an *Essay on Feudal Tenures,* and a history of the late Franco-German War, *The War Chronicle* (1837). Capt. Pim is a magistrate for the county of Middlesex, a member of several scientific societies, and proprietor of a newspaper called *The Navy,* devoted exclusively to the maritime interests of Great Britain.

Pi'ma, county of S. E. Arizona. Area, 28,000 sq. m. It is traversed by numerous mountain-ranges and has a very dry climate. The soil when irrigated is usually very fertile. Mining and cattle and wool raising are the leading pursuits. The county is bounded N. by Gila River, E. by New Mexico, and S. by Mexico. Cap. Tucson. P. 5716.

Pimas, or **Névomes,** a nation of agricultural and non-nomadic Indians of Arizona, called by themselves *Ohotama,* classed by H. H. Bancroft along with the Maricopas and Pápagos in the Pueblo family of the New Mexican group. Dr. J. G. Shea connects them, on the evidence of language, with the Opatas, Eudeves, and Joves of the Mexican states of Sonora and Sinaloa. The whole region, from the Gila River southward to the Yaqui River (Sonora), was known to the Spaniards as the Pimeria, and divided into Alta and Baja ("upper" and "lower"), the latter being that now occupied by the Opatas and their allied tribes. The Pimas were subdivided into a multitude of bands, to which specific names were given by the Mexican missionaries, but they seem to have rested upon no ethnological evidence. Missions were begun among the Pimas proper in the seventeenth century, and at the close of the eighteenth century they had 22 towns with 8 missions. They now occupy, along with the Maricopas, a reservation of 64,000 acres on both sides of the Gila River, from Maricopa Wells to Sacaton, in Pima and Maricopa counties, set apart for them in accordance with the act of Feb. 28, 1859. They are tall, bony, and well formed, are fond of athletic games, wear cotton blankets of their own manufacture, live in villages of dome-shaped huts, and wage a perpetual warfare against the Apaches. They cultivate the soil by means of irrigation, are skilful in weaving, in basket and boat making, and have a rude kind of pottery. They are much addicted to intemperance, and have many curious superstitions, one of them being a purification of sixteen days after having killed an enemy. They now number about 4000, and are under the religious influence of the Reformed (German) Church. A grammar of the Pima or Névome language (which is totally different from the Maricopa), by Buckingham Smith, was published in New York in 1862. (See *The Native Races of the Pacific States,* by H. H. Bancroft, vol. i., 1874.) PORTER C. BLISS.

Pimelepter'idæ [Gr. πιμελή, "fat" or "thick," and πτερόν, "a fin"], a family of fishes of the order Teleocephali and sub-order Acanthopteri. The body is compressed, and more or less oval and symmetrical, the outlines being correspondingly developed above and below the median axis; the scales are rather small; the lateral line entire; the head rounded forward; the opercula generally armed—*i. e.* preoperculum serrated and operculum with spines; mouth with an oblique lateral cleft; upper jaw moderately protractile; teeth compressed, and forming a more or less cutting edge; branchial apertures continuous below; branchiostegal rays seven; dorsal and anal fins with their soft parts opposite each other, and thick with scales; dorsal spines rather numerous, 10–12 (?); caudal separate from dorsal; pectorals with branched rays; ventrals thoracic, each with one spine and five soft rays; the skeleton has the normal or nearly normal number of vertebræ (9–10 + 14–16); the pyloric cæca are developed in great number. The species of the family are generally readily recognizable by their symmetrical outline, scaly fins, and trenchant teeth, and may be distributed among at least three subfamilies—Pimelepterinæ, Girellinæ, and Scorpidinæ; these are mostly inhabitants of the tropical or warm seas; one species (*Pimelepterus Boscii*) ascends northward to the Atlantic coast of the U. S. THEODORE GILL.

Piment'a, or **Pimento** [Sp. *pimiento*], the unripe berries of *Eugenia pimenta,* a handsome evergreen tree of the natural order Myrtaceæ, growing throughout the West Indies and in Mexico and South America. The name is a corruption of *pimiento,* the Spanish for "pepper." The fruit is a small globular berry, rather less than a third of an inch in diameter; it is two-celled, each cell containing a single black kidney-shaped seed. The active principles are a volatile oil, contained in the proportion of from 3 to 4 per cent., and a green fixed oil. Both of these occur in largest proportion in the cortical portion of the fruit. Pimenta has a warm, pungent, aromatic taste, and may be used in medicine for the general purposes of the aromatic spices—namely, as stomachics, to improve digestive power, to allay nausea, and correct the nauseating and griping effects of other medicines. But its most common use is as a spice in cookery, for which it is largely consumed under the name of "allspice" or "Jamaica pepper." It is obtained in commerce from the island of Jamaica. EDWARD CURTIS.

Pim'pernel, or **Poor Man's Weather-glass,** the *Anagallis arvensis,* a common herb of Europe, naturalized in North America, having rather handsome flowers, most commonly scarlet, but often white or blue. It is remarkable that it always closes upon the approach of bad weather. The water-pimpernel is *Samolus valerandi,* found in the U. S. and most other countries. *S. floribundus* and *ebracteatus* are found in the Gulf States. The above plants all belong to the Primulaceæ. The first-mentioned one was thought to have active medicinal powers, and the second was once looked upon as having magical qualities.

Pinal, county of S. Arizona, formed since the census of 1870.

Pi'na Mus'lin, a very valuable and costly fabric made in Manila from the fibre of pineapple leaves. It is extremely beautiful, delicate, and durable, and is chiefly employed in making ladies' handkerchiefs and dresses. It has a pale yellow tint, is transparent, and is exported only in small quantity.

Pinas'ter, the *Pinus pinaster* or *maritima,* or cluster-pine of Europe and Asia, and planted extensively in the Landes of France, where, with the *Laricio,* it covers what were once great wastes of sand. Its timber is poor, but it yields immense amounts of tar, pitch, turpentine, and lamp-black. It is a noble tree.

Pinch'beck [the name of the inventor], a kind of brass formerly much used for making cheap watch-cases, and now used as a substitute for the more costly bronze. It contains over 80 per cent. of copper, and the rest is zinc, and has when new a look quite like that of gold.

Pinck'ney, p.-v., Putnam tp., Livingston co., Mich., on Portage Lake. P. 446.

Pinckney, p.-v. and tp., Lewis co., N. Y. P. 1149.

Pinckney (Charles), LL.D., b. at Charleston, S. C., 1758; was bred a lawyer, and during a part of the Revolution was held a prisoner by the British; was in Congress 1784–87, and in the convention of 1787 which framed the U. S. Constitution; president of the convention of 1788 in which South Carolina ratified the U. S. Constitution, and of the State convention of 1790; governor of the State 1789–92, 1796–98, 1806–08; U. S. Senator 1798–1801; minister to Spain 1802–05; and was again in Congress 1819–21; an ardent and eloquent anti-Federalist. D. at Charleston Oct. 29, 1824.

Pinckney (Charles Cotesworth), LL.D., b. at Charleston, S. C., Feb. 25, 1746, son of Judge Charles Pinckney; was educated at Westminster, at Christ Church, Oxford, and the Middle Temple, London; studied military science at Caen, France; became a barrister at Charleston 1769; served as captain, and afterwards as colonel of South Carolina troops in the Revolution; was aide to Washington in 1777; displayed great valor and skill in the Southern campaigns 1778–80; suffered much as a prisoner of war 1780–82; became a brigadier-general 1783, and later a major-general of the State, and still later of U. S. troops (1797); declined many important offices; assisted in framing the U. S. Constitution; was one of the special ministers to France 1796–97, when he was ordered to leave that country; was the author of the famous sentiment, "Millions for defence, but not one cent for tribute;" Federalist candidate for Vice-President 1800, and one of the ablest lawyers of his time. D. at Charleston, S. C., Aug. 16, 1825.

Pinckney (Henry Laurens), b. at Charleston, S. C., Sept. 24, 1794, son of Gov. Charles Pinckney and brother-in-law of Robert Y. Hayne; graduated at South Carolina College 1812; became a prominent lawyer, legislator, and State Rights leader; mayor of Charleston 1832, 1839–40; in Congress 1833–37; edited for a time the Charleston *Mercury;* was collector of the port; author of memoirs of J. Maxcy, of Jackson, and of R. Y. Hayne. D. at Charleston Feb. 3, 1863.

Pinckney (Thomas), brother of C. C. Pinckney, b. at Charleston Oct. 23, 1750; graduated at Oxford, and was called to the bar at the Temple, London, 1770; entered the Revolutionary army, in which he served with much distinction, receiving a bad wound at Camden; governor of South Carolina 1787–89; U. S. minister to London 1792–94, and to Madrid 1794–96, when he negotiated the important treaty of San Ildefonso; was in Congress 1799–1801; appointed major-general 1812, and served against the Creeks and Seminoles with success. D. at Charleston Nov. 2, 1828.

Pinck'neyville, p.-v., cap. of Perry co., Ill., on Beaucoup Creek, at the junction of St. Louis Alton and Terre Haute with Iron Mountain Chester and Eastern and St. Louis and Cairo Short Line R. Rs., has 2 weekly newspapers and manufactories. P. 773.

Pin'dar, the greatest lyric poet of Greece, b. at Cynoscephalæ, a village near Thebes, Bœotia, in either 518 or 522 b. c., and studied his art at Athens under the tuition of Lasus, Agathocles, and Apollodorus. The lyrical art in those times comprised not only the rhythmical arrangement of the words, but also the composition of corresponding vocal and instrumental music and of accompanying choral dances; and Pindar is said to have been equally great in all these branches of his art, though, from what has been left to us, we can only form an opinion of his talents with respect to the first point. On his return to his native city he entered into the lyrical contest with the celebrated poetess, Corinna, and was beaten five times. Nevertheless, his merits were soon recognized. His fame grew great, and, invited by kings and free cities, highly honored and richly paid, he wandered from place to place where the Greek nation lived and the Greek tongue was spoken, celebrating the great games and religious festivals with his songs. He resided for a period of four years at the court of Hiero, tyrant of Syracuse, but left it on account of his disagreement with Simonides; lived for several years at Athens; entertained friendships with Alexander, son of Amyntas, king of Macedon, and Theron, tyrant of Agrigentum. D. at Argos about 442 b. c., sitting in the theatre. His poems, consisting of pæans and dithyrambs (hymns to the gods), prosodia and partheneia (songs for processions), hyporchemata (songs for choral dances), scolia (drinking-songs), threnoi (dirges), etc., were gathered by the old grammarians into 17 books, but only four of these have come down to us—the so-called *Epinicia,* containing his triumphal songs in celebration of the Olympian, Pythian, Nemean, and Isthmian games. The metrical rhythms of these poems are almost entirely inapprehensible to us, as the musical composition has been lost; perhaps the abruptness of their style and the obscurity of their form are due to this very same circumstance, at least to some extent. But in spite of these disadvantages, Pindar's odes show a powerful and elevated imagination and a deep and earnest religious feeling. The best aids in studying his poems are the edition of Böckh, with notes and introductions (Leipsic, 1811–22), and *Essais sur le Génie de Pindare et sur la Poésie lyrique,* by Villemain (Paris, 1859). The translations, English by Cary and Abraham Moore, German by Thiersch and Ludwig, are as hard to understand as the original text.

Pind-Dadun'-Khan, town of the dominion of Punjaub, British India, on the Jhylum, is poorly built, consisting of mud huts; has a population estimated at from 6000 to 13,000, and important saltworks.

Pindemon'te (Ippolito), b. at Verona Nov. 13, 1753; studied at Modena, and afterward travelled very extensively throughout Europe; was the personal friend of almost all the scholars of his time, many of whom consulted him as a man of perfect taste. Ugo Foscolo dedicated to him his *Sepolcri,* to which Pindemonte replied with his own *Sepolcri.* Vittorio Alfieri, who always sent his verses to Pindemonte for revision, used to say jocosely that he acted as his *blanchisseuse.* He wrote prose and verse with equal elegance. Gentle by nature, his satire was very delicate and without passion. He translated the *Odyssey* into Italian verse. Count Benassù Montanari of Verona published at Venice in 1834 a full monograph on the life and works of Pindemonte. D. Nov. 18, 1828.—His brother, Giovanni Pindemonte, b. in Verona 1751, author of the tragedy entitled *I Baccanali di Roma,* surpassed him in poetical genius and in liveliness of fancy, although he was less correct in form. D. Jan. 23, 1812.

Pine [Lat. *pinus*], the collective name of a tribe of plants of the greatest importance to man and of the greatest interest to science. We take here the word *pine* in the Linnæan sense, comprising a number of allied forms, which have been popularly as well as scientifically distinguished, but have always been kept united, if not in the genus *Pinus,* at least in the pine-tribe, Abietineæ. They belong to the family of Coniferæ, ligneous plants with sterile and fertile flowers separate, of the most simple and primitive structure, without any envelopes, such as calyx or corolla, and in the fertile ones the germs or ovules borne on open scales; not enclosed in carpels, as in all other flowering plants, nor the seeds in regular fruits. They thus belong to the class Gymnosperms, or plants with naked seeds, which mark the dawn of the higher vegetable development, and form a transition from the flowerless to the flowering plants, from the ferns and club-mosses to the palms, the oaks, etc. But, remarkable enough, though not quite unexpected in organic development, we find, together with their imperfect flowers, a high organization of the trunk, which is regularly exogenous, growing by external accretion of annual rings, though its microscopic anatomy shows essential differences from that of the other trees of our forests.

As in organic development, so in geological history, these Gymnosperms assume their place on our globe with the first land-plants, and immediately after, if not contemporaneous with, the higher Cryptogams mentioned, in the Carboniferous and even in the Devonian period, long before we find traces of any other higher organized flowering plants. The conifers of those oldest periods are closely allied to the South American representative of pines, *Araucaria;* but real pines also made their appearance long before ordinary trees, in what geologists term the Mesozoic age.

The pines, in the wider sense, are distinguished from other conifers by bearing two inverted ovules on each carpellary scale, many of which are crowded together in a cluster (inflorescence), and eventually form the well-known pine-cone, in which each well-developed scale covers two winged seeds. All the pines have linear, almost always stiff and evergreen leaves, often called needles. They are confined to the northern hemisphere, and are the only forest trees of high latitudes and altitudes. Toward the Arctic zone, in the more elevated parts of all mountain-chains, in the higher Alleghany Mountains, in the whole Rocky Mountains, and the Californian Sierras, these sombre evergreens constitute the entire forests; in the warmer temperate regions they often occupy and adorn sterile tracts unsuited to any other forest vegetation; towards the tropics they are confined to higher mountainous districts. In North

America, and especially westward, the pines are more diversified and more extensively and variously developed than in the Old World.

The wood of the pines is the most important of all trees on account of its abundance, size, lightness, and durability, and equally indispensable to us are the resinous products of these trees—tar, pitch, rosin, and turpentine—which no other plants can furnish. An essential article of food to many birds and beasts, to man the oily seeds are only remarkable as the sustenance of some Western Indian tribes, though the larger ones in the S. of Europe and Western U. S. are also much relished by civilized people.

The most numerous and most important of these Abietineæ are the trees which are more strictly called pines—*Pinus* of most modern botanists. Their angular, two or three-edged leaves (almost always serrulate or rough on the edges), in bunches of two to five, are enclosed in a sheath of membranaceous scales; only one (W. American) species has a single rounded leaf in this sheath. Their sterile flowers develop abundantly at the base of the shoots of the same spring; the fertile clusters appear singly, or a few together higher up or near the top of such shoots. The young fruit remains almost stationary for a whole year, and only in the second summer the cone enlarges, maturing in the autumn. The true pines spread over the whole geographical region assigned to the Abietineæ, from the Arctic countries to the shores of the Atlantic in our South-eastern States, and to the mountains of Mexico, Central America, and the West Indian islands, as well as to the Atlas and Himalaya, and even to the Philippine Islands.

We distinguish two sections of true pines. The white pines have five mostly slender leaves in a bunch; scales of the cones rather thin: wood whiter, lighter, softer, and less resinous, and therefore highly prized for carpenter-work. Of these our Eastern and Northern white pine (*P. strobus*) is the fairest representative, a tree of magnificent proportions and universal application, and highly prized as an ornamental tree. The immense pine woods of Maine, Michigan, and Wisconsin stand first among the great national resources of this country, which we might take better care of than we do. Similar, still more ornamental, but also more tender, is the Himalaya or Bootan white pine. In our West this group of pines is represented by the colossal sugar pine (*P. Lambertiana*), with its immense cones and large edible seeds, and by the mountain white pine (*P. monticola*) of the Pacific mountains; another species, with large squarrose cones (*P. ayacahuite*), is spread over the Mexican mountains. Similar to these, but distinguished by more rigid leaves, shorter, thicker cones, with thicker scales and large, edible, almost wingless seeds, is the small group of the Cembra pines, the principal species of which grows on the European and Siberian Alps, the similar *P. albicaulis* on the Pacific alps, and *P. flexilis* on the Rocky Mountains. *P. cembra* furnishes the red wood with the white sap from which those pretty parti-colored Swiss carvings are made.

The second and by far the largest section of true pines comprises those with knobby scales, leaves from one to five in a bundle. The small group of the four Mexican and W. American nut-pines closely approaches to the last; they are small and scraggy trees, that make excellent fire-wood, with globose cones, the scales thick with very prominent knobs, bearing large, edible, wingless seeds, like those of Cembra, and with leaves varying in the different species from a single one (*P. monophyllos*) to five in number.

Next to these range the large-fruited nut pines, with thick or hook-knobbed scales, and large short-winged seeds, of which *P. pinea* is the Mediterranean, and *P. Sabiniana*, *Coulteri*, and *Torreyana* the W. American representatives. Of the large number of pines remaining, some bear their cones just below the terminal bud of the same year's shoot; their scales are usually thinner, with less prominent prickles, and their wood whiter and less resinous. The Scotch and the Austrian pine of Europe, and our red pine of the North, all of them with leaves in pairs, belong here, as also the long and five-leaved, large-coned, and variable Mexican pines of the alliance of *P. Montezumæ*. Those pines that bear lateral cones have usually very knobby and prickly scales, and heavy, resinous, yellowish wood—the real *yellow* or *pitch pines*. Here range the seaside pine (*P. pinaster* of the Mediterranean regions), the Eastern pitch pine, the Jersey pine, prickly pine, loblolly pine, the yellow pine, Elliott's pine, and, above all, that most important and magnificent of all our pitch pines, the long-leaved pine of the South (*P. australis*), which furnishes a most highly prized naval timber and nearly all the resinous products of our country. To the yellow pines belong also a number of Western pines, the most important and widest spread of which is the heavy pine (*P. ponderosa*) and *P. contorta*, and the most interesting but very local Monterey pine (*P. insignis*), and a few others.

All the other trees allied to the true pines are distinguished by single, not sheathed leaves, by bearing their flowers on branchlets of the previous year, and by maturing their seeds in one season (except the cedar). Here belong the firs (*Abies*), stately trees with usually flat, two-ranked leaves, bearing on their uppermost branches large erect cones, which at maturity fall to pieces. The silver fir of Europe, the silver or balsam fir of the North, which furnishes the Canada balsam, the grand fir, the great timber tree of Oregon, the pale fir of the Rocky and California mountains, are fine examples of these magnificent conifers; but the largest of all seems to be the justly so-called *Abies magnifica* of the higher Sierras, one of the two spruce-leaved firs peculiar to the Western mountains. The timber of the firs is not as highly esteemed as that of the pines or spruces, as being more brittle and less durable.

The hemlock-spruces (*Tsuja*) have the flat leaves of the firs and the pendulous cones with persistent scales of the spruces; their spray is light and graceful, and their cones of the smallest, the wood rather inferior, but the bark greatly valued for tanning purposes. One species belongs to Eastern, another to Western America; two others to Japan and the Himalaya. Allied to the hemlock-spruces are two Western trees, the Douglas spruce, with flat leaves and larger cones fringed with long protruding bracts, common in the Rocky and California mountains, and far into Mexico; and the rare Patton spruce, from the highest points of the mountains from British Columbia to California, with smooth, slender cones and somewhat triangular leaves.

Of greater importance to us are the spruces (*Picea*), elegant, regularly-shaped trees, with square leaves, and persistent scales to their pendulous cones. Here belongs the most important timber tree of Europe, the Norway spruce; in this country we have the black and the white spruce of the North and East, and Menzies' and Engelmann's spruce of the West, the first and last of which are the most useful spruces of our country, with fine, white, and even timber.

The last of the pine tribe are the larches and the cedars. Both have two different kind of branchlets: vigorous elongated shoots with distinct single leaves, and short, knobby, lateral branchlets with crowded (fasciculated) leaves; such stunted branchlets also bear the flowers and fruit. The larches (*Larix*), peculiar to the mountains of Europe, Asia, and N. W. America, and the tamarack, to the swampy regions of North-eastern America, are the only trees belonging here that bear deciduous leaves. They are of some economical importance in the countries where they abound. The cedars (*Cedrus*) are distinguished from the larches by their persistent foliage, autumnal flowers, and their large compact cones, which mature one year after flowering, and after some time drop to pieces. They are, like our *Sequoias* of the West, of limited geographical range, being peculiar to some mountain-ranges of the Old World—the Atlas in Africa (Atlas cedar), the Lebanon and Taurus in Western (true cedar of Lebanon), and the Himalaya in Eastern Asia (the deodar). The cedars of Lebanon have been well known since ancient times, highly prized as the most precious timber-trees, and are greatly esteemed now as the stateliest ornamental trees in climates suited to them, such as Southern Europe, including the S. of England. Our climate seems to be less favorable to their development; in Missouri they get winter-killed every few years. GEORGE ENGELMANN.

Pine, county of Minnesota, bounded E. and S. E. by Wisconsin, from which it is in part separated by St. Croix River. Area, 1450 sq. m. It is level, with a soil often rather wet and heavy. Noble pine forests cover a large part of the county, which is traversed by Snake River and numerous other streams, and by Lake Superior and Mississippi R. R. Cap. Pine City. P. 648.

Pine, tp., White co., Ark. P. 149.

Pine, tp., Benton co., Ind. P. 523.

Pine, tp., Porter co., Ind. P. 474.

Pine, tp., Warren co., Ind. P. 1032.

Pine, tp., Montcalm co., Mich. P. 283.

Pine, tp., Allegheny co., Pa. P. 718.

Pine, tp., Armstrong co., Pa. P. 1642.

Pine, tp., Columbia co., Pa. P. 751.

Pine, tp., Crawford co., Pa. P. 343.

Pine, tp., Indiana co., Pa. P. 921.

Pine, tp., Lycoming co., Pa. P. 527.

Pine, tp., Mercer co., Pa. P. 1235.

Pine'al [Lat. *pinea*, "cone of pine"] **Gland,** or **Conarium,** a vascular mass of reddish-gray nervous matter found within the brain behind the third ventricle, and resting upon the corpora quadrigemina. It often contains

a fluid and some calcareous matter. Its use is not known. It was considered by the ancients to be the seat of the soul. It is by no means a gland.

Pine′apple, the compound conical fruit of *Ananassa sativa*, a plant of the order Bromeliaceæ, a native of tropical America, now naturalized in many hot countries, and cultivated also in hot-houses. When properly cultivated it is one of the best of fruits, but too often it is tough, coarse, and indigestible. The Bahamas and South Florida are finely adapted to pineapple culture. The leaves of this and allies afford the fibre whence the beautiful PINA MUSLIN (which see) is made.

Pineapple, p.-v., Wilcox co., Ala., on Selma and Gulf R. R. P. 1960.

Pine Bluff, p.-v., Vaughn tp., cap. of Jefferson co., Ark., located in the cotton-producing section of Arkansas, has excellent public schools, 5 churches, 1 Jewish synagogue, 2 banks, 2 newspapers, several hotels, 3 machine-shops, flouring, saw, and planing mills, and stores. P. 2081. FRANK SILVERMAN, ED. "REPUBLICAN."

Pine-chaf′er, a name given to *Pissodes strobi*, *Tomicus pini*, *T. xylographus*, and several species of *Hylurgus*, coleopterous insects, whose larvæ commit great ravages in pine forests, eating away the new material between the bark and the wood.

Pine City, p.-v. and tp., cap. of Pine co., Minn., on Lake Superior and Mississippi R. R., 63 miles N. of St. Paul, has 2 fine school-houses, 1 newspaper, 3 extensive mills, and stores. P. 220.
J. S. HUGHES AND H. P. ROBIE, EDS. "NEWS."

Pine Creek, tp., Ogle co., Ill. P. 1215.

Pine Creek, tp., Madison co., N. C. P. 887.

Pine Creek, tp., Clinton co., Pa. P. 970.

Pine Creek, tp., Jefferson co., Pa. P. 941.

Pine Creek, tp., Carroll co., Va. P. 1969.

Pine Finch, or **Goldfinch,** a bird of the family Fringillidæ, the *Chrysomitris pinus* of recent authors. It is congeneric with the common yellow-bird of the U. S. (*Chrysomitris tristis*), and occurs more or less abundantly throughout North America. It attains a length of about 4¾ inches, is brownish-olive above, and beneath whitish, streaked with dusky. It feeds chiefly on the seeds of hemlock and other trees, as well as those of grasses, etc.
THEODORE GILL.

Pine Flat, tp., Dallas co., Ala. P. 1558.

Pine Grosbeak, a bird of the family Fringillidæ and genus *Pinicola*, the *Pinicola enucleator* (Linn.), Cab. It is found throughout the northern regions of the Old as well as New World. Its average length is about 8½ inches; the bill and legs are black; the male is rosy-colored above, tinged, except on the head, with brownish, ashy below; the female brownish above, ashy, tinged with greenish-yellow below. As indicated by the name, the species affects pine and other evergreen forests; it feeds on spruce-seeds, etc. It is rare in the U. S., except near the northern border, although occasionally abundant even as far S. as Philadelphia. THEODORE GILL.

Pine Grove, tp., Van Buren co., Mich. P. 1700.

Pine Grove, p.-v., Esmeralda co., Nev. P. 305.

Pine Grove, p.-b. and tp., Schuylkill co., Pa., on Schuylkill and Susquehanna, Pine Grove and Lebanon, and Philadelphia and Reading R. Rs. P. of b. 845; of tp. 2274.

Pine Grove, tp., Venango co., Pa. P. 875.

Pine Grove, tp., Warren co., Pa. P. 1206.

Pine Grove, tp., Orangeburg co., S. C. P. 827.

Pine Grove, tp., Portage co., Wis. P. 318.

Pine Island, p.-v. and tp., Goodhue co., Minn. P. 1140.

Pinel′ (PHILIPPE), b. at St. André, department of Tarn, France, Apr. 20, 1745; studied medicine at Toulouse and Montpellier; removed in 1778 to Paris; obtained a prize in 1791 for his *Traité médico-philosophique sur l'Aliénation mentale*, and was appointed first physician of the Bicêtre in 1793, and in 1795 of the Salpêtrière. D. at Paris Oct. 25, 1826. By his scientific writings on the subject, and by his very successful management of the two asylums, he accomplished a thorough reform of the treatment of mental diseases. He also wrote *La Nosographie philosophique* (1798) and *La Médicine clinique* (1802).

Pine Level, p.-v., cap., Manatee co., Fla.

Pine Meadow, p.-v., New Hartford tp., Litchfield co., Conn., on Farmington River and Connecticut Western R. R.

Pine Plains, tp., Allegan co., Mich. P. 180.

Pine Plains, p.-v. and tp., Dutchess co., N. Y., on Dutchess and Columbia R. R., has a bank, a weekly newspaper, an academy, 4 churches, 3 hotels, and manufactories. At Shekomeko, within this township, a Moravian mission to the Indians was established in 1740. P. of v. 401; of tp. 1503.

Pine River, tp., Gratiot co., Mich. P. 981.

Pine Rock, tp., Ogle co., Ill. P. 1048.

Pinero′lo [*Pignerol*], town (once a strong fortress) of Northern Italy, province of Turin, 20 miles S. W. of the city of Turin. It stands on a hill 1200 feet above the sea, on the left bank of the torrent Chisone, with a fine view on all sides, especially on the W., where the Alps rise, crest above crest, in all their magnificence. The public buildings generally are of little interest. The cathedral stands near an ancient tower, once a prison, but at present serving as a campanile or belfry. The old Piazza d'Armi is now beautifully shaded with American elms. From the early part of the eleventh century this fortress was held for the most part by the house of Savoy, though France frequently, and often successfully, disputed its possession. In 1696 the formidable fortifications of Pinerolo were, in accordance with a treaty, mostly destroyed. Since 1748 it has been an episcopal see. Pinerolo is now a place of considerable industry; its manufactures are silks, woollens, cottons, liqueurs, etc. P. in 1874, 16,800.

Pines, Isle of. (1) An island in the Caribbean Sea, belonging to Spain, and situated 33 miles off the south-western extremity of Cuba, comprises an area of 1200 sq. m., with about 2000 inhabitants. The principal settlements of the colony are Nueva Gerona, Santa Fé, and Jorobado. The island is noted for its mild and salubrious climate.—(2) An island in the southern Pacific Ocean, belonging to France, and situated in lat. 22° 38′ S., lon. 167° 25′ E., off the south-eastern extremity of New Caledonia, was discovered in 1774 by Capt. Cook, and was selected in 1872 by the French Assembly for a penal station. The number of the inhabitants, exclusive of the convicts, is estimated at 800, belonging to the same race as the population of New Caledonia.

Pine Snake (*Pituophis melanoleucus*), a large serpent, six feet long, two inches thick, of a shining white color with dark-brown spots, and emitting a strong, disagreeable odor; received its name from having its home in the pineries of Eastern America, from New Jersey southward, though it is also sometimes called the "bull snake," from the loud bellowing sound it produces. It feeds on eggs and small birds and mammals, but is perfectly harmless to man.

Pine Spring, tp., Sanford co., Ala. P. 447.

Pine Swamp, tp., Ashe co., N. C. P. 409.

Pine Top, tp., Middlesex co., Va. P. 1968.

Pine Valley, tp., Elko co., Nev. P. 35.

Pine Valley, p.-v., Veteran tp., Chemung co., N. Y., on Northern Central R. R. P. 260.

Pine Valley, tp., Clark co., Wis. P. 953.

Pine′ville, tp., Marengo co., Ala. P. 400.

Pineville, tp., Monroe co., Ala. P. 853.

Pineville, p.-v., cap. of Josh Bell co., Ky., at the upper ford of Cumberland River. P. 974.

Pineville, tp., Rapides parish, La. P. 414.

Pineville, p.-v. and tp., cap. of McDonald co., Mo., on Elk River, situated in a rich mineral region, has good water-power and 1 weekly newspaper. P. 1057.

Pi′ney, tp., Johnson co., Ark. P. 176.

Piney, tp., Madison co., Ark. P. 270.

Piney, tp., Van Buren co., Ark. P. 160.

Piney, tp., Oregon co., Mo. P. 437.

Piney, tp., Texas co., Mo. P. 866.

Piney, tp., Ashe co., N. C. P. 839.

Piney, tp., Clarion co., Pa. P. 1160.

Piney Creek, p.-v. and tp., Alleghany co., N. C. P. 689.

Piney Fork, tp., Sharpe co., Ark. P. 1454.

Piney Grove, tp., Sampson co., N. C. P. 1776.

Pingré (ALEXANDRE GUI), b. at Paris Sept. 4, 1711; studied theology, but adopted Jansenistic views, and devoted himself subsequently to astronomy; published, 1754–57 the first nautical almanac under the title of *État du Ciel;* greatly extended Lacaille's table of eclipses in the second edition of *L'Art de vérifier les Dates;* wrote in 1783 his *Cométographie, ou Traité historique des Comètes* (2 vols.), which is his principal work, and translated the poem by Manilius, *Astronomica* (1786). D. at Paris May 1, 1796.

Pinguicola. See BUTTERWORT.

Pin Hook, tp., Lawrence co., Ala. P. 407.

Pink, the name of various plants of the genus *Dianthus*, all natives of Asia and Europe, for the wild pinks of the U. S. are of the genus *Silene*, and are properly called campions or catchflies; but *D. Armeria* and *prolifer* are sparingly naturalized here. The most common pinks are beautiful garden and window flowers, often delightfully fragrant. There are thousands of fine varieties—carnations, flakes, bizarres, picotées, pheasants' eyes, monthlies, Chinese pinks, maidens, Carthusian pinks, etc. They are somewhat doubtfully referred to some four or five original species (*D. plumarius, caryophyllus, Chinensis, Carthusianorum, superbus, deltoides*, etc.). All need much care to produce perfect flowers.

Pink'erton (John), F. S. A., b. at Edinburgh, Scotland, Feb. 13, 1758; passed an apprenticeship of five years to the law in his native city; settled in London 1780; devoted himself to literature under the patronage of Horace Walpole, and produced an immense number of works, chiefly historical, none of which, however, were marked by any great talent. The best known is his *General Collection of Voyages and Travels* (17 vols. 4to, 1808–14), with maps and engravings, which is still useful for reference. He wrote some poems not destitute of merit, but his *Ancient Scottish Poems* (2 vols., 1786), purporting to be from the MS. collections of Sir Richard Maitland, has been pronounced a literary forgery, probably executed by himself. In 1804 he settled in Paris, where he d. Mar. 10, 1826. (See his *Literary Correspondence*, edited by Dawson Turner, 1830.)

Pink Hill, p.-v. and tp., Lenoir co., N. C. P. 572.

Pink'ney, tp., Warren co., Mo. P. 1018.

Pinkney, tp., Union co., S. C. P. 2413.

Pinkney (Edward Coate), son of William, b. in London, England, in Oct., 1802; educated at St. Mary's College, Baltimore; was in the naval service 1816–24; practised law at Baltimore with little success; published *Rodolph and other Poems* (1825), and edited for a short time a political journal, *The Marylander* (1827). D. at Baltimore Apr. 11, 1828.

Pinkney (William), LL.D., b. at Annapolis, Md., Mar. 17, 1764, was the son of an English loyalist; studied medicine and law; was admitted to the bar 1786, and rapidly rose to eminence; a member of the constitutional convention of 1788; was chosen to Congress 1790, but did not take his seat; was a U. S. commissioner in England 1796–1804; attorney-general of his native State 1805; minister extraordinary, with Monroe, to Great Britain 1806; minister resident there 1806–11; U. S. attorney-general 1811–14; served as a volunteer officer at Bladensburg, and was wounded; in Congress 1815–16; minister resident at Naples 1816; minister to Russia 1816–18; U. S. Senator 1820–22. D. Feb. 23, 1822. (See *Life*, by H. Wheaton (1826); by W. Pinkney, D. D. (1853).)

Pink'root, the root of *Spigelia Marilandica*, a showy herb of the U. S., not often found N. of the Potomac. The infusion of this root is much used as an anthelmintic; it has also some narcotic qualities. The pinkroot should be combined with a cathartic, such as senna. *S. anthelmia* is a similar plant of South America. They belong to the Loganiaceæ. *S. loganioides* and *gentianoides* grow in Florida.

Pin-money (law), an annual sum of money, sometimes provided for in a marriage settlement, to be paid by the husband to the wife for the purpose of defraying her own personal expenses for dress and the like. When the wife dies, her representatives cannot claim any arrears that may be unpaid at the time, nor can the husband ever be compelled to pay more than the arrears of a single year; for the allowance is intended to be fully expended in each current year, and is designed to keep up the family dignity and appearance, and not to furnish the wife a means of accumulation. It is supposed by some that the peculiar term was derived from an ancient tax by which the queen was supplied with pins. Both the name and the provision for the wife which it designates are practically unknown in this country, being confined to the English law and social customs. John Norton Pomeroy.

Pin'nace [It. *pinnaccia*] is a rowboat carried on ships. It is larger than a cutter and smaller than a launch. The name was formerly given to small sailing vessels.

Pin'nacle [Lat. *pinnaculum*, a "little feather"], in Gothic architecture, a turret, often standing on parapets, angles, and buttresses, and usually adorned with rich and varied devices. It has a finial at the top, and below this is somewhat pyramidal.

Pinn'idæ [*pinna*, a "fin" or "wing"], a family of conchiferous mollusks. The animal with its mantle is elongated and obliquely triangular or wedge-shaped; the mantle margins fringed; the palpi long; the foot elongated, cylindrical, and grooved by a bissal cleft; the adductor muscles not very unequal; the shell is very oblique and triangular, equivalve, and gaping posteriorly, with an unarmed hinge and with a brittle texture; it is composed chiefly of prismatic cell-layers, while the pearly interior is thin and extends only part-way from the beak. Species are found in almost all warm seas, and forms of the family have existed from the Devonian epoch to the present. Over 60 living species are known. Theodore Gill.

Pin'nipeds [*pinna*, "a fin," and *pes, pedis*, "a foot"], mammals which, according to some authors, form a peculiar order, and by others are considered as a sub-order of the order Feræ, comprising the seals, sea-bears, sea-lions, and walruses. The body is more or less prone—*i. e.* little or not at all uplifted from the surface of the ground—and the legs are confined in the common integument beyond the elbows and knees; the feet are rotated backward, and the toes connected together by an extensively developed web, and especially adapted for swimming; the anterior and posterior feet have the first phalanges and digits enlarged and produced beyond the others; the skull is much compressed between the orbits; the lachrymal bone early united with the maxillary, imperforate, and entirely contained within the orbit; the malar is applied to the inner side of the transverse zygomatic process of the maxillary, and not continued to the front of the orbit; this, therefore, is bounded by the maxillary; the palatines do not extend forward sideways, and consequently extensive vacuities intervene between the frontal and maxillary bones; the tympanic bones are separated from the exoccipitals by a vacuity, as well as by the re-entering periotic bones; the teeth of the first series are extremely small and undeveloped, those of the second series well developed. In all these respects the forms of the group are peculiar, but they agree with the Feræ or carnivorous animals in the coalescence of the scaphoid, lunar, and central bones into one, and in the possession of a zonary deciduate placenta. The group is differentiated into three well-defined families: (1) Otariidæ, or sea-lions and sea-bears; (2) Phocidæ, or typical seals, and (3) Rosmaridæ, or walruses, each of which is noticed under its proper name.

Theodore Gill.

Pi'no, p.-v. and tp., Placer co., Cal., on Sacramento division of Central Pacific R. R. P. 191.

Pi'nos Al'tos, p.-v. and tp., cap. of Grant co., N. M.

Pins, pieces of wire pointed at one end and provided with a head at the other, mentioned as having been in use for the purpose of fastening from the oldest time history knows of; but the pins which have been found in Egyptian, Etruscan, and old Scandinavian tombs, or in other ways have come down to us from antiquity, are mostly very elaborate and expensive instruments, made of iron, bronze, brass, silver, or gold, sometimes twelve inches long, with artistically executed heads of wood, bone, ivory, amber, metal, or precious stones; and it is evident that in many cases in which we now use pins the ancients used clasps, laces, and other contrivances. In England pins came into common use in the fifteenth century, but were at first introduced from the Continent. Soon, however, the manufacture was introduced into England, and in the latter part of the seventeenth century Birmingham became the centre of this branch of industry. In the U. S. it was attempted in 1820, and again in 1824, but not firmly established until the invention of the Howe machine in 1832. The original process of the manufacture by hand, from the straightening of the wire to the spinning and hammering of the head, was long and tedious, and required no less than fourteen distinctly different operations. At present, all these processes, from the cutting of the wire to the sticking of the pins into papers, are performed by machinery, which needs only to be fed by the proper materials at each stage of its operation.

Pinsk, town of Russia, government of Minsk, situated in a marshy plain on the Pina. It carries on an important transit-trade on the Oghinsky Canal, which connects the Dnieper with the Niemen. P. 12,963.

Pint, a measure of capacity, the eighth part of a gallon. (See Weights and Measures.)

Pintard (John), LL.D., b. in New York City in 1759; graduated at Princeton 1776; studied law, but never practised; was a volunteer in the Revolution; acted for three years as clerk to his uncle, Lewis Pintard, commissary for American prisoners in New York City; edited for a short time the *Daily Advertiser;* engaged subsequently in commerce; was for many years city inspector and secretary to the Mutual Insurance Co.; was the founder of the New York Historical Society, vice-president of the American Bible Society, and an efficient member of other useful societies, and distinguished through a long period

as a philanthropist and the most accomplished local antiquary in New York. D. at New York June 21, 1844. Author of many fugitive articles in periodicals, chiefly on antiquarian topics, a selection from which, with a biography, was announced some years since, but has not appeared. (See interesting notices in Dr. Francis's *Old New York.*)

Pinto. See MENDEZ-PINTO.

Pin'to, tp., White Pine co., Nev. P. 51.

Pintos [Sp., "spotted"], a name popularly given in Mexico to the residents of the valley of the Mescala River in the state of Guerrero, on account of a disease to which they are subject consisting of leprous-like spots, believed to be caused by some peculiar quality of the water of the Mescala. The inhabitants are chiefly of Indian descent, whence the Pintos have often been erroneously supposed to be a specific tribe of Indians.

Pinturic'chio (BERNARDINO), or, more properly, BERNARDINO BETTI, b. at Perugia in 1454; d. at Siena in 1513; was a friend of Perugino and Raphael, and a prominent member of the so-called Roman school of painting. His principal works consist of frescoes in the Vatican (1493–96), and in the cathedral of Siena (1502–09).

Pin-worm (*Oxyoris vermicularis*), a parasitic worm, white, filamentous, from one-eighth to one-half of an inch long, accumulating in infants or children in considerable number in the rectum, and causing, especially during rest, a burning and itching sensation in the mucous membrane of the anus. The disease is generally temporary, and disappears spontaneously. With proper treatment the vexation may be much alleviated.

Pinzon', the name of a family of enterprising navigators at Palos, Spain, of which three brothers were associates of Columbus in the discovery of America, and one was afterward the discoverer of Brazil. The head of the family, MARTIN ALFONSO, rendered great service to Columbus in fitting out his little fleet and in obtaining sailors. He commanded the Pinta; was separated from Columbus in the West Indies, and subsequently by a storm on the return voyage, but reached Bayonne in safety before Columbus had arrived in Spain, and wrote to the court asking permission to give an account of the voyage. The opportune arrival of Columbus defeated what was believed to be a scheme for appropriating the honors of the discovery. Pinzon was forbidden to present himself at court, and soon afterward died.—His brother, VICENTE YAÑEZ, commanded the Niña in the first voyage of Columbus; was at the head of an expedition of four vessels which sailed from Palos Nov. 13, 1499; discovered Brazil at Cape St. Augustine Jan. 28, 1500; explored the northern coast as far as the Orinoco, entering the mouth of the Amazonas; reached Hispaniola June, 1500; lost two of his caravels, and returned to Palos in September, having lost his fortune by the voyage. In 1506 and 1508 he was associated with Juan Diaz de Solis in the respective voyages in which they discovered Yucatan and the river La Plata. His subsequent history is unknown.—FRANCISCO MARTIN, the third brother, was pilot to the Pinta in the first voyage of Columbus. The family was raised to the rank of hidalgoes by Charles V., and has continued to be of note in Spain, its present representative being Admiral Pinzon, who commanded the Spanish fleet which took possession of the Chincha Islands in Peru in 1863.

Pio'che, p.-v., cap. of Lincoln co., Nev., situated in a cañon of the Cordilleras, about 7000 feet above the sea-level, possesses several rich silver-mines, 3 schools, 2 churches, several literary and social institutions, 2 banks, 1 newspaper, 1 public library, 2 foundries, boiler and machine shops, 1 narrow-gauge railroad, and stores.

J. F. O'HALLORAN, ED. "DAILY RECORD."

Piombi'no, town of Italy, province of Pisa, lying on the sea-coast opposite the island of Elba. It is surrounded by old walls, with a fort without and a citadel within overlooking the sea. Here, near a very safe roadstead called Porto Vecchio, is a large metallurgic establishment for the manufacture of Bessemer steel, the ore being brought from Elba. Military projectiles of great hardness and perfection are also manufactured here by Signor Bosina. Piombino was the capital of the little principality of the same name, which was originally a fief of the German emperors, but which passed successively from one power and one family to another until 1860, when it became a part of the new kingdom of Italy. P. in 1874, 4000.

Pioneer', tp., Cedar co., Ia. P. 1622.

Pioneer, p.-v., Deer Lodge co., Mont., on Hell Gate River.

Pioneer, p.-v., Madison tp., Williams co., O., on St. Joseph River. P. 338.

Pioneer, p.-v., Cherry Tree tp., Venango co., Pa., on Oil Creek and Allegheny River R. R.

Pioneers' [allied to Sp. *peon*, a "foot-soldier"], in military operations, a body of men detailed from the various regiments to clear roads, fell trees, repair bridges, etc. Their work is less scientific than that of the engineers.

Piorry (PIERRE ADOLPHE), M. D., b. at Poitiers Dec. 31, 1794; studied medicine; took his degree in 1816; became professor at Paris in 1840, and retired into private life in 1866. He invented the pleximeter, which he described in his *Traité sur la Percussion médiate*, and for which he received the Montyon prize in 1828. He also wrote *De l'Hérédité dans les Maladies* (1840), *Traité de Médicine pratique et de Pathologie iatrique ou médicale* (9 vols., 1841–51), *Traité de Plessimètrisme et d'Organographisme* (1866).

Piotrkow, town of European Russia, government of Warsaw, on the Stradra, was formerly an important and prosperous city, but has fallen into decay during the wars. P. 13,633.

Pio've di Sac'co [*Plebs Sacci*], town of Italy, province of Padua, warmly contended for by Padua and Venice during the Middle Ages. Some of its churches are very ancient, others possess fine pictures. Linen and cotton were once largely manufactured here, but the making of willow-work and of straw matting is now the chief industry of the inhabitants. P. in 1874, 8221.

Pioz'zi (Mrs. HESTER LYNCH **Salusbury**), b. at Bodvel, Carnarvonshire, Wales, Jan. 16, 1740; married, in 1763, Henry Thrale, a wealthy brewer, subsequently a member of Parliament; made in 1764 the acquaintance of Dr. Samuel Johnson, who became in 1766 an inmate of her family at Southwark, and remained such until Mr. Thrale's death in 1781; contributed several poems to Mrs. Anna Williams's volume of *Miscellanies* (1766), among which was the celebrated *Three Warnings*, often supposed to be the composition of Dr. Johnson; married, in 1784, Signor Gabriel Piozzi, a native of Florence, then a music-teacher at Bath; resided a year or two at Florence, where she edited a volume entitled *The Florence Miscellany* (1785) under the signature of "Anna Matilda," thereby attracting the relentless criticism of Gifford against the "Della Crusca School;" published *Anecdotes of Dr. Johnson* (1786), *Letters to and from Dr. Johnson* (1788), a book of travels on the Continent (1789), *British Synonymy* (1794), and *Retrospection* (1801). D. at Clifton, near Bristol, May 2, 1821. (See her *Autobiography, Letters, and Literary Remains* (1861), edited by A. Hayward.)

Pipe, in music, a tube in which air is made to vibrate so as to produce a musical sound: in commerce, a wine measure, varying in size according to the kind of wine it contains, a pipe of port containing 138 gallons, of sherry 130, of madeira 110, of vidonia 120: in hydraulics and pneumatics, an artificial channel through which watery or aëriform fluids are conveyed with or without pressure: in every-day life, an instrument for smoking tobacco, consisting of a bowl of wood, stone, clay, or meerschaum for the tobacco, and a stem, long or short, stiff or flexible, connected with a mouthpiece of amber or horn, through which the smoke is inhaled.

Pipe'clay, a fine white and pure clay, very infusible and tenacious. It is used for making pottery, tobacco-pipes, for whitening the accoutrements of soldiers, and for whitening boot-tops and harnesses.

Pipe Creek, tp., Madison co., Ind. P. 2300.

Pipe Creek, tp., Miami co., Ind. P. 1227.

Pipe Fish, a name given to species of fishes with a tubular or pipe-like snout, chiefly belonging to the order Lophobranchiata and family SYNGNATHIDÆ (which see).

Pipe-mouth, a name occasionally connected with the fishes of the genus Fistularia.

Pipera'ceæ [from *Piper*, the principal genus], a natural order of exogenous and often climbing herbs and shrubs, altogether tropical, but rare in Africa. There are some 600 species, nearly all acrid, some of them astringent, and some narcotic. Pepper, cubebs, matico, and betel are the chief commercial products. The principle *piperine* abounds in many of these plants.

Pi'per City, p.-v., Brenton tp., Ford co., Ill., on Toledo Peoria and Warsaw R. R. P. 302.

Piper'no, town of Italy, province of Rome, S. E. of the city of Rome. It stands on an elevation in the midst of an amphitheatre of lofty hills near the site of the ancient Volscian town of *Privernum*, from which it takes its name. It is almost entirely surrounded by castellated walls with towers, and stones and inscriptions, taken from the ruined temples and palaces of the ancient city just below it, serve to adorn the more modern town. The principal square is embellished by orange trees of rare size, and in the midst

of it stands a statue of Priapus, one of the numerous antiquities exhumed in the vicinity. Many striking ruins of convents exist in and near this town. In a still remaining abbey, the entrance of which is rich in mosaics, died, in 1272, the celebrated Thomas Aquinas. Piperno is very unhealthy, owing to its nearness to the Pontine Marshes. P. in 1874, 5704.

Piper's Gap, p.-v. and tp., Carroll co., Va. P. 1605.

Pipe'stone, county of Minnesota, bounded W. by Dakota. Area, 460 sq. m. It is celebrated for its quarry of red pipestone, a layer of which occurs in the Sioux quartzite. From this quarry, regarded as sacred by the Indians, material was obtained for Indian tobacco-pipes.

Pipestone, p.-v. and tp., Berrien co., Mich. P. 1379.

Pipette' [Fr.], a chemical laboratory instrument of glass which is used for sucking up quantities of liquids by the application of mouth-suction. The pipette has therefore a long stem with a contracted orifice for introduction into deep or narrow-mouthed vessels, with a bulbous or elongated expanded portion above to contain the liquid. Sometimes pipettes are *graduated,* so that known quantities of liquids may be taken up. H. WURTZ.

Pip'idæ [*Pipa,* a proper name], a family of toad-like anurans peculiar for its habits. The fronto-parietal is completely ossified, the prefrontals separate; no teeth are developed; the ribs are wanting, simple; coccyx attached to a single condyle; sacral diapophyses dilated; coracoid and epicoracoid divergent, their connecting arches not overlapping; manubrium absent; the terminal phalanges are simple and acute; the external metatarsus separated by a web. The family is represented by the genus *Pipa,* peculiar to South America. In the breeding season the back of the female is developed into a number of small pits, and into these the eggs which she lays are deposited by her mate, and there hatched. THEODORE GILL.

Pippi. See GIULIO ROMANO.

Pi'qua, city, Miami co., O., on Miami River and Miami and Erie Canal, at the crossing of Pittsburg Cincinnati and St. Louis and Cincinnati Dayton and Michigan R. Rs., has 2 newspapers, an active trade, and some manufactures. P. 5967.

Piqua, v., Montgomery tp., Franklin co., O., suburb of Columbus, the State capital. P. 2364.

Piquet' [Fr.], a game of cards in which the three court-cards, the ace, the ten, nine, eight, and seven of each suit are employed. After shuffling and dealing, two by two, to each of the two players, until each holds twelve cards, the rest are laid on the table, and constitute a talon of eight cards. Next, the oldest hand (the one who did not deal) discards from one to five of his poorest cards, and draws as many more from the talon. The opponent next discards. The first player now reckons points, as follows: for *carte blanche* (twelve plain cards), 10 points; for *point* (the hand fullest of any one suit, or, if both hands are alike, the best hand of the two high suits, calling aces eleven, face-cards each ten, and counting pips on the plain cards) the highest hand scores the number of cards in his fullest suit; for *sequence* (the greatest number of cards in any suit, or, if both hands are alike in this respect, the one whose highest sequence begins with the higher card; but no two cards make a sequence) the better hand scores as follows: if the best sequence is three cards, count 3; for four cards, 4; for five, 15; for six, 16; for seven, 17, etc. Sometimes all sequences are scored. For the *quatorze,* of four equal honor-cards, the highest scores 14, or if there are no sets of four, the highest set of three equal honor-cards counts 3, etc. The first player now plays a card. The opponent now scores his *carte-blanche* if he has any, adds what other points he has, and then follows suit. Each player counts 1 for each lead; and if the second player takes a trick, he counts 1 for that. The one who takes the larger number of tricks counts 10 for *cards;* if he takes all, he counts 40 more for *capot.* If the first hand makes 29 by preliminary scores, and 1 by first lead, he counts 30 more by *pique;* but if his first score comes up to 30 before his lead, he scores 60 more by *re-pique:* 100 or 101 points make the game, but there are several ways of scoring besides the above.

Piræ'us [Gr. Πειραιεύς], a rocky peninsula, supposed to have been once an island, on the coast of Attica, nearly 5 miles S. W. of Athens, forming three natural harbors, all commanded by the hill Munychia, 267 feet high. This peninsula, with its three harbors (Munychia, now *Phanari,* Zea, now *Stratistiki,* and Piræus proper, now *Drako*), was made by Themistocles (491 B. C.) the port of Athens, instead of Phalerum, its original port. Connecting the city and these three harbors were two parallel walls, about 60 feet high and 1550 feet apart, built between 457–431 B. C., and swept away by Sulla (87–86 B. C.), though their foundations may still be traced. The principal harbor is safe and deep. The modern town of *Piræus* has sprung up since 1834. A railway, opened in 1869, connects it with Athens. P. 11,047. (See Curtius, *De Portubus Athenarum,* 1842.) R. D. HITCHCOCK.

Pirane'si (GIOVANNI BATTISTA), b. Oct. 4, 1720, at Rome; studied drawing, architecture, and engraving at Venice and Rome, and published a work (29 vols. fol., containing 2000 plates) on the antiquities and public buildings of Rome. D. Nov. 9, 1778.—His children, FRANCESCO, PIETRO, and LAURA, were also celebrated as engravers.

Pira'no, town of Austria, province of Istria, on the Gulf of Largone, has a good harbor, some shipbuilding, large fisheries, and a trade in wine, oil, fish, and salt. In the immediate neighborhood of Pirano are the extensive saltworks of Porto Rose, which were celebrated as early as the thirteenth century.

Pi'rate and **Pi'racy** [from a Greek word denoting "one who makes," or the "act of making *attempts*"—*i. e.* attacks—on ships upon the sea], a word used for the earlier term, meaning *robber*—*i. e.* sea-robber. (For the more full definition compare the article INTERNATIONAL LAW.) T. D. WOOLSEY.

Pir'masens, town of Rhenish Bavaria, Vosges, is well built, and has manufactures of straw hats, shoes, musical instruments, and glassware. P. 8563.

Pir'na, town of Saxony, on the Elbe, at the influx of the Gottleube, has manufactures of stockings, woollens, earthenware, and beetroot-sugar. The citadel, Sonnenstein, is now used as a lunatic asylum. P. 8905.

Piron' (ALEXIS), b. at Dijon, France, July 9, 1689; studied law, but did not practise; left his native town chiefly on account of an utterly improper ode he wrote; lived in Paris for a long time in obscurity; began to write for the minor theatres, and obtained admission to literary and elegant society by his brilliant sarcasm and ready wit; entered into a rather ludicrous rivalry with Voltaire as a tragedian, but wrote an excellent comedy, *La Métromanie* (1738). When proposed as a member of the Academy he was rejected on account of his ode, not by the Academy, but by Louis XV. D. at Paris Jan. 21, 1773. Collected edition of his works by Rigoley de Juvigny (7 vols., Paris, 1776).

Pi'sa, city of Italy, capital of the province of the same name, situated (lat. 43° 43′ N., lon. 10° 24′ E.) on the Arno, which flows through it in a semicircular sweep from E. to W. Its distance from the sea, now about 7 miles, has been slowly increasing for centuries, owing to the deposits at the mouth of the river. The plain in which Pisa lies is extremely fertile, and the salubrity of the climate draws hither invalids from all parts of the world. It is still a walled town, and is entered by six gates. The bridges over the Arno are very fine, especially the Ponte del Mezzo, which spans the centre of the semicircle. An aqueduct 4 miles in length supplies the town with water. The public buildings are of great interest, and the Duomo, the Baptistery, the Leaning Tower, and the Campo Santo of Pisa will always be among the first objects in Italy to call forth the enthusiasm of the traveller. The Duomo (or cathedral), founded, probably, in 1063, on the site of a palace of Hadrian, is of great architectural interest without, and contains many artistic treasures. The Baptistery (1154) and the Leaning Tower (1174) are both circular structures, the former 180 feet in height and 160 in diameter; the latter, 179 feet in height and 50 in diameter, with an inclination of nearly 13 feet from the perpendicular. The Campo Santo, besides its architectural merit, is adorned with frescoes which once excited the admiration and kindled the genius of the greatest Italian masters, but which, unhappily, are now sadly defaced by time. Another choice architectural gem is the Sta. Maria della Spina, a small Gothic church or chapel of exquisite beauty on the left bank of the Arno. This chapel has been recently taken down, stone by stone, each stone being numbered, and re-erected. Many of the other numerous churches deserve attention, as do also several palaces remarkable for their historic associations and for their artistic wealth. The University of Pisa (twelfth century) is very celebrated, and it counts the immortal Galileo among its former pupils and professors. An academy of fine arts and a botanical garden are among the many other provisions for public instruction. Pisa is of very remote but uncertain origin. As an Etruscan town its relations with Rome were friendly from the beginning. Under the first emperors it rose to great prosperity, and many monuments of this period still exist; among these, inscriptions of much interest which have been illustrated by Pagni, Noris, Tantini, Lupi, etc. This prosperity lasted till the middle of the fifth century, after which time it shared in the common calamities of barbarian invasion. In the early part of the ninth century Pisa was once more powerful enough to drive the Saracens from her coast, and

to pursue them into the heart of their own dominions. In 1003 the pope invited Pisa, now an independent republic, to assist in expelling the Saracens from the Roman territory, and in this enterprise she won the highest distinction. Having wrested Sardinia, Corsica, Elba, and other places of importance from the infidels, Pisa gave herself to commerce and the arts of peace, but her rapidly increasing power and wealth excited the jealousy of Genoa and of the other neighboring republics. Several Guelphic cities, instigated by Ugolino Gherardesca, a traitor noble of Pisa, united in a league against this Ghibelline commonwealth, and disastrous wars followed. The Pisans finally suffered a great naval defeat at Meloria in 1220, and never again fully recovered their former strength. Henceforth, rival families and rival parties disputed the government of the city, but the commonwealth sustained itself most heroically, both against France and its own sister republics, until 1509, when it was forced to submit to Florence. From this time the history of Pisa is one with that of Tuscany. The commerce and manufactures of this town are at present inconsiderable. P. in 1874, 50,500. CAROLINE C. MARSH.

Pisa, Council of, considered œcumenical by Gallican theologians, but not so regarded by the Roman Catholic Church. Bellarmine calls it a *consilium generale nec approbatum nec reprobatum.* Its object was to heal the papal schism which had scandalized Christendom since 1378. It was summoned neither by pope nor emperor, but by fourteen cardinals (seven in each obedience) of the two rival popes. It met in the cathedral of Pisa Mar. 25, 1409, and held its twenty-third and last session Aug. 7, 1409. It was composed of 24 cardinals; 4 patriarchs; 80 bishops in person and 102 by proxy; 87 abbots in person and 200 by proxy; the ambassadors of several governments; the representatives of 13 universities; and more than 300 professors and doctors of canon law. On June 5, 1409, the council deposed Gregory XII. of the Roman line and Benedict XIII. of the Avignon line, declaring them both to be schismatics, heretics, perjurers, and vow-breakers. On June 26, the 24 (some say only 22) cardinals made Peter Philargi pope, an old man of seventy years, cardinal-archbishop of Milan, who took the name of Alexander V. The reforms talked of were then adjourned for the consideration of a general council to meet in Apr., 1412, and, as for rival popes, the Church now had three instead of two. Schwab has shown (1858) that Gerson was not in attendance, although the council was mainly Gallican.—Another Council of Pisa, held May 30, 1135 (not 1134), and attended by St. Bernard, excommunicated the antipope Anacletus II. —Still another, called by five rebellious cardinals of Pope Julius II., met in Pisa Nov. 1, 1511, adjourned to Milan Nov. 11, 1511, left Milan for Asti Apr. 21, 1512, and Asti for Lyons, having ridiculously failed in its attempt to depose the pope. R. D. HITCHCOCK.

Pisa′no (NICCOLO), b. at Pisa in 1200; d. there in 1278; was a remarkable architect, and built several fine churches in Pisa, Florence, Venice, etc., but became more celebrated as a sculptor, which art he actually revived. His principal works are the pulpits of the baptistery of Pisa (1260) and of the cathedral of Siena (1266).—His son, GIOVANNI PISANO, b. at Pisa about 1240; d. there in 1320; studied painting and architecture under the guidance of his father, and became celebrated as an architect. He designed the Campo Santo at Pisa, and constructed the Castel Nuovo at Naples, which was used as a model for the Bastile of Paris.

Piscat′aqua River, for some miles the boundary between Maine and New Hampshire, is formed by the junction of Salmon Falls and Cocheco rivers, both of which furnish extensive and well-utilized water-power. Its lower course is tidal, and constitutes the harbor of Portsmouth, N. H. Drainage area, 550 sq. m.

Piscat′aquis, county of Central Maine. Area, 3780 sq. m. Its northern part is an uninhabited forest, abounding in lakes and streams, and is in some parts hilly and mountainous. It is traversed by Penobscot River, and is in part bounded W. by Moosehead Lake. The S. portion is well settled and contains much fertile soil. Cattle, corn, wool, and potatoes are leading products. Lumber and other goods are extensively manufactured. Traversed by Bangor and Piscataquis R. R. Cap. Dover. P. 14,403.

Piscataquis River rises in Somerset co., Me., flows E., and reaches the Penobscot at Howland. Length, 71 miles. Drainage area, 1276 sq. m.

Piscat′away, p.-v. and tp., Prince George's co., Md., on Potomac River, at the mouth of Piscataway Creek, opposite Mount Vernon. P. 1999.

Piscataway, tp., Middlesex co., N. J. P. 2757.

Pisciculture. See FISH-CULTURE.

Pise (CHARLES CONSTANTINE), D. D., b. at Annapolis, Md., in 1802; was the son of an Italian by an American mother; educated at Georgetown, D. C., and at Rome, where he received knighthood and the doctor's degree; became an instructor in the college at Emmittsburg, Md.; was ordained to the Roman Catholic priesthood 1825; performed pastoral labors, chiefly in Maryland, in the District of Columbia, and in New York City and vicinity. D. in Brooklyn, N. Y., May 26, 1866. Author of *Church History* (5 vols., 1830), volumes of poetry, tales, controversial, devotional and other religious writings, and was one of the ablest of American pulpit-orators of his Church.

Pi′sek, town of Bohemia, on the Watawa, which here is crossed by a large and remarkable bridge, has several breweries and distilleries and manufactures of leather and woollens. P. 8180.

Pis′gah, a mountain of Palestine, mentioned several times in the Pentateuch, especially that part of it which bears the name of Mount Nebo; has lately been identified by Prof. Paine with the south-western point of the present Jebel Siahgah, which overlooks the Dead Sea, the valley of Jordan, Bethlehem, Jerusalem, the hills around Nazareth, and Peræa.

Pisid′ia, an ancient territory of Asia Minor, situated between Phrygia, Cilicia, Pamphylia, Lycia, and Caria. It was inhabited by wild and predatory tribes ruled by petty chiefs, and was never wholly conquered by the Romans, though they held possession of the chief towns of the country, Sagalassus and Selge.

Pisid′ium [from *pisum*, a "pea"], a family of conchiferous mollusks including the small species of the fresh waters, and well represented in American streams. The form is obliquely oval; the mantle open in front, closed behind; the siphons partly united; the palpi small and pointed; the gills united behind, the outer smallest; the foot large, compressed, and extensible far forward; the shell has rather thin valves, with the umbones placed backward, the hinge with the cardinal teeth minute and the lateral elongated and compressed. The species are ovoviviparous, the eggs being hatched in the external branchiæ; the young are comparatively large in size, and consequently few in number. Species are found in the fresh waters of most of the countries of the Old as well as New World, and have survived from the Wealden to the present time. The distinctive character of the shell is the posterior position of the umbones. THEODORE GILL.

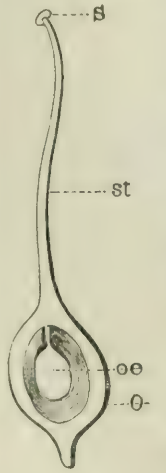
Pisis′tratus, b. at Athens about 612 B. C. (d. there 527 B. C.), belonged to the family of the Philaïdæ, of Pylian origin, descending from Neleus, the father of Nestor; his mother was a cousin-german to the mother of Solon. As a youth he was conspicuous for his personal beauty and mental endowments. With Solon he lived in great intimacy, and on several occasions he offered his celebrated kinsman valuable assistance, both with his forensic eloquence and with his military valor. Solon, however, penetrated his character, and, although Pisistratus was a master in the art of dissimulation, Solon discerned the daring ambition which grew up in his soul, and warned him. Soon after the establishment of the Solonian constitution the old parties of the republic formed again and renewed their feuds—the Pedieis, or the party of the plain, consisting of landed proprietors and headed by Lycurgus; the Parali, or the party of the seaboard, consisting of merchants and headed by Megacles; and the Diacrii, or the party of the highlands, consisting mostly of workingmen and mechanics. As demagogism is the shortest way to despotism, Pisistratus enlisted in the party of the Diacrii, and endeavored to make himself the patron of the poor. He threw open to the public his magnificent gardens, and when he appeared in the streets two boys accompanied him carrying purses, in order that he might always be able to supply immediately the wants of any needy citizen he met. Thus, he won the love and enthusiasm of the lower classes, and his noble character and brilliant talents made him a favorite with many wealthy and influential citizens, even though they suspected his plans. Solon, who had been absent from Athens for some time, returned before the crisis, and offered the most vigorous opposition, but in vain. One day Pisistratus entered the Agora covered with bleeding wounds, which he had inflicted on his own body, and said that his enemies had attempted to assassinate him. His story raised a general indignation, and one of his partisans, Ariston, proposed that a body-guard of fifty citizens should be given him. Solon opposed the proposition, and called Pisistratus a hypocrite; but the people declared that Solon was mad, and the body-guard was granted. Pisistratus now raised not fifty, but five hundred men, and one day (560 B. C.) he seized the citadel; the mask was dropped, the tyrant was ready. Megacles and Lycurgus took to flight; Solon placed his arms in the street before his house; submission was instantaneous. But before Pisistratus

could thoroughly consolidate his power the parties of Lycurgus and Megacles combined and drove him out of the city. His property was confiscated and sold by auction, though there was only one who dared to bid. Six years he lived in banishment. Meanwhile, Megacles, who was unable to maintain himself against Lycurgus, made overtures to Pisistratus, and offered to reinstate him in the tyranny if he would marry his daughter. The offer was accepted, and the restoration was accomplished by help of a new stratagem. A beautiful girl, Phya, a flower-seller, was dressed in the robe and helmet of Pallas Athene, and, with Pisistratus standing behind her in a magnificent chariot, she drove towards the gates of Athens, while heralds galloped in advance and announced that the tutelary goddess of the city was coming in person, bringing Pisistratus back with her. The stratagem succeeded; Phya was worshipped and Pisistratus accepted. Pisistratus now married Megacles's daughter, but treated her so badly that her father and her whole family, the Alcmæonidæ, exasperated at the insult, once more combined with the party of Lycurgus, and this combination once more drove him into exile. He retired to Eretria in Eubœa, where he lived for ten years, busy with preparations for his return, which was effected this time not by stratagem, but by force. Money and men he procured from other Greek cities, and with a well-equipped army he crossed over to Attica and landed at Marathon. His adversaries drew out to attack him, and the two armies met at Pallene. Pisistratus was victorious, and thus for the third time he came into possession of absolute power in Athens, which he henceforth held to his death. In order to be safe against the intrigues and attacks of his enemies, he always kept a troop of mercenaries, but in other respects his rule was so mild and wise that he was able to leave his power to his sons, Hipparchus and Hippias. He retained the form of the Solonian constitution, but he took care that the highest offices were always held by members of his own family. He exacted obedience to the laws, and many of his social measures were sound and beneficial. The poorest class of the inhabitants, which generally lay idle, he compelled to leave the city and engage in agriculture, and he provided them with seed and cattle. The artisans he kept busy with great building undertakings, such as the temples of the Pythian Apollo and the Olympian Zeus, the Lyceum, and the Fountain of Nine Springs. Many of the most beautiful and most characteristic institutions of Athenian life are ascribed to Pisistratus; as, for instance, the establishment of the festival of the Greater Panathenæa, the introduction of tragedy and of dramatic contests at the Attic Dionysia, the collection of the first library in Greece, and the collection, revision, and written preservation of the Homeric poems. CLEMENS PETERSEN.

Pista'chio-Nut, or **Green Almond,** the fruit of the pistachio tree, *Pistacia vera* (order Anacardiaceæ), which is common in the S. of Europe and in Asia and Africa. The nut is delicious for dessert. The kernel is somewhat like that of the almond, but is green. The nut yields a good table oil. To the same genus belong the mastich, the terebinth, and other valuable trees. Lamb fattened upon pistachio-nuts is a famous delicacy.

Pistic'ci [mediæval *Pisticcium*], town of Southern Italy, province of Potenza, 23 miles S. of Matera. It was a large and flourishing town from the ninth to the seventeenth century, but in 1688 was almost totally destroyed by an earthquake. P. in 1874, 7737.

Pis'til [Lat. *pistillum*], the female or central seed-bearing organ of fructification in phænogamous plants. A flower may possess one or more pistils; these, taken collectively, receive the name of *gynæcium*. The pistil may consist of one carpel or of several combined, as indicated by the number of cells or the angles of the ovary. A perfect pistil has three parts, to which appropriate names have been given. These are the *stigma*, the *style*, and the *ovary*. The stigma and the ovary are the only essential portions, and the style is often omitted. The ovary is the young pod, containing the ovules to be fertilized and become seeds. Several carpels which unite to form one ovary may be again divided as to the styles or stigmas. The style is usually cylindrical or columnar, often long and thread-form, sometimes flat, and it is crowned by the stigma, which may be a knob or a double or single line extending down the inner face of the style. It assumes very many different forms, but whatever may be its appearance, it always serves the same end. It consists of naked cellular tissue, or is rough with papillæ, or hairy or viscous. On its surface falls the pollen from the anthers, which then imbibes moisture, swells, and protrudes tubes, which penetrate the style, and finally reach the ovary and fertilize its contained ovules. These now develop the embryo or germ, increase in size, and become seeds. In theory, each carpel may be considered as a small leaf folded upon itself. It may be sessile or borne upon a stalk, representative of the petiole of the leaf. In some cases this is very much extended. The ovules are generally attached to the margin of this transformed leaf, and the portion where they are attached is called the *placenta*. The pistils may be in flowers by themselves on the same or different plants. In hermaphrodite flowers both stamens and pistils are present, although they may be so situated with reference to each other as not to be self-fertilizing. In such cases the desired cross-fertilization is usually accomplished through the agency of insects. The partitions which divide an ovary into cells are called *dissepiments*. The ovules may be arranged on a central placenta, or borne on the sides of the ovary, when the placentation is called *parietal*. There is every gradation between these two arrangements. In a few exceptional cases the seeds are not produced and matured within an ovary, as in the case of the Coniferæ and Cycadaceæ. These plants are hence called *gymnospermous* or naked-seeded. In them the pollen, which is abundant and scattered by the winds, falls directly upon the exposed ovules.



W. W. BAILEY.

Pisto'ja [Lat. *Pistoria* or *Pistorium*], town of Italy, province of Florence, 21 miles N. W. of the city of Florence. It lies in a most fertile valley between two spurs of the Apennines, one of which separates the valley of the lower Arno from that of the Ombrone, a torrent flowing a little to the E. of this town. A fine view of Pistoja is obtained from the remarkable railway which crosses the Apennines between Bologna and Florence. A wall, rhomboidal in outline, surrounds the town, which is entered by four gates besides the railroad barrier. The streets are sufficiently wide and well paved, the squares large, and the public buildings very respectable. The cathedral, in form an ancient basilica, was built in the sixth century, rebuilt in the twelfth after a destructive fire, and again remodelled by Niccolò Pisano between the thirteenth and fourteenth. It contains some interesting works of art, among them a famous silver altar and the cenotaph of Cino da Pistoja. The baptistery, opposite the cathedral, is octagonal in form, though popularly called the Rotondo. The font is worthy attention. San Bartolomeo, Sant' Andrea, and San Giovanni are all churches of very ancient date, and the latter contains a pulpit of white marble (fourteenth century) exquisitely wrought in alto-rilievo; also an admirable marble group by N. Pisano. The bishop's palace is an imposing edifice. The façade of the hospital is decorated with remarkable terra-cottas by the Della Robbia family, representing the seven works of mercy. The elder Pliny first mentions Pistoja as a Roman military colony; Gregory the Great sent thither its first bishop in 594. From the time of the countess Matilda (1046) Pistoja began to govern itself as an independent commonwealth; but, after a long period of prosperity with occasional reverses, it fell in 1351, desperately resisting, under the dominion of Florence, and it has little separate subsequent history. The manufactures of Pistoja consist chiefly of hides, woollens, silk, ironwork generally, and especially firearms. Pistols are said to have been first made here, a fact which is thought by many to explain their name. A very fine rock-crystal is also wrought here. P. in 1874, 13,000.

Pistol. See SMALL-ARMS, by GEN. P. V. HAGNER, U. S. Army.

Pis'tole [from the It. *piastruola*, a "little piastre"]. The Spanish pistole is a gold coin, lately worth about $4, but formerly much more valuable. The new Italian gold pistole of twenty lire is worth $3.823, but the old ones are variable. There are also German and Swiss pistoles.

Pitaval', de (FRANÇOIS GAYOT), b. at Lyons in 1673; served for some time in the army; studied law; practised as an advocate in Paris, and acquired a name by his publication of *Causes célèbres et intéressants* (20 vols., Paris, 1734–43). D. at Paris in 1743. The work, a collection of law-cases and their decisions, excited considerable interest, was several times abridged, translated into other languages, and continued after the death of Pitaval by François Richer (22 vols., Amsterdam, 1772–88). In 1842, Hitzig and Häring commenced a similar collection at Leipsic, under the title of *Der neue Pitaval*, which was afterward continued by Vollert, and reached nearly 50 vols.

Pit'cairn, p.-v. and tp., St. Lawrence co., N. Y., on Oswegatchie River. P. 667.

Pitcairn (Major John), b. in Fifeshire, Scotland, about 1740; became captain of marines Jan. 10, 1765, major Apr., 1771; was stationed several years at Boston, Mass.; led the advance in the expedition to Lexington and Concord, Apr. 19, 1775; commenced the first battle of the Revolution, and was killed at Bunker Hill June 17, 1775.

Pitcairn Island, a small island in the Pacific Ocean, in lat. 25° 3′ S. and lon. 130° 6′ W., and comprises an area of 1½ sq. m. It is of some consequence, because it is the only place on the route from South America to Otaheite in which fresh water can be procured. It was discovered in 1767, and colonized in 1790. It belongs to Great Britain.

Pitch, in music, the degree of acuteness or gravity of a sound, as distinguished from its other qualities, as loud or soft, harsh or smooth, dull or piercing, etc. A musical sound is not necessarily identified with any particular degree of the diatonic, chromatic, or even an enharmonic scale. A string tuned, for instance, to C may be shortened by the finger or a bridge in a hundred or more places successively, and at each shortening it will give forth under the bow a musical sound more or less acute, according to the length of the sounding portion. In like manner, an organ-pipe while sounding may be made to give a great number of slightly varying musical tones by drawing its stopper up or down with a sliding motion. The musical scale, however, is not thus uncertain, but consists of eight definite sounds, derived for the most part from the tones given by the mathematical divisions of a string, and then gathered and arranged in a regular series. (See Music, Scale, and Temperament.) But such a series, unless fixed by some determinate standard limiting and defining its measure of acuteness, may be supposed to take its rise from any point even of a *sliding scale*, as in the case just mentioned of a *single* sound produced by a pipe or string. The fixing, therefore, of some invariable standard of pitch, whereby any given note of the scale shall represent a sound of one and the same degree of acuteness in all written music, has been an object of interest and importance from the first rise of musical science. It is quite improbable that in early times, when music was in its rudest state, there was any standard corresponding to what we now call *concert-pitch;* for though the ancient Greeks had a certain familiarity with the relations and order of intervals, yet the very imperfect nature of their instruments seems to forbid the conclusion that the adjustment of such instruments to a strictly accurate pitch was an object of much practical importance. The human voice also, on account of its variety of range in different individuals, could be used only approximately as a standard of pitch. Stringed instruments are equally useless in determining pitch, as they merely exhibit a pitch that has been otherwise ascertained, and into agreement with which they are tuned. There is much room, therefore, for conjecture in regard to the mode in which the pitch of the scale came, in the course of time, to be settled by common consent as it stood, for instance, in the fifteenth or sixteenth century. It is probable that the organ-builders of that period contributed as much to the settlement of the question of pitch as those who found its solution in the doctrine of vibrations. The organ-builder knew that an open pipe about two feet long and of moderate diameter would give the sound which we now call "middle C;" and the theorist knew that the column of air in such a pipe would make 512 vibrations in a second of time. But in all such cases the practical issue would prove of more immediate consequence than the theoretical; and the fixing of any *one* sound by a pipe of a certain length would be, in fact, the fixing of the whole scale above and below, whether that sound were taken as tonic, dominant, or any other term in the octave. When by this or any other means a standard of pitch was once established, conformity to it would almost necessarily follow in vocal exercises and in the construction and tuning of instruments generally. This conformity, however, has never been strictly exact, either in time or place, as it is found that concert-pitch varies somewhat in different countries, and has apparently undergone some changes in one and the same country within the last two centuries. It is asserted by musicians of eminence that an alteration of pitch to the extent of a semitone upward has taken place even since the time of Haydn (d. 1809); and the opinion has been expressed that in the age of Tallis (sixteenth century) the ordinary pitch was two whole tones lower than it is at present. That concert-pitch has been gradually rising may be proved by comparing old and new tuning-forks, the older being flatter than those now in use; but some singular facts on the other side may also be alleged, such as the existence of several old organs in Germany which are a whole tone *sharper* than the current pitch. To account for these variations, it has been maintained with some plausibility that there have existed simultaneously *several* standards of concert-pitch—viz. the secular or orchestral and the ecclesiastical—and that in the latter the pitch of the organ differed sometimes a full semitone from that adopted by the voices, rendering it necessary for the organist to transpose his part in order to bring it into agreement with the choir. Efforts have been made within the last few years, and scientific measures set on foot, for the establishment of a uniform standard of pitch; but the adoption of such a standard, even if agreed upon, suggests difficulties which seem almost insuperable—such, for instance, as the mechanical operation of bringing all organs and other instruments of fixed tone to an exact conformity with the prescribed pitch, and a general agreement among instrument-makers and vocalists to yield their preferences (if any), and accept a pitch possibly less brilliant than that in ordinary use. Wm. Staunton.

Pitch. See Bitumen, by Gen. Q. A. Gillmore, U. S. Army; and Tar.

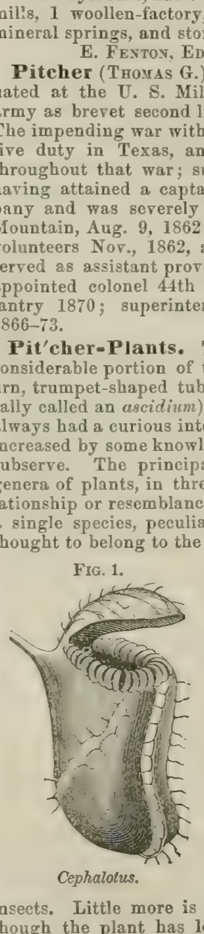
Pitch'er, tp., Cherokee co., Ia. P. 144.

Pitcher, p.-v. and tp., Chenango co., N. Y., 16 miles S. E. of Syracuse, has 6 churches, 1 newspaper, 2 flouring-mills, 1 woollen-factory, 1 fork and edge-tool factory, 2 mineral springs, and stores. P. of v. 148; of tp. 1124.
E. Fenton, Ed. "Otselic Valley Register."

Pitcher (Thomas G.), b. in Indiana about 1824; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of infantry July, 1845. The impending war with Mexico called him at once to active duty in Texas, and with his company he served throughout that war; subsequently on frontier till 1861, having attained a captaincy 1858; commanded his company and was severely wounded at the battle of Cedar Mountain, Aug. 9, 1862; appointed brigadier-general of volunteers Nov., 1862, and on recovery from his wound served as assistant provost-marshal-general; in 1866 was appointed colonel 44th Infantry; transferred to 1st Infantry 1870; superintendent U. S. Military Academy 1866–73.

Pit'cher-Plants. These have their leaves, or some considerable portion of the leaf, in the form of a pitcher, urn, trumpet-shaped tube, or other hollow vessel (technically called an *ascidium*) capable of holding water. They always had a curious interest, which has of late been much increased by some knowledge of a probable use which they subserve. The principal kinds belong to five different genera of plants, in three orders, which have no near relationship or resemblance except in the pitchers. One, of a single species, peculiar to South-western Australia, is thought to belong to the Saxifrage family, where it stands alone. It is named *Cephalotus follicularis*. The leaves are all in a cluster next the ground; some are flat and of ordinary conformation; others are oval pitchers, hanging from a short stalk near the top on one side, where the handle of a pitcher should be, and fitted with a lid, which neatly covers the mouth, resting at first upon a thickened and crested ring which surrounds and strengthens the orifice, but opening on its hinge as soon as the pitcher is full grown. (Fig. 1.) It has long been observed that this pitcher secretes a watery fluid and entraps many insects. Little more is yet known as to its action, although the plant has long been in conservatories; but it is difficult of cultivation. The other pitcher-plants belong to two natural orders, which are peculiar, and so far as known contain only pitcher-bearing plants. One of them, Nepenthaceæ, consists of numerous species of one genus, chiefly inhabiting the Indian Archipelago; the other, Sarraceniaceæ, is wholly American, mainly North American, and consists of three genera—one, of a single species in the mountains of California; another, of one species, in the mountains of British Guiana; the third, of several species, is confined to Atlantic North America. This is *Sarracenia*. The pitchers are all at the root, and appear to rise from the ground in a cluster. Instead of a proper lid, they have a sort of hood at the top, and a projecting wing runs down the inner or upper side from top to bottom. *Sarracenia purpurea,* native of bogs from Newfoundland to Florida, was the earliest known and is the most familiar species, as well as the only one N. of Virginia. Its oblique, urn-shaped pitcher (Fig. 2) is sometimes called "huntsman's cup." Instead of a proper

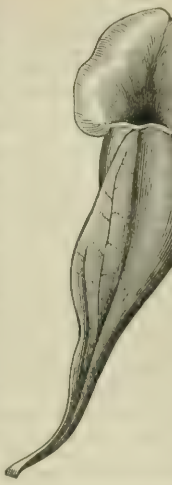
Fig. 1.



Cephalotus.

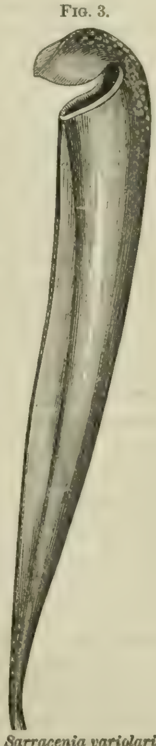
hood or cover, it has a large projecting lip, nearly erect, which half surrounds the open orifice. Most of the water with which the cup is usually half full may therefore come from rain, but at first some is doubtless secreted. This water in summer is charged with the decomposing matter of insects and the like, of various kinds, which are in some way attracted to it and drowned in it. In low grounds of Southern U. S., from Virginia to the Gulf of Mexico, near the coast, is found a second species (*S. flava*), with very long and narrow pitchers, which, on account of their shape, are popularly called "trumpets," while the yellow flowers, from their depressed rounded shape, when young, are called "watches." The hood of this species closes the orifice in the growing state, overarches it for some time afterward, but at maturity stands erect or nearly so. The interior secretes a watery fluid, ordinarily in small quantity, and this may perhaps be sparingly replenished by rain; but there is reason for the opinion that most of the liquid found at the narrow bottom of the tube is a secretion. Many insects are entrapped in these pitchers, and few if any of those that enter ever escape, owing partly to the narrowness of the tube, which prevents flight except directly upward, of which they are mostly incapable, partly to the extreme smoothness of the gorge and upper portion, and still more to the lining of the portion below with a fine *chevaux-de-frise* of close and sharp downwardly-directed bristles. The captured insects therefore perish, decompose, or are macerated in the liquid when this is abundant, or their remains are fed upon by the larvæ of other insects hatched in the decomposing mass from eggs which are deposited therein. There are two red-flowered species in the Southern States (*S. rubra* and *S. Drummondi*), with tubular or trumpet-shaped pitchers, generally similar to those of *S. flava*, the common yellow-flowered species. But the most curious of all is a yellow-flowered species named *S. variolaris*, which is common in the low country from South Carolina to East Florida. Its tubular pitchers, which are purplish-variegated and white-blotched over the back at top, are carried into dwellings to serve as fly-catchers, for which they are more efficient than any other. One of them is shown in Fig. 3, much reduced. They vary from eight or ten to twenty inches in length. The orifice is permanently protected by a strongly overarching hood, which must naturally exclude the rain. The liquid which they contain, often in some abundance, collected at the bottom of the tube, is doubtless a secretion. Flies, ants, and most other insects which have entered far or fallen into the deep cavity are unable to escape. It remains to be ascertained whether the secretion is increased after insects are captured.

Fig. 2.



Sarracenia purpurea.

Fig. 3.

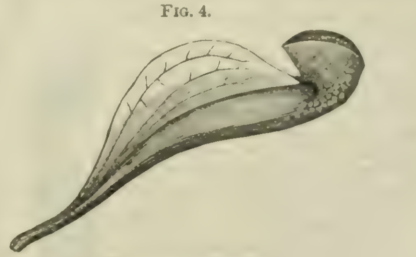


Sarracenia variolaris.

In all these tubular pitchers, when freshly grown and vigorous, and in the warm temperature of early summer, a different secretion, sweet and somewhat viscid or honey-like, is exuded within the orifice and base of the hood, which is the attraction to insects, and allures them to the brink or within the gorge of the pit, into which they eventually fall. It has been thought to intoxicate or stupefy the insects that sip it, thus causing their fall. This was affirmed by Mr. Grady of North Carolina to be true of *S. flava*: but Dr. Mellichamp of South Carolina does not find this to be true of *S. variolaris*, the most efficient of all as a fly-trap. His account was published in the New York *Tribune* in July, 1874, and in the *Proceedings* of the American Association for the Advancement of Science for that year. Dr. Mellichamp's experiments, however, go to show that the watery liquid within, into which the insects are precipitated, is narcotic or asphyxiating to them, as they perish in it much sooner than they do in ordinary water. The existence of this sweet secretion and its attraction of insects in the Southern species appear to have been more or less known at an early period, but nearly to have passed out of knowledge until recently. There are some allusions to it in William Bartram's *Travels in Georgia and Florida*, published in 1791, but they are vague, and do not discriminate between the sweet secretion at the orifice and the watery liquid below. The first good observations we know of were made by Dr. James Macbride of South Carolina in 1810 and the following years, and published in the *Transactions* of the Linnæan Society in 1815. A less specific announcement of the existence of this "honeyed fluid" and its action, but without mention of the species in which it occurred, had meanwhile been published in 1812, in Tilloch's *Philosophical Magazine*, by the distinguished Prof. Benjamin Smith Barton, whose paper is dated Sept. 3, 1811. But as Dr. Barton states that these facts had only just then come to his knowledge, and mentions them only in a general way, while Dr. Macbride's observations, which are particular and specific, were mainly made in the spring of the year 1810, as between the two the latter should be credited with the discovery, which indeed he probably made known at Philadelphia. The species which he investigated are *S. variolaris* and *S. flava*; and all the facts already referred to are clearly brought out, except the stupefying property of the watery liquid, which rests on the authority of Dr. Mellichamp. The latter discovered a most interesting particular in *S. variolaris*—namely, that, at the period of the greatest activity of its pitchers in secretion and in insect-capture, a narrow line or trail of the sweet exudation appears upon the edge of the wing, and extends from the orifice down to near the base, a distance of from eight to eighteen or twenty inches, according to the size of the leaf. This trail of treacle, continuous from the copious similar deposit within the orifice down to near the ground, seems especially adapted for the allurement of ants and other wingless insects fond of sweets. And it had already been observed by those unacquainted with this arrangement, and has since been confirmed, that the pitchers of *S. variolaris* usually contain far more ants than they do of all other insects together.

A remaining species, *S. psittacina*, or the parrot-headed

Fig. 4.



Sarracenia psittacina.

Sarracenia (Fig. 4), of the Southern U. S., bears small pitchers, of less width than the leafy wing; it is mainly remarkable for the inflated hood completely inflated over the orifice, which is thus reached only from underneath. Its arrangements for enticing insects are not yet made out. It is chiefly interesting as showing a transition toward the pitchers of the Californian representative of the family of a peculiar genus—viz. *Darlingtonia Californica*. This is found only in the northern portion of the Sierra Nevada, extending to Shasta Peak. The flower is less like that of *Sarracenia* than are the leaves or pitchers, which only are now under consideration. These may be compared with those of the last-mentioned *Sarracenia*; only they are far larger, varying from a span to two feet in length, stand erect or nearly so, have a twist of at least half a turn, the summit is equally hooded and inflated, so that the orifice looks downward, and the extremity of the hood bears a curious, two-forked, pendulous appendage, in the form of a fish's tail. These are the leaves of the adult plant. Those of seedlings are open-mouthed, with a small and merely overarching hood, and no such appendage; in all these respects well agreeing with the tubular Sarracenias. The ensuing account is from observations on the living plant in its native habitat by Mrs. Austin of Taylorsville, Plumas co., Cal., supplemented by Mr. Wm. M. Canby (in a paper read before the American Association for the Advancement of Science in 1874, published in its

Proceedings, and in recent letters). The pitchers capture insects in abundance, both of ambulatory and flying kinds, such as wasps, grasshoppers, beetles, ants, flies and gnats, butterflies and moths, also spiders, worms, and snails. The decaying mass at the bottom generally contains the thin white larvæ of some dipterous insect. Some watery secretion is found in young pitchers which have not yet opened; it increases somewhat afterward, especially after insects have been caught, and in proportion to their number. Bits of meat thrown in also increase the secretion. This at times fills six or seven inches of the lower part of the tube, and sometimes almost the whole of it. From the situation of the orifice it is evident that no rain is likely to enter. The liquid when first secreted is slightly bitter and astringent. Later, it is shown to be slightly acid by litmus-paper. Insects immersed in it ordinarily die in a few minutes. After warm weather comes on, a sweet secretion begins to appear in the form of minute drops, like honey-dew, on the inside of the hood and of the fish-tail appendage. As summer advances this is increased, extends all over the appendage or its lobes, outside as well as inside, occasionally gathering into a drop at the tip of each lobe. It has some odor and the taste of honey. Insects, flies especially, are fond of it. In large leaves at midsummer a line of this sweet secretion extends from the orifice downward along the edge of the wing almost to the ground; in most leaves, whether large or small, it occurs, in the form of minute globules resembling honey-dew, along the angle on either side formed by the junction of the wing with the tube.

FIG. 5.

Darlingtonia Californica.

It is difficult to believe that such adaptations, and the consequent captures, are purposeless or of no benefit to the plant, the more so now that several plants of the sundew family are found to be carnivorous. (See SUNDEW and DIONÆA.) It has not been shown, however, and it is not very probable, that there is any proper digestion or absorption of unaltered animal matter in the *Sarracenia* family. But the products of decomposition, in a liquid or gaseous form, are probably absorbed and made subservient to the plant's nourishment.

Nothing is known as to the action of the only remaining pitcher-plant of the *Sarracenia* family, *Heliamphora* of Guiana. Its short and broad pitchers are erect and open-mouthed, as much so as those of the northern *Sarracenia purpurea*, and the hood or lid is obsolete or a mere rudiment. The pitchers, being opened, are liable to be filled with rain-water, and can therefore serve only for maceration.

FIG. 6.

Nepenthes.

However it be in some *Sarracenias* and in *Darlingtonia*, there is reason to believe that something like a true digestion takes place in the remaining order of pitcher-plants, represented only by the rather large genus *Nepenthes*. (See art. NEPENTHES and Fig. 6.) These plants, as is elsewhere stated, belong to the southern hemisphere and to the great islands, from Madagascar to Borneo. It is now known (mainly by the observations and experiments of Dr. Hooker, president of the Royal Society) that a sweet secretion which allures insects forms on the rim of the pitcher, and sometimes on its lid; that the watery liquid which is secreted by and contained in the interior of the pitcher increases in quantity when insects are caught or drowned in it, and equally so when bits of meat or little cubes of cartilage or boiled white-of-egg are thrown in; also, that the secretion then becomes acid, and acquires the power of dissolving such solid matters, in a manner apparently analogous to that of the gastric juice of animals.

ASA GRAY.

Pitch'stone, a name given to a variety of feldspar of somewhat resinous appearance; it is also a popular name for many sorts of opal which have a decidedly resinous lustre, and other glassy minerals.

Pith, in the stalk and branches of exogenous plants, the central core of soft cellular tissue. It communicates with every leaf-bud directly, and with the bark by the "silver-grain" or medullary rays. In most trees and shrubs the older wood encroaches upon it, and to some extent obliterates it. In the young shoot it is a reservoir of nutritious juices for the use of the growing parts. Its cavity is lined by the medullary sheath.

Pit Hole City, p.-b., Allegheny tp., Venango co., Pa., on Pit Hole branch of Oil Creek and Allegheny River R. R., a noted centre of the petroleum-supply. P. 237.

Pit'kin (TIMOTHY), LL.D., b. at Farmington, Conn., Jan. 21, 1766; graduated at Yale 1785; became a lawyer, and was five times Speaker in the State legislature; a Federalist Congressman 1806–20; author of *Statistical View of the Commerce of the U. S.* (1816; rev. ed. 1835), *Political and Civil History of the U. S.* (2 vols., 1828, with a continuation, not yet published). D. Dec. 18, 1847.

Pit'man (ISAAC), b. at Trowbridge, Wiltshire, England, Jan. 4, 1813; was educated in the normal college of the British and Foreign School Society at London; was appointed master of the British School at Barton-on-Humber 1832; established a similar school at Wotton-under-Edge 1836; published *Stenographic Short-Hand* (1837) and *Phonography, or Writing of Sound* (1840), giving the principles of his invention of a superior method of short-hand called phonography, since so widely diffused as almost to have extinguished the earlier systems; removed to Bath 1839; devoted himself to the perfection and propagation of phonography and its complement phonetics; founded in 1843 the Phonetic Society, and established the Phonetic Institute, a printing-office from which he has brought out for many years *The Phonetic Journal* (weekly, with a lithographed *Supplement*); has issued several revised manuals of phonography and a considerable number of standard works in phonetic printing. His most complete professional work is the *Phonographic Reporter's Companion* (1853). His system was introduced into the U. S. by S. P. Andrews and A. F. Boyle in their *Complete Phonographic Class-book* (1847), soon followed by many similar works.—A brother of the inventor, BENN PITMAN, removed to the U. S., settling at Cincinnati, where he devoted himself to the propagation of phonography; published a *Manual of Phonography* (New York, 1860), and reported the treason trials at Indianapolis (1865) and the trial of the assassins of Pres. Lincoln (New York, 1865). His present system differs slightly from that of his brother.

Pitman (ROBERT CARTER), LL.D., b. at Newport, R. I., Mar. 16, 1825; graduated at Wesleyan University 1845; was admitted to the bar in 1848, and became a lawyer of New Bedford, Mass.; was often in the State senate, of which he was president in 1869; became a police judge in 1858, and in 1869 was appointed one of the judges of the Massachusetts superior court.

Pitra' (JEAN BAPTISTE), b. at Champforgeuil, department of Saône-et-Loire, France, Aug. 31, 1812; studied theology at Autun; took holy orders; became a member of the Benedictine congregation of Solesmes; published *Spicilegium Solesmense* (5 vols., Paris, 1852–60); was commissioned in 1858 by Pius IX. to write a history of Oriental rites and canon law, of which the first volume appeared in 1864, second in 1868, under the title of *Juris Ecclesiastici Græcorum Historia et Monumenta.* Cardinal Mar. 16, 1863.

Pit'ri [cf. Lat. *pater*, "a father"], in Hindoo mythology, originally meant a deceased ancestor, but was ultimately transformed to signify one of an order of divine beings into which the spirits of mortals may be received on condition of the due performance of the *Sraddha* or funeral rites. The legends and accounts of the Pitris in the Vedas, the laws of Menu, the Puranas, and the later mythical works are very conflicting, but the most constant tradition is that which considers them as ancestors not only of men, but of gods and demons. The worship of the Pitris forms a large part of the Puranic ritual.

Pitt, county of E. North Carolina. Area, 700 sq. m. Traversed by Tar River; has extensive pine forests, and a light, productive soil. Live-stock, corn, cotton, and forest products are staples. Cap. Greenville. P. 17,276.

Pitt, tp., Wyandot co., O. P. 991.

Pitt (William). See Chatham, Earl of.

Pitt (William), generally called the **Younger Pitt,** the second son of the earl of Chatham, and b. May 28, 1759. He was a boy of delicate constitution, but of great precocity of mind, and when, in 1773, he was sent to the University of Cambridge, he astonished all with his knowledge and power of judgment. In 1780 he entered into public life, and took his seat in the House of Commons as member for Appleby. The opposition against the party in power, the cabinet of Lord North, consisted of two factions—one led by Rockingham and Fox, and the other by Lord Shelburne. Pitt joined the latter, which mostly consisted of old friends of his father, and his speeches made such an impression that Lord Shelburne, when he became first lord of the treasury in July, 1782, offered him a place in the cabinet as chancellor of the exchequer. Lord North, although at one time driven from power by Rockingham and Fox, now formed a coalition with them against the cabinet of Lord Shelburne, and in 1783, Lord Shelburne had to give in his resignation, and Pitt with him. But in the very next session, when Fox brought in his bill for transferring the government of India from the East India Company to Parliament—that is to say, to the ministry—the coalition was defeated and the cabinet compelled to retire. Pitt was called upon to form the new cabinet, and after dissolving Parliament and gaining a majority at the general election of 1784, he established himself firmly in the most powerful position which a subject can occupy in England, and he maintained himself in this position without interruption for fourteen years. This extraordinary success was not due to an equally extraordinary talent. Pitt was no doubt a very talented man, but his greatest fortune was his name. The nation loved him first because he was a son of the great Pitt, and secondly because he was disinterested, honest, upright, and fearless; which latter virtues were so rare among English statesmen of the eighteenth century that they alone were almost sufficient to make a man great. And Parliament respected him first because he was a man of eloquence and business capacity—two qualities which are valuable everywhere, and which in England are as indispensable as coal; and secondly, because he was a son of the great Pitt. Macaulay in his *Biographies* falls into strange raptures of admiration because he can assert that Pitt never stole, never touched "unlawful gain." Indeed, the only pecuniary advantage he took of his political position was that very harmless one of leaving behind him a debt of £40,000, which he could never have made if his creditors had not known that after his death Parliament would pay his debts, as it had paid those of his father. No less unqualified is Macaulay's admiration of Pitt's eloquence, its "ample periods," its "merciless sarcasm." But what about its objects? All his great measures, the constitution of the East India Company, the establishment of the sinking fund, the subjugation of Ireland, the war against Napoleon, were accompanied by the loud praise and eager sympathy of his contemporaries; but that is not enough to make them great, especially since not one of them has escaped the heavy censure of posterity. No English historian has as yet been able to give a sufficient reason for the war which England began against France in 1793 and continued to 1815. It seems to have been a whim, a chimera of the minister; he would imitate his great father in this point too. But his war administration was weak and confused, and when losses and disasters followed, the chimera grew into a mania. In 1801 he retired from office. Different reasons are given. Some say that after establishing the union between Ireland and England he intended an emancipation of the Roman Catholics of Ireland, and resigned when the king refused to give his assent. Others say he retreated before a public opinion which not only in England, but in all Europe, demanded peace. In February he resigned, and in May the Peace of Amiens was concluded. Pitt's stubbornness, however, had made it one of Napoleon's principal objects to crush England, and that line of policy which in England had originated in a mere chimera became in the course of time a dire necessity. In 1804, Pitt was recalled and the war was renewed. But the surrender of the Austrian army at Ulm, the battle of Austerlitz, the Peace of Presburg filled the haughty but impotent minister with such chagrin that he actually died from disappointment and rage, Jan. 23, 1806; and although, at last, England came out triumphant and victorious, it is more than questionable whether she, or Europe, or civilization in general, derived any good from this war between Napoleon and her minister. Clemens Petersen.

Pit'tacus, one of the Seven Wise Men of Greece, b. at Mytilene in Lesbos 652 B. C.; as a leader of the democratic party participated very actively in all the feuds and embroilments of his native city, and was chosen *æsymnetes* in 589 B. C.—that is, ruler with absolute power—which office he filled to 579 B. C. D. 569 B. C. Of his laws and other acts as a ruler nothing is known; of his elegiac poems Diogenes Laertius has preserved a few lines.

Pit'tidæ [Gr. *πίττα*, "pitch," in allusion to the color of some species], a family of passerine birds popularly known under the name ant-thrushes. They are larger than the thrush; the bill moderate and nearly straight, with the sides compressed toward the tip, and with the tip decurved; the nostrils lateral, in a membranous groove, and near the base; the wings short, with the third and fourth quills longest; tail very short and even; feet robust; tarsi long, slender, and with transverse scutellæ; toes three in front, of which the outer is longer than the inner, hind toe quite long; all with long curved claws. The species are quite showy, and the most salient character is the shortness of the tail. They are inhabitants of India and the contiguous regions, as well as Western Africa, Australia, and Madagascar, where alone the species *Philopitta* are found. The family embraces only two genera—*i. e. Pitta* and *Philopitta;* the former has thirty-nine species, the latter two.

Theodore Gill.

Pitts'borough, p.-v., Middle tp., Hendricks co., Ind., on Indiana division of Indianapolis Bloomington and Western R. R. P. 201.

Pittsborough, p.-v., cap. of Calhoun co., Miss. P. 186.

Pittsborough, p.-v., cap. of Chatham co., N. C.

Pitts'burg, tp., Johnson co., Ark. P. 959.

Pittsburg, p.-v., Tippecanoe tp., Carroll co., Ind., on Wabash River. P. 320.

Pittsburg, or **Cross-Roads,** tp., Wicomico co., Md. P. 2132.

Pittsburg, p.-tp., Coos co., N. H. P. 400.

Pittsburg, city, cap. of Allegheny co., Pa., at the junction of Allegheny and Monongahela rivers, the two rivers here uniting to form the Ohio, which empties into the Mississippi 1000 miles below. The city is 354 miles, by rail, W. of Philadelphia, and about 40 miles E. of the Ohio State line; lat. 40° 26′ 34″ N., lon. 80° 2′ 38″ W. It is the western terminus of Pennsylvania R. R. from Philadelphia, and Connellsville R. R. from Baltimore; the southern terminus of Allegheny Valley R. R. from Buffalo, Erie and Pittsburg from Erie, and Cleveland and Pittsburg from Cleveland; the eastern terminus of Pittsburg Fort Wayne and Chicago R. R. from Chicago, and of Pittsburg Cincinnati and St. Louis R. R.; and the northern terminus of Pittsburg Virginia and Charleston R. R., not yet completed. It also has railroad connection with Butler, Blairsville, and Indiana by West Pennsylvania R. R., and with Washington, Pa., by Chartiers R. R. Allegheny River is navigable as far up as Warren, but only when in flood. Monongahela River is slack-watered up to the Virginia line, and steamboats ply on it during the whole year, except in seasons of extreme cold. Ohio River is navigable from six to eight months in the year, according to the rainfall. Lumber and oil are transported to a considerable extent, nearly all the lumber from the western counties of the State finding its way to market in rafts by this stream. Coal and coke are produced in large quantities on the Monongahela, and are floated in barges to Cincinnati, Louisville, and New Orleans when the rivers are in flood. The annual product is about 60,000,000 bushels, or 2,000,000 tons.

The city was originally confined in its limits to the peninsula of level ground between the two rivers, but has since spread out up the banks of both rivers and over the adjoining hills, until it now extends to 7 miles up both rivers and across, and a population of over 30,000 has also been added from the S. side of the Monongahela and Ohio. Allegheny City, on the opposite side of the Allegheny River, still maintains a separate municipal existence, but is always regarded as being a part of what is known under the general name of Pittsburg. The site of the city was regarded in early days as being of great strategic importance. Washington as a young surveyor became acquainted with its value as early as 1753. In Feb., 1754, the English took possession of it and built a stockade at the junction of the rivers, but the French drove them out in the following April, and built Fort Duquesne for its protection. The disastrous expedition of Gen. Braddock in 1755 was undertaken for the purpose of dislodging the French, but he was met and defeated (July 9, 1755) by the French and Indians at a point 12 miles above Pittsburg, on the Monongahela, where now stands the flourishing village of Braddock. Maj. Grant, with 800 men, made a second attempt Oct. 15, 1758, and penetrated to the high ground on which a part of the city now stands, but his command was cut to pieces. The hill on which he en-

camped prior to his defeat is still known as Grant's Hill, although the hill has nearly all been graded away. The court-house now occupies the ground of his encampment. A third attempt, made by Gen. Forbes with 8000 men (Nov. 25, 1758), was more successful, and the French withdrew permanently. A new fort was built in 1759, the French having burned the old one, and the place immediately became a great point for trade. The fort was called Fort Pitt, in honor of William Pitt, then at the head of the British ministry, and when the place had grown to a town it was called Pittsburg. The post was given up by the English in 1772, but as early as 1764 efforts were made to build up a town, and it gradually increased its population. In 1804 it was incorporated into a borough. Virginia at one time claimed that all that part of Western Pennsylvania along the Monongahela and Ohio belonged to her, and a commission of Virginians took possession of Fort Pitt in 1775; but when the boundary-line was settled between Pennsylvania and Virginia in 1779 it was placed considerably S. of Pittsburg, and the possession of the fort was surrendered. The site of the original town was a part of one of the manors reserved by the Penn family when they surrendered to the State their proprietary rights to the soil, and the town was surveyed and laid out by them in streets and town-lots at a very early day after the English left. The lower part of the city still retains the streets and general conformation given to it by this survey. The Whisky Insurrection and the agitation attending it, which extended from 1791 to 1796, led to many scenes of violence and excitement in Pittsburg, many of its then citizens taking an active part in that trouble. The borough was incorporated into a city in 1816, its limits being unchanged. In the same year a town called Bayardstown was laid out immediately adjoining it on the N. E., which was many years afterward added to the city. The U. S. arsenal was built in 1814 at a point on the Allegheny River 2 miles above the city. It is now entirely surrounded by the city, which has extended miles beyond it. After Bayardstown was admitted into the city as the fifth ward (the old city consisting of four) the city-line was extended over the large hills immediately E. of the old city, increasing the number of wards to twelve; in 1867 the whole territory between the two rivers, from a point 7 miles above the junction, was added, increasing the number of wards to twenty-three. Subsequently, in 1872, the several towns S. of the Monongahela were added, increasing the number of wards to thirty-seven. The population in 1793 was 1139; in 1820 it was 7497; in 1850, 46,601; in 1860, 49,217; in 1870, 86,076; and in 1874, with the additions made on the S. in 1872, it is about 140,000. Adding Allegheny City, which is practically a part of Pittsburg, the population is 210,000. The business of manufacturing, which is the distinguishing characteristic of the city, began at a very early period. As early as 1777 boat-building was extensively carried on, and in 1794 a line of keelboats was established between Pittsburg and Cincinnati. The first paper-mill was built in 1798, the first cotton-mill in 1805, the first glasshouse in 1807, and the first nail-machine was put up in 1814. The establishment of rolling-mills and foundries began shortly after the close of the second war with Great Britain, and has been going on steadily. The first bank was started in 1814, and the rivers were both bridged in 1816.

The present condition of the city may best be inferred from the following statistics: There are 10 daily papers published, 2 of which are in German, and 20 weeklies. The number of iron-mills is 43, using 570 puddling furnaces and 520 nail-machines. There are 12 blast furnaces for the production of pig metal, yielding, in 1873, 163,853 tons, and the pig metal imported into the city by rail and river in the same year was 320,342 tons, making a total consumption of 474,195 tons for mills and foundries. The amount of ore imported for use in furnaces and mills was 346,380 tons. The number of foundries and machine-shops is 75. The coal and coke mined and sent to market was 130,000,000 bushels, of which 60,000,000 bushels were shipped down the river to ports below, and 70,000,000 consumed in the city. Number of glasshouses, 70, employing 5000 men. Number of home insurance companies, 19; banks of discount and deposit, 36; savings banks, 23; capital of insurance companies, $3,250,000; of banks, $13,000,000; of savings banks, $3,250,000. The receipts of crude oil in 1874 were 2,000,000 barrels and the exports of refined were 800,000 barrels. The grocery and produce trade, wholesale, amounts annually to $25,000,000, and the dry goods trade to $10,000,000. The capital invested in manufactures is estimated at $60,000,000, and the annual export of manufactured goods at $150,000,000. The receipts of flour were 400,000 barrels, and 5,000,000 bushels grain. The great "Union" gun, the largest in the world, was cast here in 1861, weighing 49,050 pounds. The various manufactories of the city embrace sheet, bar, and boiler iron of all kinds, nails, spikes, rivets, bolts, nuts, screws, blister, plough, and cast steel, axles, vises, crow-bars, gas-pipe, stoves, water-pipes, iron and wooden bridges, tacks, glassware of all kinds, copper, sheet and pig, white lead, ploughs, wagons, carriages, shovels, axes, safes, cutlery, wire, boilers and engines, files, guns, etc. There are 3 copper-mills, 10 white-lead factories, 2 silver-smelting furnaces for extracting lead and silver from Rocky Mountain ores, and quite a number of smaller factories of various sorts. The number of men employed is from 30,000 to 40,000, and the total business of the city reaches an aggregate of $200,000,000 annually. There are now 6 bridges over the Allegheny, connecting the two cities of Pittsburg and Allegheny, 1 of which is a beautiful suspension bridge; and 4 over the Monongahela connecting the old city with the S. side. There are 8 street railways, leading to all parts of the city, and 2 inclined planes up the bluff hill on the S. side formerly known as Coal Hill. The city has an excellent system of ward schools, with a high school for advanced pupils, and many of the ward school-houses are fine specimens of architecture. Besides a large number of fine buildings, public and private, there are 1 university, an insane hospital, 4 hospitals for the sick and injured, 2 orphans' asylums, an observatory, a marine hospital, 3 public libraries, and about 200 churches, belonging to all denominations. Both Pittsburg and Allegheny are well supplied with water from Allegheny River, the S. side being supplied from the Monongahela. There are 4 large basins on high ground, holding the supply for daily use—1 S. of the river, 2 between the rivers, and 1 N. of the Allegheny; and the city of Pittsburg is now engaged in building new reservoirs, to be filled with water drawn from the Allegheny above the city-line, and of sufficient capacity to supply a city with 1,000,000 inhabitants. There are 5 gasworks, with mains extending to all quarters, and gas is cheaper in this city than in any other city in the Union, being supplied to the city at 75 cents per 1000 cubic feet, and to citizens at $1 in the densely-settled parts of the city. Nine railroads enter the city from various points, and the people have direct access to all parts of the country by rail. The Pittsburg Virginia and Charleston road is the only one unfinished. It is now built only to Monongahela City, in the adjoining county of Washington, but is to be extended into West Virginia and southward until it connects with the Southern chain of roads. The steady growth of the city may be inferred from the fact that from 1500 to 2000 new houses are annually built, more than half of them being brick. The city was visited by destructive floods in 1832 and 1852, and by a terrible fire in 1845, which swept away one-third of the business part of the city. It has also been thrice visited by the cholera, but only to a very limited extent each time. The general health of the city is remarkably good, the death-rate being 80 to 100 weekly in a population of 210,000. RUSSELL ERRETT, ED. "COMMERCIAL."

Pittsburg, p.-v., cap. of Camp co., Tex.

Pittsburg Landing. See SHILOH.

Pitts'field, p.-v. and tp., cap. of Pike co., Ill., at the southern terminus of Pittsfield branch of Toledo Wabash and Western R. R., has 2 newspapers, several flouring-mills and tobacco manufactories, and a considerable trade. P. 1621; of tp. 2799.

Pittsfield, p.-v. and tp., Somerset co., Me., on Maine Central R. R. P. 1813.

Pittsfield, p.-v. and tp., cap. of Berkshire co., Mass., in lat. 42° 36′ N., lon. 73° 15′ W., is located upon a beautiful plain 1200 feet above the sea, and surrounded by fine sheets of water, adding much to its picturesqueness and scenery. There are 6 lakes and lakelets, the outlets of which form Housatonic River, one branch girting the village on the W. and the other on the E., both finally meeting S. of the village. It is supplied with water and gas, and contains a park, a free library of 7000 vols., works of art, etc., 1 high and 30 public schools, 2 seminaries, a fine court-house, 10 churches, 2 weekly newspapers, 3 banks, a life and fire insurance company, several fine hotels, a jail, and fine stores. The lakes in the vicinity afford excellent water-power, which is utilized in the manufacture of cotton and woollen fabrics, silk, and tacks. Pittsfield is an important railroad centre; Boston and Albany, Housatonic, and Pittsfield and North Adams R. Rs. pass through it, affording good facilities for transportation in all directions. A benevolent institution for the disabled by accident or disease ranks among its charities. The site of Pittsfield was granted to Boston in 1735, and was known as Boston Plantation until its incorporation in 1761, when it received its present name. P. 11,112. JOHN TATLOCK.

Pittsfield, tp., Washtenaw co., Mich. P. 1121.

Pittsfield, p.-tp., Merrimack co., N. H., on Suncook Valley R. R., 15 miles E. of Concord, has an academy, 5 churches, 2 banks, 2 newspapers, 1 cotton-factory, and 1 shoe-factory. P. 1600. J. C. CASHMAN, ED. "STAR."

Pittsfield, p.-v. and tp., Otsego co., N. Y., on Unadilla River. P. 1469.

Pittsfield, p.-v. and tp., Lorain co., O. P. 980.

Pittsfield, p.-v. and tp., Warren co., Pa., on Broken Straw Creek and Philadelphia and Erie division of Pennsylvania R. R. P. 1260.

Pittsfield, p.-v. and tp., Rutland co., Vt. P. 482.

Pittsfield, tp., Brown co., Wis. P. 585.

Pitts'ford, tp., Butler co., Ia. P. 512.

Pittsford, p.-v. and tp., Hillsdale co., Mich., on Lake Shore and Michigan Southern R. R. P. 1675.

Pittsford, p.-v. and tp., Monroe co., N. Y., on Irondequoit Creek, Erie Canal, and New York Central R. R. P. of v. 505; of tp. 1974.

Pittsford, p.-v. and tp., Rutland co., Vt., on Rutland R. R. P. 2127.

Pitts'grove, p.-v. and tp., Salem co., N. J., on West Jersey R. R. P. 1667.

Pitt's Point, p.-v., Bullitt co., Ky. P. 98.

Pitts'ton, p.-v. and tp., Kennebec co., Me., on Kennebec River. P. 2353.

Pittston, p.-b. and tp., Luzerne co., Pa., in the centre of the Wyoming coal-region, 9 miles from Wilkesbarre, ships annually over 1,000,000 tons of coal, and has 3 railroads, excellent public schools, churches of all denominations, 2 newspapers, 4 banks, water and gas works, 1 foundry, and machine-shops, 1 knitting and 2 planing mills, a stove manufactory, terra-cotta works, lumber-yards. P. of b. 6760; of tp. 4447.
G. M. RICHART, ED. "GAZETTE."

Pitts'town, p.-v. and tp., Rensselaer co., N. Y., on Troy and Boston R. R. P. 4093.

Pittsylva'nia, county of Virginia, bounded S. by North Carolina. Area, 900 sq. m. It is hilly, picturesque, and very fertile. Iron ore and limestone abound. Live-stock, grain, and tobacco are largely produced. Traversed by Richmond and Danville R. R. Cap. Competition (Pittsylvania Court-house P. O.). Danville is the largest town. P. 31,343.

Pittsylvania Court-house (P. O. name of Competition), cap. of Pittsylvania co., Va.

Pitu'itary Body [Lat. *pituita*, "mucus"], a small, soft, reddish, oval, vascular body within the skull, is situated on the *sella turcica*. It has two lobes, and appears to be a ductless gland, of the same class with the thyroid, the thymus, etc., and like them is proportionally much larger in the fœtus than in the adult.

Piu'ra, town of Peru, in a dry and sandy plain on the river Piura, in lat. 5° 11′ S., 63 miles from its port, Payta, on the Pacific, was founded by Pizarro in 1531, and is the oldest settlement of the Spaniards in Peru. The province of which Piura is the capital, and which bears the same name, is rich in sulphur, iron, lead, magnesia, lime, and petroleum, and produces maize, tobacco, cacao, cotton, and sugar; it is also noted for its fine breed of mules. The city is well and substantially built, and carries on a considerable trade. A railway connecting it with Payta is under construction. P. about 15,000.

Pi'us, the name of nine popes, of whom three have acquired a conspicuous name in history.—PIUS VI. (*Giovanni Angelo*), Count Braschi, b. at Cesena, province of Forli, Italy, Dec. 27, 1717; was elected pope Feb. 15, 1775, under very difficult circumstances. In most Roman Catholic countries, Austria, France, Portugal, Naples, and Tuscany, there showed itself a marked tendency to emancipate the national Church from the authority of the pope and place it under the direct control of the state; against which tendency Pius VI. found no other weapon to apply than a repetition of the old papal pretensions. But these declamations sounded so much the more singular in his mouth as he was not a character of any great weight. Although a handsome, graceful, affable man, of prepossessing manners, he was somewhat vain, a little ostentatious, weak and irresolute of will, and soon entangled in glaring self-contradictions. He drained parts of the Pontine Marshes, but the immense sums which this undertaking cost he raised by establishing in his states one of the most objectionable forms of lottery, which here, as everywhere, speedily reduced poor people to complete misery. He built the harbor of Ancona, but he gave his nephew, Luigi Braschi, a monopoly of the trade in oil and corn. With Joseph II. he succeeded in negotiating without incurring any open breach, but with the revolutionary government of France this proved impossible. The policy of the National Convention and the Directory was as violent and cynical as that of the pope was imprudent and undignified. In 1797 he bought the Peace of Tolentino by immense sacrifices of land and money. But new complications soon arose, and on Feb. 18, 1798, the French proclaimed the Republic in Rome and imprisoned the pope. The old man, now eighty-one years of age, was carried from Rome to Florence, thence to Grenoble, and at last to Valence, borne across Mount Genèvre in a litter and sheltered against the cold by the furs of the hussars who formed his guard. At Valence he d. shortly after, Aug. 29, 1799.—PIUS VII. (*Gregor Barnabas*), Count Chiaramonti, b. at Cesena Aug. 14, 1742, a cousin of Pius VI.; was elected pope Mar. 14, 1800; entered Rome July 3 by the aid of Austrian, English, and Turkish troops, and took possession of all the papal dominions with the exception of Avignon and Venaissin Nov. 22, 1801, having concluded the concordat with France on July 15 of the same year. His aim, like that of his predecessor, was the re-establishment of the papal authority in all its mediæval glory, but he was a man of strong convictions and firm will, and all his actions bear a mark of gentleness and simplicity which commands respect and sympathy. Nov. 28, 1804, he arrived at Paris, on the invitation of Napoleon, in order to crown him, but this visit, which lasted till Apr. 4, 1805, was fatal to the good relations between the emperor and the pope. The incompleteness of the concordat gave rise to many questions at once delicate and important. The demands of Napoleon became by degrees almost outrageous. While the Directory simply declared the papal authority null and void, the emperor seemed inclined to use it as a puppet. The resistance of Pius VII. was energetic and dignified, but unsuccessful. Feb. 2, 1808, Rome was garrisoned with French troops, and Apr. 2 of the same year the provinces of Urbino, Ancona, Macerata, and Camerino were incorporated with the kingdom of Italy. May 17, 1809, the incorporation was extended to the whole of the papal dominions, and when the pope excommunicated Napoleon by a bull of June 11, Gen. Radet broke into the Vatican during the night of July 6 and carried the pope away a prisoner, first to Grenoble, then to Savona, at last (in 1812) to Fontainebleau. Here Napoleon compelled him to sign a new concordat (Jan. 25, 1813), but Mar. 24 the pope revoked his consent, and declared that he would enter into no negotiations with the emperor until he had been restored to Rome. Jan. 22, 1814, he was allowed to return to his capital, and by the Congress of Vienna all his possessions, with the exception of Avignon and Venaissin, were restored to him. His subsequent government was energetic and just, but thoroughly reactionary in both ecclesiastical and political respects. D. Aug. 20, 1823.—PIUS IX. (*Giovanni Maria Mastai-Ferretti*), b. at Sinigaglia May 13, 1792. Delicate health compelled him to give up his original plan of embracing the military profession. He entered an ecclesiastical seminary, studied theology at the College of Volterra, and took holy orders in 1818; in 1823–25 visited Chili; in 1827 was created archbishop of Spoleto, whence he was transferred in 1832 to the see of Imola; in 1840 was made cardinal, and was several times employed in diplomatic missions. In all the different offices he filled he distinguished himself by the mildness, benevolence, and vivid sympathy of his nature. Asylums, hospitals, schools—in short, all kinds of educational and charitable institutions—received his attention and support, and when, on the death of Gregory XVI., the conclave chose him pope (June 16, 1846), he was greeted with general acclamation. His first steps as a sovereign increased his popularity still more. He granted a general amnesty to all political offenders, and suppressed with great energy all abuses in the administration. He lowered the taxes, granted concessions for railroads, favored commerce and manufactures, opened the civil offices to laymen, and called together (Nov., 1847) a council of state composed of delegates from the provinces. These proceedings created quite an enthusiasm for him, not only in Rome and Italy, but in the whole civilized world, and excited the most sanguine expectations. The more surprising was it that the next year (Nov. 24, 1848) he had to flee from Rome in disguise and take refuge in the Neapolitan fortress of Gaëta. But this sudden change in his position is to be explained partly from the fact that all his reforms resulted from the kindness of his personal character, rather than from any liberality in his political ideas; partly from the circumstance that by his general amnesty Rome had become the gathering-place of a great number of political intriguers, exasperated exiles, and fanatical enthusiasts, whose exaggerated demands no liberality of views could satisfy, and who never ceased to stir up and inflame the general excitement of the people. The

pope appealed to France, Austria, Spain, and Naples for help, and in Apr., 1849, an Austrian army moved toward Rome from the N., and a French from Civita Vecchia. On Aug. 22, Rome surrendered to the French, and the papal authority was re-established; the pope himself returned in Apr., 1850. As long as the Austrian army occupied the northern part of the state, and the French army Rome and the southern part, the government of Pius IX. remained undisturbed; but it was evident enough that it was antagonistic to the feelings and ideas of his subjects. As soon as the Austrian army retired (in 1859), the northern provinces annexed themselves to the kingdom of Italy, and the same took place in Rome and the southern province on the withdrawal of the French army in 1870. Without any further revolutions or disturbances, the temporal power of the pope glided out of existence. How far the views of Pius IX. are from harmonizing with the spirit of the nineteenth century is best seen in his management of ecclesiastical affairs. He has enriched the dogmatics of the Roman Catholic Church with two new doctrines—namely, the immaculate conception of the Virgin, established by a decree of Dec. 8, 1854, and the infallibility of the pope in all matters of faith and morals, established by the so-called œcumenical council of Rome in 1870. But both these doctrines seem to belong to the Middle Ages, rather than to the nineteenth century; and still more apparent is the discrepancy in the encyclical letter of Dec. 8, 1864, especially in its famous Syllabus. Here Pius IX. condemns as heretical the ideas of liberty of conscience, of the liberty of the press, of the independence of the secular government from the ecclesiastical, of the equality of laymen and clergymen before the law, of the right of a people to make their own laws and elect their own magistrates, etc.; that is to say, he condemns in the eighty-four theses all the principal ideas of modern civilization as heretical. In France the publication of the syllabus was forbidden; the Italian government protested against its contents in very strong expressions; and the Austrian government took a cautious reservation. The general effect was that the antagonism between the spirit of the nineteenth century and the present head of the Roman Catholic Church became very vividly felt. CLEMENS PETERSEN.

Pi Ute′, county of S. E. Utah, extending W. from the Territory of Colorado. Estimated area, 5500 sq. m. It embraces a great variety of soils and surface. Mining is the chief industry. Cap. Bullion. P. 82.

Pi-Utes. See PAH-UTES.

Pix′ley, tp., Clay co., Ill. P. 1517.

Pizar′ro (FRANCISCO), the "great marquis," b. at Truxillo, Spain, about 1471, was the natural son of a Spanish colonel of foot by a peasant-girl of Estramadura; was bred a swineherd, and even, according to a popular account, was suckled by the swine in infancy, on account of his mother's neglect. He grew up a bold, ignorant, and brutal man, and from 1510 to 1525 was engaged in perilous adventures in Spanish America; was one of Balboa's party which discovered the Pacific Ocean. Having heard of the existence of Peru, with its great wealth, he led a party which after incredible hardships reached and partly explored that country in 1526, a previous expedition having failed (1524). In 1528 he obtained leave of Charles V. to attempt the conquest of Peru, but without public aid; and in 1531, after great sufferings, he invaded the Peruvian empire with 110 foot-soldiers, 67 mounted men, and two small cannon; treacherously seized the confiding inca, Atahuallpa, and in less than two years had overthrown the ancient government of the realm, partly by good generalship, unceasing activity, and unfailing valor, but quite as much by perfidy and brutal violence. Pizarro was made a marquis, founded Lima and other towns, and for some years ruled Peru as captain-general with almost absolute power; but a desperate and nearly successful revolt of the Indians was followed in 1538 by a contest with Almagro, his associate, who was defeated and slain; soon after which Almagro's followers attacked Pizarro in his palace (June 26, 1541), and he was killed after a desperate struggle. Pizarro was simply a successful robber. Avarice, perfidy, jealousy, cruelty, and habits of brutal outrage marked his career. When in power he said *no* to every request. Courage and constancy to his purpose must be conceded to him. He was a Roman Catholic, and died embracing the crucifix. He never learned to read and write. He married the inca's daughter, and founded a line of grandees, marquises de la Conquista, who still bear his name. His half-brothers, Gonzalo, Hernando, and Juan, were partners of his crimes in Peru.

Piz′zo, seaport town of Southern Italy, province of Catanzaro, on a rocky hill rising above the Gulf of Sta. Eufemia. This town is in general well built, and the old baronial castle still exists. It is a place of very considerable trade, and the fisheries are important, the tunny being most abundant. P. in 1874, 8300.

Placenta. See EMBRYOLOGY, by PROF. JOHN C. DALTON, M. D., M. N. A. S.

Placen′ta [Gr. πλακοῦς, "a flat cake"], a structure peculiar to mammals of the highest class—Monodelphia or Placentalia—and destined for the nutrition of the fœtus during a prolonged intra-uterine life. It is developed in various degrees of complication, and these have led to the differentiation of the placentiferous mammals into various groups, distinguished by the degree of development.

In (1) the Primates (man and monkeys), (2) Chiropters (bats), (3) Insectivores, (4) Rodents, (5) Carnivores, (6) Proboscidians, and (7) Hyracoids, the placenta is formed by outgrowths from both the ovum and the lining membrane of the uterus, the former furnishing the amnion and chorion, and the latter the decidua: in the first stage the chorion develops villi, which fit into depressions of the decidua, but finally the chorion and decidua grow together and form a single structure; the decidua itself is resolvable into three parts—(1) a *decidua vera*, lining the general cavity of the uterus; (2) a *decidua reflexa*, which is an outgrowth of the decidua vera, and invests the ovum; and (3) a *decidua serotina*, which is a special development of the decidua vera, and is, says Huxley, "a layer of especial thickness, developed in contiguity with those chorionic villi which persist and become converted into the fœtal placenta." The placenta of this type characterizes the (Monodelphia) Deciduata of Huxley; in some of these (the Primates, Chiropters, Insectivores, and Rodents) the placenta encloses the fœtus in a discoid sac; in others (Carnivores, Proboscidians, and Hyracoids) it forms a zone-like girdle around the fœtus.

In the Ungulates and Cetaceans no decidua is developed from the lining of the uterus. The types thus distinguished are combined by Huxley under the common name (Monodelphia) Non-deciduata.

Among the Edentates are exemplifications, it is said, of all these types; and inasmuch as the concordance in other respects of these mammals indicates their consociation to be natural, the classificatory value of the placental characters are strongly impugned.

The chief zoologists who have made use of the modifications of the placenta for the characterization and arrangement of the orders of mammals are Von Baer, H. Milne Edwards, and Huxley. H. Milne Edwards has especially used the modifications of the placenta in great detail for the classification of the several forms (*Récherches pour servir à l'Histoire naturelle des Mammifères*, introduction, 1868). THEODORE GILL.

Placenta′lia [from *placenta*], a name given by Owen to those mammals which are provided with a placenta. It is equivalent to the sub-class Monodelphia of De Blainville and recent authors. (See MAMMALS.) THEODORE GILL.

Placentia. See PIACENZA.

Placen′tia, seaport, cap. of Placentia district, Newfoundland, on a low beach (sometimes overflowed) on the E. side of Placentia Bay. Its harbor is spacious, but not very deep. Placentia, settled by the French in 1626, was long held by them as a menace to the English, who once attacked it without success. Placentia is the seat of a Roman Catholic bishop. P. about 400.

Placer′, county of California, extending W. and S. W. from the Nevada State line to Sacramento River. Much of it is rugged and densely timbered. The W. part is level. Wool, wheat, fruit, and lumber are extensively produced. Quartz, hydraulic, and other gold-mining are important industries. Traversed by Central Pacific R. R. and by N. fork of American River. Area, 1386 sq. m. Cap. Auburn. P. 11,357.

Placerville, p.-v. and tp., cap. of El Dorado co., Cal., situated about 40 miles E. of Sacramento, has excellent public schools, 1 private academy, 4 churches, 1 synagogue, 2 weekly newspapers, 1 iron-foundry, 2 fire-engine companies, 4 distilleries, 2 breweries, 1 evaporator for fruit-drying, 1 grist and 9 saw mills, and stores. Quartz lodes bearing gold are numerous, and water is obtained for mining and irrigation from lakes situated near the summit of the Sierra Nevada, through an aqueduct over 40 miles in length. Fruit-growing is extensively carried on, and the breeding of Angora goats has proved successful. The Odd Fellows, Masons, Knights Templar, Red Men, and Druids have each lodges here. Numerous quartz-mills are located in the vicinity. P. of v. 1562; of tp. 2624.
W. A. SELKIRK, ED. "MOUNTAIN DEMOCRAT."

Placerville, p.-v., Boisé co., Id. P. 318.

Placerville, v., Elko co., Nev. P. 160.

Placogan′oids [from πλάξ, a "flat plate," γάνος, "brightness," in allusion to the lustre of the plates or

scales, and εἶδος, "form"], the name of a group of extinct fishes, embracing types peculiar to the Silurian and Devonian epochs, and which were distinguished by their plate-like armor. (See FISH.) THEODORE GILL.

Placun'idæ [*Placuna*, πλακοῦς, a "flat plate," given in allusion to the flat, plate-like form of the shell], a family of conchiferous mollusks allied to the oysters, etc. The body is much compressed and sub-orbicular; the mouth has its margins free, double, and fringed with cirrhi; gills two on each side, unsymmetrical, united behind; mouth with plain lips confluent with the gills; foot small and cylindrical, with a small retractor muscle; the sexes are distinct; "the generative system attached to the right mantle-lobe, and the ventricle exposed" (*Woodward*); the shell has moderately unequal subcircular valves, which are semi-transparent, and consists entirely of sub-nacreous plicated laminæ penetrated to some extent by minute tubuli; the hinge has a cartilage bounded by two diverging ridges in the right valve, corresponding with grooves in the left; there are scars left of a large submedian adductor muscle, and a small one in front of it. The family is chiefly represented by species in the Indian and Pacific oceans. The Anomiidæ of North America are the nearest allies. THEODORE GILL.

Plagal. See MODES, ECCLESIASTICAL.

Pla'gal Ca'dence, in music, a cadence formed by the harmony of the subdominant, followed by that of the tonic or keynote. It is of frequent use in church music, and hence is sometimes called the "ecclesiastical" cadence. (See MUSIC.)

Plagios'tomi [πλάγιος, "oblique," and στόμα, "the mouth"], an order, or rather super-order, of Selachians, including the sharks (order Squali) and rays (order Raiæ). They are distinguished, in contrast with the Holocephali, by the freedom of the mandibular bone and its simple articulation with the cranium, the absence of opercular bones, the development of five (rarely six or seven) external branchial apertures. (See further RAIÆ and SQUALI.) THEODORE GILL.

Plague [Gr. πληγή; Lat. *plaga*, a "blow"], a malignant and fatal contagious fever, now little known, but formerly epidemic in Egypt and the Levant, and spreading in devastating epidemics throughout Europe. By its mortality it was an obstacle to the growth of countries and the advance of civilization. It was termed "the pest," the "black death," and the "great mortality." Its first appearance in Europe was at Constantinople in A. D. 544. Since that time epidemics have occurred at variable intervals; there were forty-five in the seventeenth century. The "Great Plague" of London was in 1665, and was supposed to have been brought from Holland. It is estimated that in Europe 25,000,000 have died of plague. The disease has prevailed in brief and local epidemics during the eighteenth and first half of the nineteenth centuries—at Copenhagen in 1712, Marseilles 1720, Moscow 1771, Malta 1813, Silesia 1819, Bulgaria (in the Russian army) in 1828–29. It has not appeared even locally in Europe since 1841. Its last appearance in Egypt was in 1844. In 1857–58 it occurred among the Arabs of North Africa, in 1857 in Mesopotamia, and in 1871 in Persian Koordistan. The plague is now regarded as a zymotic disease, derived from insalubrious and poisonous atmospheric or telluric conditions, a *materies morbi* gaining access to the blood, and rapidly multiplying in it and destroying its nutritive elements. In malignity and nature it resembles typhus fever, but is regarded as distinct from it. Its propagation was formerly supposed to be by contagion, but it is now regarded as due to importation by ships or on the person, and communicable by atmospheric infection. In Egypt the overflow of the Nile was considered its pestilential source. Overcrowding, bad ventilation, uncleanliness, deficient food, and residence in damp, marshy soils have been considered the predisposing causes of local epidemics. After exposure there is a period of latency or incubation of from two to seven days. The disease has four stages, yet all may occur in rapid succession and brief time: (1) invasion, (2) fever, (3) local phlegmons, and (4) collapse or convalescence. It is preceded by lassitude and enfeeblement of mind and body; its definite onset is announced by shivering, headache, vertigo, vomiting, high fever-heat, great prostration, stupor or unconsciousness, blood in the urine or from the bowels, the appearance of bubos or inflammatory enlargement of lymphatic glands, or of carbuncles, or again, in fatal cases, of petechiæ or purple spots and mottling of the skin. Its duration is two or three days, and, when survived, a slow subsequent convalescence. It is to be prevented by hygienic measures and public quarantine, but its treatment, beyond general measures of stimulation and nutritive support, avails little. (See Hecker's *Epidemics of the Middle Ages*, London, 1846.)

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Plaice. See PLEURONECTIDÆ.

Plain, tp., Monroe co., Ark. P. 220.

Plain, tp., Kosciusko co., Ind. P. 1490.

Plain, tp., Franklin co., O. P. 1293.

Plain, tp., Stark co., O., on Pittsburg Fort Wayne and Chicago R. R. P. 2226.

Plain, tp., Wayne co., O. P. 1837.

Plain, tp., Wood co., O. P. 1719.

Plain City, p.-v., Darby tp., Madison co., O., on Pittsburg Cincinnati and St. Louis R. R., 17 miles W. of Columbus, has 3 churches, 1 weekly newspaper, 2 banks, 1 steam flouring-mill, 2 hotels, and 1 planing-mill. P. 467.

A. SMITH, ED. "PRESS."

Plainfield, p.-v. and tp., Windham co., Conn., at the junction of Norwich and Worcester with Providence Hartford and Fishkill R. R., on Quinebaug and Moosup rivers. P. 4521.

Plainfield, p.-v. and tp., Will co., Ill., on Du Page Creek. P. 723; of tp. 1750.

Plainfield, p.-v., Guilford tp., Hendricks co., Ind., on St. L. Vandalia Terre H. and Indianapolis R. R. P. 795.

Plainfield, p.-v. and tp., Hampshire co., Mass. P. 521.

Plainfield, tp., Iosco co., Mich. P. 122.

Plainfield, tp., Kent co., Mich., on Grand River and Grand Rapids and Indiana R. R. P. 1499.

Plainfield, p.-v. and tp., Sullivan co., N. H., on Connecticut River. P. 1589.

Plainfield, city, New Providence tp., Union co., N. J., on Central R. R. of New Jersey, was incorporated as a city in 1869; has 1 institute, 1 seminary and free graded school, 15 churches, 4 banks, 3 weekly newspapers, and an extensive clothing manufactory. P. 5095.

J. C. RUNYON, ED. "CENTRAL N. J. TIMES."

Plainfield, tp., Otsego co., N. Y., on Unadilla River. P. 1248.

Plainfield, tp., Northampton co., Pa., on S. slope of the Blue Mountains. P. 1988.

Plainfield, p.-v. and tp., Washington co., Vt., on Winooski River. P. 726.

Plainfield, p.-v. and tp., Waushara co., Wis. P. 997.

Plain Grove, p.-v. and tp., Lawrence co., Pa. P. 775.

Plainland, tp., Monroe co., Ark. P. 220.

Plains, p.-v. and tp., Luzerne co., Pa., on Susquehanna River. P. 4018.

Plains, tp., Rockingham co., Va., on Washington City Virginia Midland and Great Southern R. R. P. 3035.

Plain Song, or **Plain Chant** [Lat. *cantus firmus*; It. *canto fermo*], in music, the simple, grave, and unadorned chant in which the services of the Catholic Church have been rendered from a very early age. It consists largely of monotone, and its inflections seldom exceed the range of an octave. The ecclesiastical chant is supposed to be chiefly of Greek origin, with some modifications brought in from Hebrew sources by the converts from Judaism in the first centuries. Prior to the time of St. Ambrose (fourth century) the music of the Church was in a rude and unsettled condition, but by his skill and energy it assumed the more regular form known as the Ambrosian chant. At a later period Gregory the Great introduced many improvements, corrected certain abuses, and gave to the ritual chant that more systematic form which has since borne his name. Plain song is usually written in black note on a stave of four lines, with either a C or an F clef. (See GREGORIAN MUSIC.) WILLIAM STAUNTON.

Plaint'iff (law). At the common law this term was confined to the class of legal actions called personal as distinguished from real, and described the moving party therein, the one who is named on the record as bringing the action; in the modern nomenclature, which prevails in most of the States, it designates the same person in all classes of civil suits, whether legal or equitable. It is a French word, first used when the records of judicial proceedings were kept in that language, and finally passing into the English with a slight change of orthography. In the earliest books it appears as *pleyntyfe*, from *pleyndre*, now *plaindre*, to "complain." Thus, Britton says: "No judgment—that is, judicial proceeding—can take place without three persons—*un juge, un pleyntyfe, et un defendaunt*." In the *Year Books*, which are the earliest reports of decided cases in England, and are written in the law French, the spelling is *pleintife*, while in Littleton, and other subsequent reports still in the French, it is changed

to *plaintife*, but in the oldest editions of Coke's *Commentaries* it is treated as an English word, retaining, however, the form last mentioned, which was ultimately altered to the present mode of spelling. By the early English law, and before any statutory modifications, special names were employed to designate the moving party, the party who institutes the proceedings, in the various classes of suits and in the different courts. In "real actions"—that is, the ancient forms of legal actions by which title to land was established and its possession recovered—he was denominated "the demandant;" in suits in equity he was called "the complainant;" and in the admiralty and ecclesiastical courts, or wherever the proceedings were based upon the Roman civil law, he was known as "the libellant." The term "plaintiff" was thus restricted to a class, but most important and common class, of legal actions, embracing all those which were not "real." Under certain circumstances a distinction existed, growing out of the extreme technicality of the common law, between the legal or nominal plaintiff and the equitable or real plaintiff. The former was the one who appeared as such on the record, and in whom the bare legal title to the subject-matter of the controversy was vested; the latter was the person who, not holding this bare legal title, and not appearing on the record, was still the actual owner of the demand, entitled to the proceeds, and for whose benefit the action was prosecuted. These common-law rules formerly prevailed in most of the States of this country. The reformed procedure, originally adopted in New York in 1848, and extending at the present day over more than twenty other commonwealths, has, however, greatly modified and simplified the judicial practice in reference to parties. In pursuance of that system all forms of civil action, legal and equitable, are reduced to one, in which the complaining party is denominated the plaintiff; and as he must be the real party in interest, the distinction between nominal and real plaintiffs has disappeared. A "plaintiff in error" is the party who obtains a "writ of error," and thereby removes a judgment into a higher court for the purpose of review. JOHN NORTON POMEROY.

Plainview, tp., Saline co., Ill., on N. fork of Saline River. P. 450.

Plain View, p.-v. and tp., Wabash co., Minn. P. 637; of tp. 1365.

Plainville, p.-v. and tp., Hartford co., Conn., at the crossing of New Haven and Northampton and Providence Hartford and Fishkill R. Rs., 13 miles S. W. of Hartford, has a graded school, fine water-power, 3 churches, 1 weekly newspaper, and 14 manufactories. P. 1433.
S. TOMLINSON, ED. "NEWS."

Plainville, p.-v. and tp., Onondaga co., N. Y., at the confluence of Seneca with Oswego River. P. 161.

Plainwell, p.-v., Gunplain tp., Allegan co., Mich., on Lake Shore and Michigan Southern and Grand Rapids and Indiana R. Rs., has 4 churches, 1 foundry, union schools, waterworks, 1 newspaper, paper-mills, several flouring and saw mills, and 4 hotels. P. 1035.
JEROME WINCHELL, ED. "REPUBLICAN."

Plaistow, p.-v. and tp., Rockingham co., N. H., on Boston and Maine R. R. P. 879.

Pla'na, de (GIOVANNI ANTONIO AMADEO), BARON, b. at Voghera, Piedmont, Nov. 8, 1781; studied at the Polytechnic School of Paris; became professor of mathematics at the school of artillery in Alessandria in 1803, and professor of astronomy at the University of Turin in 1811. D. there Jan. 20, 1864. His principal works are *Sulla teoria dell' Attrazione degli Sferoidi ellittici* (1810), and *Théorie du Mouvement de la Lune* (3 vols., 1832).

Planché' (JAMES ROBINSON), b. in London Feb. 27, 1796; became early distinguished as a writer of plays and librettos; gave great attention to archæology and costumes, on which subjects he wrote; author of some 200 dramatic pieces; designed Shakspearian costumes for Mr. Charles Kemble and his assistants; published in 1852 *The Pursuivant of Arms*, a treatise on heraldic subjects, which procured him the appointment of Rouge Croix Pursuivant in 1854. In 1866 he was promoted to be Somerset Herald. Has also written books of travel, songs, etc.

Planche (JEAN BAPTISTE GUSTAVE), b. at Paris Feb. 16, 1808; studied literature and art; lived from 1838 to 1845 in Italy, and had for some time, both before and after his Italian journey, entire control of the critical department of *Revue des Deux Mondes*. His contributions, collected under the titles *Portraits littéraires* (4 vols., 1836–49), *Portraits d'Artistes* (2 vols.), *Études sur l'École française de 1831 et 1832* (2 vols., 1855), are very valuable. D. at Paris Sept. 18, 1857.

Planck (GOTTLIEB JAKOB), b. at Nürtingen, on the Neckar, in Würtemberg, Nov. 15, 1751; studied theology at Tübingen, and became professor at the Karlsacademie in Stuttgart in 1780, whence he removed in 1784 to the University of Göttingen, where he d. Aug. 31, 1833. His principal works are—*Geschichte der Entstehung, der Veränderungen und der Bildung unsers protestantische Lehrbegriffs* (6 vols., 1781–1800), *Geschichte der protestantischen Theologie von der Concordienformel an bis in die Mitte des 18. Jahrhundert* (1831), *Geschichte der Entstehung und Ausbildung der christlich-kirklichen Gesellschaftverfassung* (5 vols., 1803–09), *Geschichte des Christenthums in der Periode seiner ersten Einführung in die Welt durch Jesus und die Apostel* (2 vols., 1818), etc.

Plan'cus (LUCIUS MUNATIUS), one of Cæsar's legates in Gaul in the winter of 54 B. C.; commanded his troops at Ilerda in Spain in the beginning of 49; accompanied him in his African campaigns in 46, and was nominated to the government of Transalpine Gaul for the year 44. After the death of Cæsar, he hastened to take possession of his province, but hesitated long before he decided what part to take in the ensuing contest. He finally joined D. Brutus, but, when this proved wrong, immediately went over to Antony. When the triumvirate was formed in 43, he consented to the proscription of his own brother in order to enjoy his consulship in 42 undisturbed. When the war between Octavius and Antony broke out, he tried to keep aloof, but finally fled with Antony to the East, and was first made governor of Asia, then of Syria, where he committed unheard-of cruelties and extortions. When he foresaw the fall of Antony, he hastened to Octavius, and it was on his proposition that the senate conferred the title of Augustus on the latter. He afterward lived very pleasantly in Rome at the new court. The date of his death is unknown. Horace addressed the seventh ode of his first book to him.

Plancy', de (JACQUES ALBIN SIMON COLLIN), generally called **Collin de Plancy,** b. at Plancy, department of Aube, France, Jan. 28, 1793; came to Paris in 1812; built up a business as a printer, publisher, editor, and author, and wrote *Dictionnaire infernal, Dictionnaire féodal, Mémoires d'un Vilain au 14e Siècle, Taxe des Parties casuelles de la Boutique du Pape, Biographie pittoresque des Jésuites, Le Diable peint par lui-même*, etc.—all in a decidedly anti-clerical, not to say anti-religious, revolutionary, and frivolous manner. In 1830 he fled from Paris on account of pecuniary difficulties, and settled at Brussels, where he wrote *Fastes militaires de la Belgique, Histoire des premières Années du Règne de Léopold*, and other things—all very flattering to the national vanity of the Belgians. In 1837 he was able to return to Paris, and he came back thoroughly converted. He now wrote *Légendes de la Sainte Vierge, Légendes des Origines, Légendes du Juif-Errant, Chronique de Godefroy de Bouillon, Légendes des Sept Péchés capitaux, Légendes des Esprits et des Démons qui circulent autour de nous, Le Chansonnier du Chrétien*, etc.; which books were zealously canvassed by Roman Catholic associations for the introduction of good books among the lower classes. The method which he generally applied in making a new book consisted in cutting up two old ones and rearranging their contents. The new book was then generally provided with a new pseudonym. Among the many names he employed as an author are "Paul Béranger," "Croquelardon," "Hormisdas-Peath," "Baron Nilense," "Saint Albin," "Johannes Videlbius," etc.

Plane [Lat. *planus*], a surface such that if any two points of it are joined by a straight line, that line will lie wholly in the surface. The surface extends to infinity in all directions.

Plane [Lat. *planus*], an instrument much used by carpenters and joiners for smoothing wood. It is of many forms, each adapted to special uses, but for planing upon a large scale it has been superseded by machines driven by steam or water. There are also special forms of the planing-machine for smoothing metallic surfaces.

Plan'er Tree, the *Planera aquatica*, a rather small ulmaceous tree of swampy lands in the Southern States. It has the general appearance of the elms, but is quite distinct from them in flower and fruit. It was named in honor of J. J. Planer, a German botanist. Its timber is hard, and suitable for many economic uses. The wood of *Planera abelicea*, of the Levant, is aromatic. It is the Cretan false sandal-wood of old writers. Another planer is *P. Richardi* of Persia and the Caucasus, partly naturalized in Europe, and sometimes called *zelkoua*. It is a tall and handsome tree, producing excellent timber.

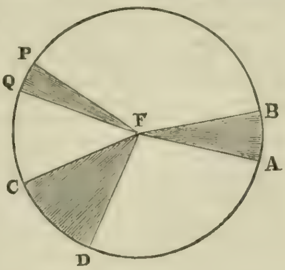
Plan'et [Gr. ἀστήρ πλανήτης, "wandering star"]. This term was applied by the ancient Greeks to five conspicuous stars (Mercury, Venus, Mars, Jupiter, and Saturn), which, changing their places, seemed to *wander* among the constellations. Modern science has added to these no less than 160 other bodies, all having special characteristics,

and all subject to the same common conditions, the earth itself being, for these reasons, undoubtedly to be classified among those bodies, and also Uranus and Neptune, as well as the minor planets between Mars and Jupiter, which by Sir William Herschel were designated as *asteroids*; of which, up to the present time (Jan. 6, 1876), 157 have been recognized. But this systematic nomenclature and designation does not include satellites (see MOON) nor comets, nor yet meteorites of various dimensions, whose physical constitution or governing centres of force, or both, are different.

The conditions to which all the planets are subject are distinctly indicated in *Kepler's Laws*. These are:

Law 1st. That the planets describe ellipses, all having a common focus at the centre of the sun.

Law 2d. That every planet so moves around the sun that an inflexible line drawn from the planet's centre to that of the sun would describe areas proportional to the times. [Thus, in *equal* times, F A B, F P Q (Fig. 1) would be found to be *equivalent*. With the one time the *double* of the other, the corresponding area F C D would be the double of F A B or of F P Q; etc.]



Law 3d. That the squares of the *periodic times* (times of entire revolution around the sun) are as the cubes of the mean distances from the sun. [Thus, to present a supposititious case in order that the ratios may be exhibited in whole numbers, if the mean distance of a planet were exactly four times that of the earth taken as 1, then the *cubes* would be—

$$4 \times 4 \times 4 = 64,$$
and
$$1 \times 1 \times 1 = 1;$$

and the ratio of the cubes would be that of 64 : 1. But the periodic time fulfilling the law would, in such a case, be 8 years, the earth's periodic time being 1 year; and their respective squares would be—

$$8 \times 8 = 64,$$
and
$$1 \times 1 = 1;$$

and the ratio of *these also* be 64 : 1.]

The third law affords the means of determining the relative mean distances of the several planets, and even those of the periodic comets, when the periodic times have been first ascertained; and these in the instances of the principal planets have been very accurately determined by long-continued observations. The third law is itself slightly modified by the consideration due to the *masses* of the revolving bodies. Thus, if M represent the mass of the sun, and m, m' the respective masses of any two planets, while a, a' represent their mean distances from the sun, and T, T′ represent their periodic times, we have

$$\frac{T'^2}{T^2} = \frac{a'^3}{a^3} \times \frac{M+m}{M+m'},$$
$$\frac{T'^2}{T^2} \times \frac{M+m'}{M+m} = \frac{a'^3}{a^3}.$$

A more accurate determination of the masses than any previously obtained must, then, slightly modify the ratio of the cubes of the distances as here exhibited in equation, and therefore also the ratio of the distances themselves. The results of a careful re-discussion of the expressed values of the mean distances, in view of the more correct determination of the masses, is exhibited by the author of this article on p. 3 of No. 280 of the *Smithsonian Contributions to Knowledge*.

The relative mean distances, that of the earth being 1, are as follows:

Mercury	0.3870987 —	Jupiter	5.2028004 —
Venus	0.7233322 —	Saturn	9.5338544 —
Earth	1.0000000	Uranus	19.1833617 +
Mars	1.5236913	Neptune	30.0567298 —

Of the so-called Bode's Law.—Bode's Law is the name given to a singular progression in the series of distances, or rather special differences of distances, of the planets from the sun. The most simple expression of this is that given by Sir John Herschel (*Outlines of Astronomy*, 11th ed., 505), viz.: "The interval between the orbits of the earth and Mercury is nearly twice that between those of Venus and Mercury; that between the orbits of Mars and Mercury nearly twice that between the earth and Mercury; and so on." The same is more commonly expressed as follows: the values of the successive terms being stated to the nearest whole number in every case, the earth's distance being represented by 10. And in the arrangement as exhibited below the actual value on the same scale is in every case compared with the empirical value:

Empirical distances.		Actual distances.
Mercury	4	4 —
Venus	4 + 1 × 3 = 7	7 +
Earth	4 + 2 × 3 = 10	10
Mars	4 + 4 × 3 = 16	15 +
(Asteroids)	4 + 8 × 3 = 28	
Jupiter	4 + 16 × 3 = 52	52
Saturn	4 + 32 × 3 = 100	95 +
Uranus	4 + 64 × 3 = 196	192 —
Neptune	4 + 128 × 3 = 388	300

The failure of the "law" is notorious in the cases of both Saturn and Neptune. Yet deficient as it was, it, years before the discovery of Neptune, was suggestive of the probability of the existence of one planet at least between Mars and Jupiter; and the conjecture that such might be the case was verified by the discovery of the minor planet Ceres Jan. 1, 1801—a discovery since followed by that of 166 other minor planets in the same region. ("Bode's Law" is ascribed by M. Voiron to Prof. Titius of Wittenberg, instead of M. Bode of Berlin.—*Supplement to Bailly's History of Astronomy*, p. 69.)

A comparison of the results now stated will at once make it manifest that whatever might be said of generality, "Bode's Law" is deficient in that *precision* which belongs to a law of nature. It notwithstanding furnished some approximation toward what must be the estimated distance of the planet the effect of whose perturbations was accurately made out and discussed by Messrs. Adams and Leverrier previously to the discovery of Neptune by M. Galle.

Laws of Planetary and Satellite Distances.—Let (*V*) represent a limit between the mean distance of Uranus and that of Saturn, and (⊕♀) in like manner another limit between the earth and Venus. Then if of the distance of Neptune we take $\frac{5}{9}$, and of that fractional product, again, $\frac{5}{9}$, etc. etc., the several results in this *geometrical progression* will exhibit a *very close* approximation to the various planetary distances and intermediate limits, as exhibited in the annexed comparison of Law with Fact: a *missing* term in the region of Fact, which, as will be hereafter shown, would have had a position analogous to that of Venus, being itself represented by ⛢*i*, and the term due to the asteroid region, by (A):

First Approximate Arrangement.

Names.	Law.	Fact.	Difference, L.—F.
Neptune	30.05733	30.05733	0.000
Uranus	....	19.183 +	
Limit (*U*)	16.698 +	....	
⛢*i*	....	(missing)	
Saturn	9.277 —	9.539 —	— 0.262
Jupiter	5.154 —	5.203 —	— 0.049
Limit (A)	2.863 +	(to be supplied)	
Mars	1.591 —	1.524	+ 0.067
Earth	....	1.000	
Limit (⊕♀)	0.884 —	....	
Venus	....	0.723 +	
Mercury in aphelion	0.491 —	0.467 —	+ 0.024

(The arrangement, even thus far, presents a marked contrast to the rough approximations obtained by "Bode's Law.") The ratio of every term except the first to its immediately preceding term being that of 5 to 9, the ratio of every superior to its immediately inferior term will be that of 9 to 5, which $= \frac{9}{5} = \frac{18}{10} = \frac{1.8}{1} = 1.8$.

An inspection of what is here exhibited will moreover reveal the fact that the Earth and Venus seem to have characteristics of *half-planets*; the *one* term, 0.884 (in the series), pertaining to them, being indicative of a distance between those of the two planets at which their masses should be united; which *limiting* distance is designated as *limit* (⊕♀). This being so, it seems also desirable to ascertain whether they have not also themselves each a determinate position such as may be exhibited in a definite ratio to a term or terms in the whole planet series. In the ascertainment of this let it be noted that the distance of *Mars* is, in fact, a little greater than $1\frac{1}{2}$ times that of the *Earth*, while the like is also true of the distance of *Neptune* compared with that of *Uranus*. This being so, if we call the terms due to Uranus and the Earth respectively *exterior* half-planet terms (while that due to Venus is styled an *interior* half-planet term), and extend, moreover, the *exterior* half-planet designation of term to the *perihelion* distance of Mercury, we shall have precisely for the ratios of the mean distances from the sun introduced by the *exterior* half-planet terms, as follows:

$$\left.\begin{array}{l} \dfrac{\text{Neptune}}{\text{Uranus}} = 1.56681 \\[2ex] \dfrac{\text{Mars}}{\text{Earth}} = 1.52369 \\[2ex] \dfrac{\text{Mercury in aphelion}}{\text{Mercury in perihelion}} = 1.51768 \end{array}\right\} \text{Mean} = 1.53606.$$

But 1.8 being, as already shown, the approximate ratio which obtains for other than half-planet distances, we have withal, as respects this ratio,

$$(1.8)^{\frac{3}{4}} = 1.55401,$$

agreeing very nearly with the preceding; so that r being the ratio for other than half-planets, the ratio for the *exterior* half-planets is $r^{\frac{3}{4}}$.

Also, as again respects mean distances from the sun,

$$\frac{\text{Earth}}{\text{Venus}} = 1.38249;$$

while as, once more, respects the ratio r of 1.8, the *square root of* r, or

$$r^{\frac{1}{2}} = 1.34161.$$

All this sufficiently indicates the existence among the planetary distances in the solar system of *three* ratios: the leading ratio due to the *whole*-planet terms being very nearly 1.8; that due to the *exterior* half-planet terms, $(1.8)^{\frac{3}{4}}$; and that due to the *interior* half-planet term, $r^{\frac{1}{2}}$.

Completed Arrangement of the Planetary System, exhibiting the Correspondence of Law with Fact.

Names and symbols.	Law.	Fact.	Law – Fact. Earth's dist. = 1.	Law – Fact. Planet's, etc. dist. = 1.
Neptune.....	30.057264	30.057332	—0.000+	—0.000+
URANUS......	19.55718	19.18336	+0.374+	+0.019+
Limit (U).........	16.91431			
Int. to ♅, ♅*i*......	(14.64275)	missing.		
Saturn	9.44511	9.53885	—0.094—	—0.010—
Jupiter	5.23391	5.20280	+0.031+	+0.006
Limit (A).........	2.87831	(2.82293)	+0.055+	+0.020—
Mars..........	1.57096	1.52369	+0.047+	+0.031
Earth.........	0.99335	1.00000	+0.007—	—0.007—
Limit (⊕ ♀)......	0.85101			
Venus...............	0.72975	0.72333	+0.006+	+0.009+
Aph. of Mercury	0.45758	0.46670	—0.009+	—0.020—
MERCURY........	0.39166	0.38710	+0.005—	+0.012—
Per. of Mercury	0.28573	0.30750	—0.022—	—0.071—

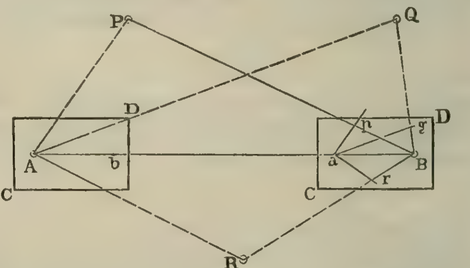
After more extended induction and an enormous number of tentative processes, it was found that a mean value of ratio $r = 1.8253$, instead of 1.8, would be more perfectly consistent with the existing state of the system; and yet more so if the ratio from that of the greatest terms inward were subjected to a *small* but regular *increase*, the extreme values differing from the mean by a little less than $\frac{1}{38}$th of the latter. Then, moreover, as the limit due to the *missing term* interior to Uranus—*i. e.* to ♅*i* in the first approximation—is that of an *interior* half-planet, the ratio of the distance of Uranus to that is $r^{\frac{1}{2}}$; the value of r being that due to that region of the system—viz. very nearly 1.8 itself. The *interior* half-planet *limit* ♅*i* will thus be found to be $= 14.64275$. The value of the asteroid limit (A) may be independently determined in the region from *Saturn* to *Mars* inclusive. It is thus found to $= 2.82293$; which value is inserted in the preceding table in the column of Fact, but in a parenthesis for comparison with the value of the same term resulting from the general series from *Neptune* downward. In the table the respective powers of r are indicated outside of the braces which in every case connect the quantities compared. In this table the *half*-planet terms are marked in italics, and the position of Mercury is indicated in small capitals. It here is (incidentally) derived from the position of the *half*-planet Venus. But Mercury has other relations, which, however, are exhibited only by the aid of an hypothesis, which designedly is not here introduced; the results being as directly dependent *on existing relations in the solar system itself* as are the *Laws of Kepler*. (It is, however, at least not a little curious that the limit (⊕♀) is very nearly at the distance of the *centre of* (*simultaneous*) *gyration* of the Earth and Venus at which the *vis viva*, or the *turning power*, of these masses concentrated would be the *same* as that of the separate masses (simultaneously revolving at their now existing distances), as though they *had* once turned around the sun together; which is, in part, what the *nebular hypothesis* of Laplace supposes. But such being very nearly the *fact* with respect to the two half-planets Earth and Venus, we may, by the application of the formula for the centre of gyration, ascertain what ought to be due to the missing mass ♅*i*, as an interior half-planet to Uranus; and it will be, mass of ♅i = nearly $1\frac{4}{10}$ times that of Uranus.)

In the *system of Saturn*, also, as *facts existing independently of any hypothesis*, three ratios of the distances from Saturn's centre are apparent, and the rings, both bright and dusky (as it were), *claim their places as satellites*, the ring-systems in every case being referred to *their respective centres of gyration*. In the limited systems of Jupiter and Uranus two ratios are apparent. The satellite systems are thus in their arrangement analogous to those of the primary system. (For other arrangements and the application of theory and for numerous coincidences with the same, see the exposition by the author of this article, in No. 280 of the *Smithsonian Contributions to Knowledge*, already referred to.)

Eccentricities of the Orbits of the Planets.—The orbits of the asteroids, of Mercury, and of Mars are the most eccentric, while those of Venus and Neptune are least so.

S. ALEXANDER.

Plane Table, an instrument used in surveying for mapping in the field. It is particularly employed in filling in outline sketches of trigonometrical surveys. It is not used where great accuracy is required, but where approximate sketches only are needed it is particularly valuable on account of the rapidity with which they can be executed. The plane table consists essentially of a drawing-board mounted on a tripod in such manner that its upper surface may be made horizontal, and so that the entire table may be turned in azimuth through any angle whatever. The combination of parts by which these motions are effected is entirely similar to that employed in levelling and orienting the horizontal limb of a theodolite. The instrument as described is accompanied by a ruler, usually of brass, and provided with a telescope so mounted that its line of collimation and the bevelled edge of the ruler shall always be in the same plane. The telescope is arranged with a vertical arc, by means of which we may measure



small angles of elevation and of depression. The paper on which the map is to be made is stretched and held firmly in contact with the table by suitable clamps. The method of using the plane table is indicated in the diagram. Let it be required to determine the relative position of the points P, Q, and R. Two stations, A and B, are selected as the extremities of a base line A B, and each is marked by a flag; the distance between them is measured; a line, Ab, is drawn on the paper C D to any suitable scale to represent the line A B. The plane table is then set up at A and levelled, so that the point A of the table shall be exactly over the corresponding point A in the field; the bevelled edge of the ruler is then made to coincide with the line Ab, a small pin being placed at A to serve as a guide, and then the latter is turned in azimuth till the flag at B coincides with the intersection of the cross-hairs of the telescope, and in this position it is clamped. The telescope is then turned in succession upon the objects P, Q, and R, the bevelled edge of the ruler always touching the pin at A; and in each of these positions a pencil line is drawn along the edge of the ruler. The instrument is then taken to B, and bevelled so that the point B of the table shall be exactly over the point B in the field; a guiding-pin is placed at B; the edge of the ruler is made to coincide with Ba, and then the telescope is directed to the flag at A; and in this position the table is clamped. The telescope is then turned in succession to the points P, Q, and R, and in each position a line is drawn along the bevelled edge of the ruler intersecting the lines drawn to the same points at the other station; the points p, q, and r, in which the latter lines intersect the former, have the same relative positions on the plot that the given points have in the field. In like manner any number of points may be plotted. If the limits of the paper do not permit the whole area to be represented on it, a second sheet may be used, taking care to determine two common points on each sheet. The two sheets are united so that the plotted positions of these two points shall coincide.

W. G. PECK.

Plane Tree. The preferable name for trees of the genus *Platanus* and order Platanaceæ, commonly known as buttonwood, sycamore, cottonwood tree, etc. The Oriental

plane (*Platanus orientalis*) of the Old World grows rapidly, lives long, and in favorable situations attains a great size. It is a valued timber tree. The Occidental plane, the buttonwood of the U. S. (*P. occidentalis*), is one of the largest of our native trees, and is often cultivated for shade. Its large leaves, its huge trunk marbled with patches of white, and its pendulous globose heads of fruit are well known. Its wood is a good fuel, but its timber is hard and brittle, warps easily, and is considered perishable. The buttonwood of the Pacific coast (*P. racemosa*) has a deeply-lobed leaf and pendulous clusters of balls. It furnishes valuable timber.

Plan'isphere [Lat. *planus* and *sphæra*], a projection of the various circles of a sphere on a plane. It is used in astronomy as a substitute for a celestial globe.

Pla'no, p.-v., Kendall co., Ill., on Chicago Burlington and Quincy R. R., 55 miles W. of Chicago, has an academy, 3 churches (including a Mormon, presided over by Joseph Smith, son of the prophet), 2 newspapers, 1 tannery, several cheese-factories, and the manufacturing shops of Marsh's harvesters. P. about 1800.

D. M. CORBIN, ED. "MIRROR."

Plano, p.-v. and tp., Collin co., Tex., on Houston and Texas Central R. R. P. 155.

Plant. (See BOTANY, PHYTO-CHEMISTRY, and VEGETABLE PHYSIOLOGY.)

Plant, tp., Pulaski co., Ark. Pop. 461.

Plantag'enet, the surname of the Angevine dynasty of English monarchs, derived from the marriage of Matilda, daughter of Henry I., to Geoffrey Plantagenet, count of Anjou. The Plantagenet monarchs reigned from 1154 to 1485, when the victory of Bosworth transferred the crown to the house of Tudor. They were usually ambitious and warlike princes, who distinguished themselves in the field, both in France and in the long civil contests known as the "wars of the Roses." The surname is still borne by the family of the dukes of Buckingham and Chandos.

Plantagina'ceæ, a natural order of exogenous herbs, found in nearly every part of the world, but mostly in temperate regions. It is almost restricted to the genus *Plantago*, to which the common herbs called *plantain* belong. A few have bitter and mucilaginous properties and a limited use in medicine, but no important commercial product comes from this order. There are about 120 species, mostly humble and stemless herbs.

Plant'ain [Lat. *plantago*], the *Plantago major*, an herb which is common in nearly every part of the world. It belongs to the order Plantaginaceæ, and although nearly inert, is employed in domestic medicine. Its seeds are fed to cage-birds, and its young leaves, boiled as potherbs, are palatable. There are a great many species in this genus, which is well represented in the U. S. Of these, the ribwort (*P. lanceolata*) is sown in Europe as a forage-plant on light soils, and fleawort (*P. Psyllium* and *arenaria*) is raised in France for the seeds, which yield a valuable size for cotton goods and paper.

Plantain, a name given to the fruit of the coarser cultivated varieties of *Musa paradisaica*, the finer and more delicate sorts being called bananas. The plantain is a native of the East Indies, but is now common in nearly all hot countries. It is of the order Musaceæ. *M. Cavendishii* or *Chinensis* is a dwarf variety. The plantain furnishes a very large part of the food of the human race in some hot countries. The leaves yield a fibre which may become a very important commercial product, since it closely resembles MANILA HEMP (which see).

Plantain-Eater. See MUSOPHAGIDÆ.

Planter, tp., Chicot co., Ark. P. 332.

Planter's, tp., Phillips co., Ark. P. 1102.

Plantersville, p.-v., Dallas co., Ala., on Selma Rome and Dalton R. R. P. 854.

Plantigrades. See MAMMALOGY, by PROF. THEODORE GILL, M. D., PH. D., M. N. A. S.

Plant-Louse. See APHIDES.

Plants'ville, p.-v., Southington tp., Hartford co., Conn., on Quinnipiac River and New Haven and Northampton R. R.

Plaquemines', parish of Louisiana, bounded E. and S. by the Gulf of Mexico. Area, 900 sq. m. Its surface is low and in parts swampy, and much cut up by bayous. The soil is very fertile. Leading products, sugar, molasses, and rice. Cap. Point à la Hache. P. 10,552.

Plaquemines, p.-v., cap. of Iberville parish, La., on W. bank of Mississippi River, at mouth of Plaquemine Bayou, 20 miles S. of Baton Rouge, has 3 newspapers and a large river-commerce. P. 1460.

Plasen'cia, town of Spain, province of Caceres, is picturesquely situated on the Jerte, at the entrance of the valley which that river traverses, and which is celebrated for its fertility and romantic beauty. The town is old, surrounded with walls surmounted by Gothic towers, and has an aqueduct of eighty arches, three bridges across the Jerte, and many monasteries and churches. P. 6844.

Plas'ma [Gr., an "image"], a leek-green variety of chalcedony, much esteemed by the ancients, who often cut and wrought it as a gem. It often occurs in collections of antiques, but is now esteemed inferior to bloodstone.

Plassey, Battle of. See CLIVE.

Plas'ter (*emplastrum*), in pharmacy, an adhesive mixture of lead-oxide and a fatty acid, or a resinous and fatty compound, often medicated, and designed to be spread upon leather, linen, or even paper, and then applied to some portion of the human body. Plasters have a considerable use in medicine, and especially in surgery, where strips of adhesive plaster are employed for many purposes.

Plaster of Paris. See GYPSUM.

Platæ'æ, ancient city of Greece, in Bœotia, on the northern slope of Mount Cithæron, was famous as the place where in 479 B. C. the Greeks under Pausanias totally routed the Persians under Mardonius. The city was twice destroyed by the Thebans, in 427 and in 374 B. C., but was both times rebuilt, and existed in the sixth century A. D. Remains of it are still visible near the village of *Kokhla*.

Plata, La. See ARGENTINE REPUBLIC.

Platale'idæ [*Platalea*, the old Latin name of the spoonbill], a family of wading birds popularly known as spoonbills. The general form is heron-like; the bill elongate, nearly straight, and with its apical half much depressed and broadly dilated into a spatula-like extremity, furrowed above by two lateral grooves, which commence on the forehead, and for their distal half are concentric with the margins; nostrils not far from the base, on the upper surface of the bill, and in the grooves originating from the forehead; wings long, and with the second quill produced; tail short; tarsi elongated and covered, with reticulated scales which extend a short distance on the tibiæ, as well as on the toes; toes long, the anterior three united by a basal membrane, the posterior somewhat elevated; claws short. The birds of this family are distinguished by their spoon-like bill, and are quite generally distributed throughout the warm regions of the earth. Seven species are generally recognized. THEODORE GILL.

Platanist'idæ, a family of toothed Cetaceans, allied to the dolphins and represented by the singular susus of the Indian rivers. The form is dolphin-like except as to the head, which is distinguished by its upraised forehead and its small eyes; the external respiratory aperture is longitudinal; the beak is elongated; the cervical vertebræ are all separate; the hinder, the tubercular, and capitular articulations of the ribs blend together posteriorly; the costal cartilages remain unossified; the skull has the vertex produced forward, the supraoccipital not projecting forward laterally above the temporal fossæ; the frontals visible above only as elongated falciform borders produced around the maxillary; the nasal bones moderately unequal; the maxillary bones are remarkable for their large bony, incurved crests; the teeth are simple and destitute of cingulum or tubercle. The family is represented by but a single known genus, with two species—(1) *Platanista Gangetica*, inhabiting the Ganges and Brahmapootra and their tributaries; and (2) *P. Indi*, found in the river Indus. They rarely exceed the length of seven feet. Although the body appears to be adapted for swiftness, the species are said to be rather sluggish animals; they prey upon fish, like their salt-water relations. THEODORE GILL.

Pla'ta, Rio de la, the name of the estuary formed by the entrance of the two great South American rivers, Parana and Uraguay, into the Atlantic, 180 miles long, and 130 miles broad at its mouth, but its depth soon decreases from 10 fathoms to 16 feet; its navigation is difficult on account of irregular currents and sudden tempests.

Plated Ware. See ELECTRO-PLATING.

Pla'ten-Hallermün'de, von (AUGUST), COUNT, b. at Ansbach, Bavaria, Oct. 24, 1796; served for some time in the Bavarian army; studied language and philosophy at Würtzburg; devoted himself to literary pursuits, and lived mostly in Italy. D. at Syracuse Dec. 5, 1835. His historical work, *Geschichten des Königreichs Neapel, 1414–43*, is dry and tedious; his drama, *Die Liga von Cambrai*, and epic, *Die Abbassiden*, are flat and uninteresting, but his dramatic satires, *Die verhängnissvolle Gabel* (1826), against Müllner, and *Der romantische Œdipus* (1829), against Immermann, are not without power, and all his

lyrical poems, from the *Polenlieder* to the *Ghaselen*, evince a mastership and purity of form which are truly admirable.

Plate-powder, a polishing powder, a mixture of fine chalk with powdered talc, peroxide of tin, or other detergent materials. Some plate-powders contain mercurial salts, but such compounds are very destructive to silver.

Pla'ter (George), b. about 1736; graduated at William and Mary College 1753; became a judge of the Maryland court of appeals; was in Congress 1778–81; president of the State convention of 1778 to ratify the Federal Constitution; governor of Maryland 1792. D. at Annapolis, Md., Feb. 10, 1792.

Plather's Creek, tp., Alleghany co., N. C. P. 637.

Plating. See Electro-plating, Nickel, and Silver.

Platino-Iridium. See Iridium.

Plat'inum, or **Platina** [Sp. *plata*, "silver"], a whitish, steel-gray metal, malleable, very ductile, and as unalterable by ordinary agencies as gold. Like gold, it occurs in the native state, and in this form its specific gravity ranges from 16 to 19, and its hardness upon the mineralogical scale from 4 to 4.5, being harder than either gold or silver, and a little softer than iron. When fused and refined it is, however, as soft as copper, and the gravity is increased to 21.15. This metal was first discovered in Choco, South America, and was taken thence to Spain in 1735 by the traveller Ulloa. It was obtained in Jamaica from Carthagena in 1741, and in 1822 was discovered in Russia, whence the chief supply has since been obtained. The chemical and physical properties of platinum were studied by European chemists as early as 1750. The native metal from Siberia was analyzed by Berzelius in 1828, who found it to contain iron, rhodium, iridium, palladium, copper, and osmium, the amount of platinum ranging from 73 to 86.5 per cent. It is found, like gold, chiefly in alluvial deposits, in rounded grains, *pépites* or nuggets, or in flattened scales worn smooth by attrition in the gravel of river-beds. It is there associated with gold and the other heavy metals, as iridium and iridosmine. Having nearly the same specific gravity as gold, it cannot be separated from it by washing in the ordinary way, and quicksilver, which will amalgamate with the gold and leave the platinum untouched, is used to effect the separation. Upon the northern coast of California, for example, a mixture of gold and of the platinum metals in extremely small scales is washed from the beach-sand, and from this mixture the gold is removed by amalgamation. Observations of the rocks and minerals found with platinum in deposits sustain the belief that the metal is chiefly derived from the disintegration of serpentine rock. Chromic iron is a common associate. It is also found in syenite. It has not been found, however, in regular veins in quartz, and its precise mode of occurrence is still obscure.

Nearly all the native platinum is more or less magnetic. Some masses have true polarity and hold iron filings like magnetic iron ore. There were several specimens of this kind in the collection sent to the Paris Exposition in 1867 by Prince Demidoff, upon whose estates, in the government of Perm, there are twenty or more localities from which some of the largest masses known have been obtained. One specimen at Paris was six inches in its greatest diameter, and weighed thirteen pounds troy. A mass weighing twenty-one pounds is preserved in the Demidoff cabinet. A specimen weighing 4728 grammes, and very perfect in form, was shown at Vienna in 1873. It is estimated that the production of the metal in the Urals, from the discovery to the year 1851, was 2061 Russian poods; in 1830 it was 106 poods, and in 1860, 61 poods. From 1860 to 1863 it averaged 84 poods annually, which is the equivalent of 1344 kilogrammes. In 1871 there were six mines in operation, producing from 10,440,650 poods of sand and gravel 125 poods of platina, against 118 in 1870. This is more than is obtained from Brazil, Colombia, California, Borneo, and other regions combined, which is believed not to exceed 1000 pounds annually. The raw metal finds its chief market in London and Paris, where it commands about $70 per pound of the pure metal, and is refined before being made into ingots, plate, wire, and various objects. The comparative infusibility of platinum, it yielding only to the oxyhydrogen blowpipe or to powerful electrical currents, and its resistance to oxidation, render it peculiarly valuable for many purposes in the arts and to the chemist in analytical work and in manufacturing. One of its most important uses is for large evaporating stills for the concentration of sulphuric acid. A still of this kind, valued at 95,000 francs, exhibited at Vienna in 1873, was capable of concentrating 20,000 pounds of sulphuric acid daily. The joints of such stills are autogenously soldered, thus giving entire uniformity of material, and making the whole vessel in one piece. It would not be possible to produce such large homogeneous vessels without the aid of the oxyhydrogen blowpipe. As early as the year 1837, Dr. Hare of Philadelphia proposed to melt platinum by this means, and succeeded in melting twenty-eight ounces into one malleable, homogeneous mass. MM. Deville and Debray of Paris have greatly extended and perfected this method, so that ingots can be made weighing 200 pounds or more. An ingot of this weight, worth $17,000, was made by Johnson & Matthey of London for the Exhibition of 1862. An ingot of one-third of this size is sufficient for the body of a five-ton still. The experiment of using platinum for money was tried in Russia for several years, but was finally abandoned. It was formed into coins of eleven and twenty-two roubles each, and the value of this coinage from 1826 to 1844 was about $2,500,000. The value of platinum, compared with silver, is about as 5 to 1.

The chief solvent of the metal is aqua regia, and the chloride is the most important salt. It forms alloys with gold and silver and with many of the more fusible metals. These alloys are much more fusible than the pure platinum. When combined with iridium it forms an alloy of great hardness, especially well adapted for gun-vents and for standard weights and measures. The alloy known as platino-iridium is used for the manufacture of standard mètres, and is melted in lime crucibles upon Deville's method. (For details of the process for the purification of platinum and its fusion in large quantities reference should be made to the memoirs of Deville and Debray upon platinum and the associated metals.) William P. Blake.

Platinum Black, a finely-divided form of platinum, resembling soot. It has the property of condensing gases upon its surface in a remarkable degree. It absorbs many times its bulk of oxygen gas, and gives it off in contact with alcohol or ether, forming new compounds. Platinum sponge is another form of the metal, porous and slightly coherent, obtained by heating to redness the double chloride of platinum and ammonia. It also condenses gases upon its surface, and to such a degree in a current of cool hydrogen that the metal glows with the heat evolved and inflames the gas. W. P. Blake.

Pla'to, tp., Kane co., Ill. P. 1004.

Pla'to [Πλάτων], a Greek philosopher, b. 429 B. C., and d. at the advanced age of eighty-one years. Solon and Codrus were both reckoned among his ancestors. Many incidents of his life are related by the gossiping writers of antiquity. There is the fable of the bees settling on his lips in infancy. We are told of his early attempts at poetry, and his giving it up when he found his verses inferior to those of Homer. His extensive reading of the Greek poets needs no other voucher than his own writings. With the opinions of all previous philosophers he seems to have been familiar. There are stories of his travels in Egypt and the East, but they rest on little or no foundation in his own writings. Aristotle shows an intimate acquaintance with his doctrines, but tells us hardly anything about him personally. The accounts given first by writers who lived many centuries after him, such as Proclus and Iamblichus, are of no value. And yet there is no philosopher of antiquity with whom we have the means of so close an acquaintance. There was one teacher whom he has made most familiar to us, and from whom, in turn, we become most familiar with the pupil: Plato and Socrates are inseparable names. They are one power in the world's movement. This view can be held without diminishing the value or the position of either. Plato is not the mere reporter, neither is Socrates the merely ideal sketch. There is, in all the *Dialogues*, a most real Socrates, but equally unmistakable is the presence of another soul, like a related harmony, in closest unison with the life depicted as creative of its own.

The Platonic *Dialogues* have remarkable dramatic merit. We feel that we are in the midst of the real; we are living at Athens; we know Socrates; we know his pupils, aside from their being, for the most part, historical characters. We walk with them from the Piræus; we stroll with him and the youthful Phædrus one warm June morning up the shady Ilissus, and listen to Socrates discoursing all that long summer day on the celestial love whilst bathing his unsandalled feet in the cooling water. And then there is Socrates, the street-preacher, ever talking to the boys when he could gather a number round him, "*corrupting*" the youth, as the Athenian lawyers said, or wasting his time and talents, as the hard politician Callicles charges him, in "prattling" to these youngsters about the καλόν and the ἀγαθόν, the dreamy "*fair* and *good*," when he might be a "*practical* man," a man among men, and "conspicuous in the public assemblies of the state." Imagine him in his encounters with the really corrupting Sophists or the unprincipled politicians. Observe him in the scenes of the Symposion, that most exquisite picture which Plato has given us of an Athenian literary soirée. How odd his

appearance, and still more odd his ways, moving the jest, yet at the same time eliciting their deepest reverence, and melting to tears the dissolute Alcibiades when he remembers what he might have been had he followed the counsels of his early teacher! But it is in the prison dialogues, the *Crito* and the *Phædo*, that the solemn and familiar meet in most impressive unison. The early assembling of those devoted friends on the morning of that last memorable day. "Plato, I think, was sick," says the modest narrator; but Plato was there, beyond all question. No one else could have so reported that immortal argument on the immortality of the soul; no one else could have so painted the tender passages between Socrates and those two attached young men; no one else could have so described that death-scene, of whose every incident the reader is as certain as though he had himself been one of that tearful band which surrounded the couch of the dying martyr.

The identity of the two minds appears especially in the *doctrine of ideas*. It is this, more than anything else, that gives character to the Platonic philosophy. It is, too, the doctrine which shows how far from the truth is the prevailing notion of this philosophy, as mystical, transcendental, imaginative, far removed from what is called "common sense" or "positive knowledge." "Nothing so clear," says the young man Simmias in the *Phædo*, "as this doctrine of reminiscence, and the ideas of the fair and the good thus awakened in the soul." The word is used in two different yet closely-related aspects. An idea is, in the first place, what the mind adds to a sensation so as to make it rational. Without it, the sense is ἄλογος, as Plato supposed the animal to be (a view, in fact, held by Aristotle as well as Plato), mere sense, and of itself incapable of becoming anything more. His illustrations are drawn mainly from the mathematical ideas. In attempting to follow him here the utmost brevity must be consulted. Let us image to ourselves a confused mass of spots or points, such as the spatterings of a paint-brush thrown at hazard upon a canvas. There is visible, at first, no order, no idea—nothing for the mind, all for the sense. As far as the soul is concerned, there seems *nothing* there—or rather *no thing*, since it is *form* of some kind that makes a *thing*; that is, a thing thinkable, a *res* or *reality* for the mind. The animal and the man see at first the same, neither more nor less. As far as sense is concerned, the former may even have the keener vision. The human subject at last beholds the dawning of something supersensual, though the light has come from himself. Even in a single point he sees something more than the point. It is the idea of unity. The spatterings begin to assume form, or the soul is waking up to give its own forms to the formless. He is rising above sense. He begins to see *continuity*, or the rudiments of line-extension. He looks more steadily; there is something more than mere lineality; rectilineality, or *straightness*, is coming into view. It may be a mere approach to it; for the cognition of defect, or deviation, or *non-straightness*, is just as positive an evidence of some supersensual measuring-rule or idea as the most perfect agreement. In all this he not only *cognizes*, but *re-cognizes*. Aha! says he, I see something which draws my eye, or which my eye seems rather to draw out of its chaos. This supersensual thing has an interest for me beyond anything of sense. There is beauty in it. I seem to *know* it, although it never may have crossed my sense before. Have I imagined it? What, then, called out that supersensual power? A closer gaze sees not only a series of points forming one straight line (or evenness, τὸ ἴσον), but another seeming to hold to it a peculiar relation. There is the equality, or the approach to equality, of angular spaces. Here is a new beauty, a new interest, which could not have come from lines, perfect or imperfect, inclining to each other in any manner however irregular. There is no name as yet, but the soul sees perpendicularity, and delights in it as satisfying its idea. In the same way it sees parallelism. It is another aspect of the τὸ ἴσον. It sees relation; it sees ratio, multiple, proportion. It sees radii, or seeming equalities, tending, more or less perfectly, to a point of union. It is an idea again, something which the mind seems to know. In other words, it sees *circularity*, whilst the gazing animal, gaze he ever so long, sees only roundness (στρογγυλότης), or *difference* of sensation merely, whether quantitative or otherwise. In this way one might go through the infinite range of the mathematical ideas. Their teaching is really ἀνάμνησις, recollection, but not merely the recollection of one object of sense by another, as of Simmias by Cebes, but the true calling up of something *in the soul* at the sight of some outward object serving as its perfect or imperfect diagram. It is that which gives intelligibility to the object, making it a real thing for the mind—its own creation in fact, instead of the *tohu* and *bohu*, the utter formlessness of sense.

In an analogous way are seen the ideas of the *fair* and the *good*. The emotional mingles, more or less, with them all. In the sight of a straight line even there is beauty, interest, emotion, something of the soul's own; and this is because, like all beauty, it is in some way soul seeing soul, and rejoicing at the sight. It is like the feeling of the philosopher Aristippus when, after his shipwreck, he discovered a circle marked upon the sandy beach. "Let us be of good cheer," said he: "I see mind." If such an appearance were made by nature, it only shows that ideas are older still, fashioning the laws and *powers* of nature in harmony with their forms and their equalities. Or it is like the emotion of the boys in the *Meno* and the *Theætetus*, as Socrates, in his obstetric way, delivers them of their mental births: it is something which they felt they had ever *known*, but did not *know* that they *knew* it. Even experience, here, teaches an *a priori* truth, strange as that may seem. A man need only carefully examine the difference in his own feelings between the learning of an inductive truth wholly from without, and the soul's recognition of an idea in geometry, in morals, or in æsthetics.

Now, this is not mystical or transcendental or a mere play upon words, as the followers of Mill would call it. It is clear as the light itself. It is, as has been said, the true doctrine of "common sense," of the κοινῶν ἐννοιῶν, and Plato is the most lucid of all writers in bringing it out. When a young man sees it, his mode of thinking, his philosophical and, in some respects, his theological, temperament is changed for ever. Even admitting that this inner transforming knowledge may be a knowledge *acquired* does not change the wonder or the interest in the fact that our sense-world is, to so great an extent, the creature of the spiritual. Whether innate or by a divine mirroring of the supersensual, it is its imbuing the sensitive perception with its own thought that forms the mysterious difference between man and the animal, or between certain men and others. Surely there is nothing in the painter's retina or on the last matter of his brain that is not optically in that of other men.

Another Platonic doctrine, somewhat different from this, though often confounded with it, is that of *universals* as real existences. Nothing is more certain than that names for them are in language before the names of individuals; and that is one reason why Plato insists so much on dialectics as a mode of discovering universal truths. It is not generalization alone, but that within us, which makes us generalize, instead of being content with individual sense-objects. Without it we should be like the animal, who has no language, not from defect of vocal organs (for some are here superior to man), but because he has no inner or ideal world for which language is needed. We cannot seek, says Plutarch, without some idea of that for which we are seeking. We must have some notion of universals before we can even think of classifying. *Humanity* is as real as the individual man, who becomes *man*—that is, who becomes *real*—by partaking of this divine creation. It was for this doctrine of universals that Plato was ever a favorite with the best of the Christian Fathers, the Schoolmen, and the Reformers. In the old Nominalism of Epicurus, especially as revived by Abelard, they saw the dissolution of all faith, even as the best thinkers now regard it as threatening the interest of all true science. If individuals are the only realities, it cannot stop short of individual atoms. All forms are but accidental phenomena; there are no species; all are reduced to arbitrary classifications, having no standard but the ever-varying assimilations of sense. But where do universals exist? what is the locus of the ἓν ἐν πολλοῖς? They exist ἐν νῷ ("in mind"), says Plato, ἐν νοητῷ τόπῳ; and this is as real a mode of being as position ἐν τόπῳ, or pure space existence. Their locus is the eternal mind, whence they are mirrored in the finite intellect.

Connected with *ideas* is Plato's doctrine of pre-existence. Did he mean an individual pre-existence? He sometimes seems to accommodate his language to such a conception. In the highly imaginative *Phædrus*, Socrates has something to say of unborn souls "riding on the supercelestial sphere." But, on the other hand, it is easy to see that to maintain such a pre-existence of *individual* souls in a former sense-world, like the present, would destroy the argument in the *Phædo*. The true ideal reminiscence is gone. It would only be a sense-notice in this life, recalling a preceding sense-notice in another. The whole of that immortal argument is based upon the fact of a sense-experience here, calling up an idea belonging to the very constitution of the soul regarded as lying back of all sense. It is the pre-existence, then, of something belonging to all rational souls, and by partaking of which they become rational as they are born into this life. "In the image of God made He man." It was a divine reality, not a mere generalization or outward classing of individual resemblances. So He who is "the

express image," the "image of the substance," "lighteth every man as he cometh into the world." This is the pre-existence that satisfies the argument in the *Phædo*, whilst the other view of a sense-pre-existence is wholly at war with it.

Plato held to the eternity of matter, it is said. In one sense it may be true; in another and clearer sense it is certainly most false. Matter, as body, as occupying space, as having even the lowest degree of resistance so as to become sensible to any *possible* sentiency—matter as fluid, aërial, æthereal, or nebular—matter as having any sense-conception whatever,—such matter, according to Plato, is one of the things of time, of the γιγνόμενα, of the things that are born and perish. It is a direct product of the Γεννήσας Πατήρ who made it, as he made the *Anima Mundi* or nature—the one for the body, the other for the soul or life of the world. Nothing can be clearer than the expression of this in the *Timæus*. So, too, in the argument against the atheist in the tenth book of *The Laws*. Soul—that is, God—ideas, truth, as older than matter—such is the principle on which, in that discussion, all depends. But there is another idea of Plato's which has doubtless given rise to the charge. He speaks of the *hyle* (ὕλη), "the mother of matter," "without form or qualities," and wholly supersensual, belonging, in fact, to the νοητά rather than to the αἰσθητά, or νούμενον rather than φαινόμενον (Heb. xi. 3)—a thing for the mind rather than the sense. This has, indeed, a being before time, though nowhere represented as coeternal with God. It is something supposed to be between matter and spirit, matter and God. The truth is, Plato lost himself here, as some of our scientific men, and even theologians, are now losing themselves in the attempt to conceive of *force* as something existing before *body*, or of which matter itself is but a manifestation, or in the still darker and more pantheistic effort of resolving it into spirit itself or the divine will. But this does not affect the purity of his theism, any more than similar attempts to get beyond the limits of the human conception warrant the charge of pantheism oftentimes so ignorantly and absurdly made. It is enough that, according to Plato, the world, its *body* and its *soul*, its *matter* and its *nature*, all belong to time; all had a beginning; all are declared to be the product of the "Generating Father" (*Timæus*, 37 c.), who stands "rejoicing over his work," even as in Genesis God is represented as admiring his creation and pronouncing it "good, very good."

Plato connects evil with matter, but it is with this gross matter whose resistance is in proportion to its grossness and consequent unmanageableness. God has brought into time this hard-to-be-governed thing, and there is in it what the philosopher calls ἀνάγκη, or hard necessity; but it is not, on that account, an original and eternal evil. So, too, he elsewhere speaks of an "evil soul," but this could not be the *Anima Mundi*, for that is described in the close of the *Timæus* as the "intelligible Kosmos" itself, "the image of the intelligible God, most fair, most perfect, the one, the only-begotten." Much less could it be, as in the Persian doctrine, any eternal partner of the Γεννήσας Πατήρ. But, in truth, Plato fell into inconsistency, and even absurdity here, from his attempt to explain that dark problem of evil which all human thinking has found insolvable, and of which revelation (see Isa. xlv. 7) only cuts the knot, saying, without explaining, and in defiance, as it were, both of the Persian and the Greek philosopher, "Forming the light and creating darkness, forming peace and creating evil, it is I, Jehovah, that do all these things."

This doctrine of Plato, that evil dwells in matter, whether as an eternal or an acquired principle, might be regarded as a mere speculation, and in that sense comparatively harmless. It may be called, however, the great defect of the Platonic philosophy; not by making two eternals, but from the great practical mischief it works in its ethical teaching. It may be said to have given it ascetic features not derived from Pythagoras. It introduces a purgatorial idea into its otherwise most impressive system of future retribution. But worse than all is the view it gives of *sin* as mainly, if not wholly, belonging to the *flesh*. It is the φρόνημα σαρκός, taking the latter word literally for the very body itself, instead of using it, as Paul does, for all that is wrong in our perverted human nature. In consequence of this laying all evil upon the poor body, it ignores the sins of the spirit, or "lusts of the mind," as Paul calls them—the dire soul-sins, such as ambition, malice, revenge—that have little if anything to do with any corporeal constitution—or envy, that pure spiritual devilism, hatred of another's excellence, and which a disembodied demon may be conceived as possessing in even a higher degree than the most fleshly man. These *soul-sins* are hardly mentioned by Plato at all. He stands in striking contrast with the Greek poets here, as his doctrine is equally opposed to a sound ethical psychology. The body would soon be all right, a σῶμα πνευματικόν, in fact, if the soul, the original corrupter, were perfectly pure; and yet to get away from this body, as the seat of evil, is represented, even in the *Phædon*, as the most morally deserving of human efforts.

To compensate for this great defect there is the noble argument, presented in so many places, that *virtue*, the good, the ἀγαθόν, inseparable from the καλόν, the fair, is the end of the rational life, instead of happiness, the ἡδύ, the pleasant, the agreeable, evermore resolving itself, in its more refined as well as its grosser forms, into pleasurable sensations as its ultimate analysis. If *happiness* be the *end*, whether of the individual or of the universe, then *virtue* is a *means*, a subordinate thing; and that is a position which Plato could not bear. It was not a compromise between Hedonism and Cyreneacism, as some have lately said—that is, an identifying virtue with happiness, and making the latter, in the end, the unfailing accompaniment of the former, or, as it is commonly expressed, virtue its own reward. Any such thought of compensation would have destroyed the Platonic idea: "Men must serve God, or serve the good, for naught." See the picture of "the superlatively righteous man" (ὁ δικαιότατος ἀνήρ, in the second book of the *Republic*, 360, 361). He has the ring of Gyges that gives invisibility; he can do all evil with impunity and without reproach; yet is he righteous still. He may be the very opposite of this, having the reputation of unrighteousness, and no means of ever reversing the unjust decision; yet is he righteous still. The picture, even thus far, tries our Christian faith, but it does not stop here. He may be made to endure the severest pains, with no prospect of deliverance either now or at any other time; yet is he righteous still. The hope of compensation must have no place on the canvas. Finally, says this strange painter, what may a man, thus conditioned, expect from his fellow-men? Wonderful is the answer: Ὁ δίκαιος, οὕτω διακείμενος, μαστιγώσεται, στρεβλώσεται, δεδήσεται, καὶ, τελευτῶν, πάντα κακὰ παθὼν, ἀνασχινδυλευθήσεται ("The righteous man in this state will be scourged; he will suffer dislocating tortures; he shall be bound with cords, and, finally, after suffering all evils, he shall be impaled or crucified"). What δαίμων or spirit spoke in Socrates when he said these things? What wondrous far-reaching view possessed Plato when he ascribed such words to his master? It is not at all strange that some of the Christian Fathers were almost inclined to regard it as a prophecy of Him, "the Prince and Perfecter of Faith," who, "instead of (ἀντὶ χαρᾶς) the joy set before him, endured the cross, despising the shame," that we might be "partakers of his righteousness." "Virtue the end, but not without happiness;" this has been given as a solution, but if it means that happiness—and pain too, just as well—furnish the necessary theatre on which virtue finds its exhibition, the idea may be in harmony with the Platonic. Still, virtue is the *end*, and becomes dethroned by any mixture, as end, with the hedonic element. In another place (*Gorg.*, 494, 495) the same exhausting process is pursued in respect to *pleasure*. The ἡδύ, or happiness, if it is the end of being, becomes simply a question of *quantity*. It is the amount that is to be considered, whether it be the glut of some exquisite moment, or a thinner pleasure hoarded for its rarity and spread over a longer period. The cultivated Cyrenean has no right to talk of his refined happiness, and to condemn that of others as gross and low. If the ἡδύ is the ἀγαθόν, then it constitutes the ἀγαθὸς ἀνήρ, and the man who gets the most of it is "the better man." Then, too, if the world were one huge ζῷον, so made as to be quivering for ever with the maximum of ecstatic sensational delight, that would be the best of all possible worlds. Discard the ἀγαθόν as the end of life, and the maxim *De gustibus non est disputandum* becomes the highest ethical rule. Happiness in that case is only to be judged by its degree or its intensity. If there are real differences in pleasures, so that some may be called *good* and others *bad*, then there must be some more ultimate principle, not resolving itself into happiness or into "self-rewarding virtues," according to which their respective ranks and moral values are to be determined. The argument is unanswerable, and this gives rise to a like extreme statement in the opposite direction. Some of the lowest pleasures, as they are called, excel all others in the fulness of their pleasing sensations. Let the man who chooses this have it for his portion to all eternity—no palling, no abatement; one everlasting succession of never-paining, never-cloying, pleasurable, and even ecstatic, emotion. The Almighty might have made it so. He has, indeed, most mercifully put Nature in the way, making her his executioner, instead of the lawgiver, as a certain kind of modern ethics are inclined to regard it. But Plato presents it as an ethical and æsthetical supposition. What should we think of one who had chosen, and to whom there was permitted, for ever, such an uncloyed

existence? The answer is most dramatically brought out of the moral feeling, even of the sensualist. Socrates but gives back to him his own rising thoughts: "Such an existence, would it not be δεινὸς καὶ αἰσχρός—awful and shameful"? "Would he not be ἄθλιος, a very *wretch* indeed, not in the sense of pain, but as denoting the extreme of degradation and perdition, abhorrent to the rational mind"?

What is called Plato's hedonic view is carried even into the State. As he says, in the beginning of the fourth book and in other parts of the *Republic*, the object of government is not so much to make men happier or richer, as to secure a healthy civic organism—ὅπως ὅτι μάλιστα ὅλη ἡ πόλις—"for in such a commonwealth may we best hope to find righteousness." There is the same idea in the *Gorgias*, that the true statesman is he who aims not to *please*, but to leave the people morally better, "healthier in their souls," than he found them.

There is one feature in the Platonic *Dialogues* which has not received the attention it deserves. Allusion is made to what are called the Platonic myths. For the more extensive and gorgeous of them the reader is referred to the close of the *Republic*, the *Phædon*, and the *Gorgias*; the first two setting forth the retributions of the unseen world, and the third the appalling scenes of the spiritual judgment *"for sins done in the body."* Nowhere out of the writings of Paul does this expression assume a more terrific significance. The "sins done in the body," all appearing as marks in the soul, not one, the least, having failed in stamping itself upon the tablet of the eternal spiritual memory. There is the myth of *Prometheus* in the *Protagoras*, the fanciful myth of the *Phædrus*; the wholly original and splendid myth of the *Politicus*, setting forth the alternating cosmical periods, the one of the divine order, the other of Nature left to herself, when (in direct opposition to the latest scientific holdings) she inevitably begins to degenerate, as having in herself no principle of progression, or even of permanence, though even in her abandonment she may preserve some portions of the spermatic reasons that were sown during her diviner circuit.

It is a question of interest whence Plato—or, in this case, more properly, Socrates—derived these myths. Some aspects of them seem to show that there was in them a popular lore that arrested his attention, as being more ancient and, at the same time, more truly significant, than the common mythology as represented on the stage. There are resemblances, indeed, but at the same time some striking differences. They are more serious than either the epic or dramatic. They seem to be regarded by Plato as an ancient body of truth, a sort of primitive revelation, as it were, in respect to the retributions of the other world, and the ante-historical and superhuman destinies of the earth on which we live. Some regard them as mere pleasant tales forming a part of the Socratic humor, leading him to tell a story where he finds himself failing in the argument. No careful reader, however, can retain this, or avoid feeling that Socrates is never so serious and, we venture to say, so Christlike (see the account of the Cavern of Sense, the prison of the worldly soul, in the beginning of the *Republic*, vii.) as in these myths and allegories. It seems also to have been an idea ever present in the mind of Plato that there was some superior wisdom in the minds of the earliest men, or, as Cicero expresses it, probably deriving it from him, "et primum omnis antiquitas, quæ quo propius aberat ab ortu et divina progenie, hoc melius ea quæ erant vera cernebat." (*Tusc. Disp.*, i. 26; *Aristot. Metaph.*, Lib. xi. (xii.), Lips., vol. ii. p. 254; παραδέδοται ὑπὸ τῶν ἀρχαίων καὶ παλαιῶν, ἐν ΜΥ΄ΘΟΥ ΣΧΗ΄ΜΑΤΙ καταλελειμμένα τοῖς ὕστερον, ὅτι περιέχει ΤΟ᾽ ΘΕΙ͂ΟΝ τὴν ὅλην φύσιν): "For by the primitive and very ancient men it has been handed down in the form of myths, and thus left to later generations, that the Divine it is which holds together all nature."

As has been already said, hardly any writings are more clear from the mystical or the false profundity that seeks the shade of unmeaningness. The German editors and commentators, though great as critics, have confused themselves and their readers by an affectation of too much insight. The *Timæus* itself is easier reading than Schleiermacher. The unpretending Stallbaum gives us the best, because the plainest, clue to the historical connections and the plans of the several parts. With others their unceasing cant about "multiplicity in unity," and "working out from a central ground," only bewilders the reader when he finds how different from this labyrinthine refinement is the clear though involved and apparently aimless discourse, winding along like a river at its will, and surprising us all the more by the pleasant places to which it is ever leading us. On this character of the *Dialogues* and the Socratic method generally more might be said, were it not that it will come better under the title SOCRATES itself. It is sufficient to say here that whilst, of all writings, they show the least of logical design—concealing it, in fact, instead of bringing it under notice—there are none more remarkable for the extreme tenacity with which they ever hold fast to certain peculiar ideas. To use Socrates' own figure, the game is never lost sight of until it is unearthed, however many may have been the apparent doublings of the hounds. Some dialogues, even quite long ones, seem to come to no result. These have been called *tentative*, sometimes skeptical. Socrates himself is made to style them the *kathartic*, sometimes the *kunegetic*. Their object is to evacuate the soul of error before the attempt to fill it with truth—to chase away the idols of the cavern in order to admit the sunlight with its realities; or, to use another figure, to test whether the idea so long sought proves to be, on its birth, a true offspring of the soul, or nothing more than an ὠὸν ἀνεμιαῖον, an abortion, or *wind-egg*, to be cast away. There are none more valuable than these, though none have been less understood.

There have been various translations of Plato, such as those of Taylor, Sydenham, Victor Cousin, and others. The one, however, which for the English reader must supersede all others is that of Jowett. He has done the best, perhaps, that could be done in transferring this most spiritual and colloquial Greek into the most vivacious and, at the same time, idiomatic English. Yet still it is felt to be a translation. It is no disparagement of it to say that to one who reads Plato with ease in his grand old tongue the grace is often gone; threadbareness frequently takes the place of the shining gloss, whilst what suffers most of all is the Socratic wit ever enhancing instead of lowering the Platonic dignity. TAYLER LEWIS.

Pla'tof (MATVEI IVANOVITCH), b. Aug. 6, 1757, on the banks of the Don; distinguished himself in the Turkish wars; was made hetman of the Cossacks of the Don in 1801, and evinced considerable administrative talent; sprang suddenly into European fame by the military operations he performed as leader of the irregular cavalry in the rear of the French during their retreat from Moscow. With his twenty regiments of Cossacks he hung on their skirts like a cloud of birds of prey. Their Moscow booty he recaptured; their baggage and provision trains he seized and burnt; fragment after fragment of the grand army he cut off, defeated, and massacred. And this tale of horrors lasted from Moscow to Paris, and grew wilder with every step; his cruelties after entering France herself knew no bounds. At the end of the campaign the emperor Alexander made him a count, the citizens of London presented him with a silver sword, and loaded with honors he retired to his native place, where he d. Jan. 15, 1818.

Platoon', the half of a company.

Platt (EDWARD R.), b. in Burlington, Vt., 1827; grad. at West Point 1849, and com. brevet 2d lieut. of artillery; served on frontier and in garrison 1849–55; at West Point as ass't prof. of French 1855–59; promoted to be capt. 2d Artillery May 15, 1861; commanded his battery at Bull Run, and brevetted major for gallantry; judge-adv.-gen. Army of the Potomac Nov., 1863–July, 1865; brevet lieut.-col. for gallantry at Fredericksburg; transferred to the staff in 1873, as ass't adjt.-gen., with rank of major. J. G. BARNARD.

Platt (JAMES H., JR.), b. in St. John's, Canada, July 13, 1837, of parents who were American citizens; graduated from the medical department of the University of Vermont 1859; served during the civil war as captain 4th Vermont Vols., and on the staff of Gen. Sedgwick as acting chief quartermaster 6th corps; prisoner of war May 30 to Dec., 1864; appointed lieutenant-colonel and chief quartermaster, which he declined. Settled in Virginia at the close of the war; was member of Petersburg city council, of State constitutional convention; in 1869 elected to the 41st Congress, and re-elected to the 42d, 43d, and 44th.

Platte, county of Missouri, bounded S. W. by Missouri River, which separates it from Kansas. Area, 400 sq. m. It is diversified, well wooded, and very fertile. Products, live-stock, grain, and wool; manufactures, lumber and flour. Traversed by various railroads. Cap. Platte City. P. 17,352.

Platte, county of Central Nebraska. Area, 630 sq. m. It is undulating and mostly well watered, fairly wooded, and productive. The S. E. part is traversed by Platte River and Union Pacific R. R. Cap. Columbus. P. 1899.

Platte, tp., Taylor co., Ia. P. 163.

Platte, tp., Union co., Ia. P. 565.

Platte, p.-v. and tp., Benzie co., Mich. P. 181.

Platte, tp., Andrew co., Mo., on Little Platte River. P. 3416.

Platte, tp., Buchanan co., Mo., on Platte River. P. 1159.

Platte, tp., Clay co., Mo. P. 3085.

Platte, tp., Clinton co., Mo., on a branch of Platte River. P. 1631.

Platte City, p.-v., Carroll tp., cap. of Platte co., Mo., on Chicago Rock Island and Pacific R. R., has 2 academies, 2 newspapers, 2 banks, 2 hotels, fine water-power, extensive paper-mills, and stores. P. 599.

WM. M. PAXTON, ED. "PLATTE COUNTY ADVOCATE."

Plattekill, p.-v. and tp., Ulster co., N. Y. P. 2031.

Platte River is formed in Lincoln co., Neb., by the union of the N. and S. forks. The former rises in the North Park, Col., receiving the Sweetwater, the Laramie, and other streams. The South Platte flows from the South Park of Colorado, and in its upper course is extensively utilized in irrigation and as a source of water-power. The united stream flows E., and reaches the Missouri at Plattsmouth. It is the widest, but neither the largest in volume nor the longest, affluent of the Missouri. Its mouth is over 1000 yards wide, but it is so very shallow that it can nowhere be navigated with much success. Its valley is generally very fertile. The drainage-area is estimated at 7500 sq. m. The Loup Fork and Elkhorn are the chief tributary streams. Length of the main stream, 900 miles.

Platte River, tp., Polk co., Neb. P. 44.

Platte Valley, tp., Douglas co., Neb. P. 631.

Platte'ville, tp., Mills co., Ia., on Missouri River opposite its mouth. P. 762.

Platteville, p.-v. and tp., Grant co., Wis., on Galena and Southern Wisconsin Narrow-gauge R. R., has a State normal school, 13 churches, 1 bank, 1 newspaper, 2 foundries, a planing-mill, 6 flouring-mills, 2 carriage-factories, several hotels, and a powder-mill. P. of v. 2537; of tp. 3683. M. P. RINDLAUB, ED. "WITNESS."

Platt'ford, p.-v. and tp., Sarpy co., Neb., on Platte River. P. 556.

Plat'tin, p.-v. and tp., Jefferson co., Mo. P. 1217.

Platts'burg, p.-v., cap. of Clinton co., Mo., at crossing of Chicago and South-western and Lexington and St. Joseph division of St. Louis Kansas City and Northern R. R., has 1 newspaper. P. 1067.

Plattsburg, p.-v. and tp., cap. of Clinton co., N. Y., on both banks of Saranac River at its entrance into Lake Champlain, southern terminus of Montreal and Plattsburg division of Vermont Central and northern terminus of Whitehall and Plattsburg R. Rs., has a fine harbor, a good water-power, extensive woollen, flouring, and saw-mills, foundries, machine-shops, and manufactories, a large lumber-trade, fine court and custom houses, 3 hotels, an academy, 3 banks, extensive U. S. barracks, 6 churches, and 3 newspapers. Noted as the scene of the capture of a British fleet on Lake Champlain by Com. McDonough, Sept. 11, 1814. P. 5139.

Plattsburg, p.-v., Harmony tp., Clark co., O., on London branch of Cincinnati Sandusky and Cleveland R. R. P. 87.

Platts'mouth, p.-v. and tp., cap. of Cass co., Neb., located at the junction of Platte and Missouri rivers, on Burlington and Missouri River R. R., formerly the outfitting point for emigrants seeking California, has a fine high school, 2 machine-shops (1 connected with the railroad), a foundry, 2 grist-mills, 2 newspapers, and the surveyor-general's office for Iowa and Nebraska. P. of v. 1944; of tp. 2448.

JNO. A. MACMURPHY, ED. "NEBRASKA HERALD."

Platt Springs, tp., Lexington co., S. C. P. 679.

Plattsville, p.-v., Green tp., Shelby co., O. P. 94.

Platycephal'idæ [πλατύς, "broad," and κεφαλή, a "head"], a family of fishes of the order Teleocephali, represented in the Pacific and Indian oceans. The body is elongated and depressed anteriorly, covered with ctenoid scales or plates; the lateral line entire; head much depressed and triangular above; the bones more or less armed with spines; mouth with a lateral cleft; teeth present in villiform bones on the jaws as well as palate; branchial apertures continuous below; branchiostegal rays seven; dorsals two, the anterior with six to nine spines; the posterior dorsal and anal similar and opposite each other; the pectorals with the lower rays at least simple; ventrals thoracic or subjular, each with a spine and five rays; the skeleton has the vertebræ in increased number (about 12 + 15); the pyloric appendages are developed in moderate number; there is no air-bladder. The family includes three well-marked genera—*Platycephalus*, *Hoplichthys*, and *Bembras*. In some respects the family is more nearly related to the Triglidæ (*Prionotus*, etc.) than to any other familiar to American naturalists. THEODORE GILL.

Platypter'idæ [*Platyptera*, πλατύς, "broad," and πτερόν, "fin"], a family of teleocephalous fishes related to the gobies, dragonets, etc. The body is elongated, covered with ciliated scales; lateral line inferior; the head broad and depressed; opercula unarmed; mouth with a narrow cleft; upper jaw protractile; teeth small, only on the jaws; branchial apertures moderate, separated below; branchiostegal rays six; dorsal fins two, the anterior with (seven) flexible spines; the posterior dorsal and anal similar, small, and obliquely opposite each other; caudal separated; pectorals with branched rays, large and expanding laterally and forward; ventrals wide apart, each with a spine and five rays; the vertebræ are rather numerous (11 + 16); no air-bladder exists. The group is represented by a single fresh-water species (*Platyptera aspre*), found in the fresh waters of the East Indian islands Bantam and Celebes.

THEODORE GILL.

Platypus, a name applied to the DUCK-BILL (which see).

Plau'en, town of Saxony, on the Elster, has many good educational institutions, and large manufactures of paper, leather, muslin, cambric, jaconet, and other woollen and linen goods. P. 23,355.

Plau'tus (TITUS MACCIUS), b. about 254 B. C. at Sarsina, in Umbria; came early to Rome, where he found employment with the actors; saved some money and started a business of his own, but failed; worked afterward in a hand-mill at Rome, and wrote, about 224 B. C., three comedies, which he succeeded in selling to the managers of the public festivals. They were well received, and from this time he lived as a play-writer to his death, 184 B. C. The plots, and generally also the characters, of his plays he took from the Greek comedians, Menander, Diphilus, and Philemon, but both underwent a very free treatment and a thorough Latinization, which may be inferred from the general character of his dialogue; it is not only fluent and witty, but racy and taken fresh from the lips of the people. His success was considerable. While Terence, who was much more elegant, but also a much closer imitator of the Greeks, complains that the audience ran away from his plays to look at some rope-dancer, Plautus remained a favorite with the Romans down to the time of Diocletian, and was appreciated not only by the mass, but also by the most fastidious people—*e. g.* Cicero. His fertility seems also to have been great. According to Varro, there existed 130 plays which bore his name, but the number of those unquestionably genuine the critics limit to 21—namely, *Amphitruo*, *Asinaria*, *Aulularia*, *Bacchides*, *Captivi*, *Casina*, *Cistellaria*, *Curculio*, *Epidicus*, *Menæchmi*, *Mercator*, *Miles*, *Mostellaria*, *Pœnulus*, *Persa*, *Pseudolus*, *Rudens*, *Stichus*, *Trinummus*, *Truculentus*, and *Vidularia*. The last of these has been lost, but the other twenty are still extant, though in a text much corrupted and interpolated. Best edition by F. W. Ritschl (3 vols., Bonn, 1848–54, still incomplete). There is an English translation by Thornton and Warner (5 vols., 1767–74), another by Riley (2 vols., 1852).

Play'fair (JOHN), b. at Benvie, Forfarshire, Scotland, Mar. 10, 1748; educated at the University of St. Andrew's, where he was distinguished for his attainments in natural history; became a minister of the Scotch Church 1772; held the living of Benvie 1773–82, when he resigned, removed to Edinburgh, and became a private tutor; was appointed assistant professor of mathematics in the University of Edinburgh 1785, professor of natural philosophy 1805, and became in the same year general secretary of the Edinburgh Royal Society. He was a frequent contributor to the *Transactions* of that body, as well as to the *Edinburgh Review;* published a valuable edition of Euclid's *Elements of Geometry* (1795), still in use both in Great Britain and the U. S., *Illustrations of the Huttonian Theory of the Earth* (1802), and *Outlines of Natural Philosophy* (2 vols., 1812–16), containing the substance of his university lectures. Prof. Playfair was one of the precursors of the geological discoveries of the present century; travelled in search of geological data in France, Switzerland, and Italy, and left incomplete at his death an interesting *Dissertation on the Progress of Mathematical and Physical Science*, prepared for the supplement to the *Encyclopædia Britannica.* D. at Edinburgh July 19, 1819. A collected edition of his works was issued at Edinburgh (4 vols., 1822).

Playfair (LYON), C. B., F. R. S., LL.D., b. in Bengal in 1819; educated at St. Andrew's, Scotland, and the Andersonian University, Glasgow; studied chemistry under Graham and Liebig; engaged in industrial chemistry; became in 1843 professor of chemistry in the Royal Institution, and in 1858 took the chemical chair in the University of Edinburgh; became in 1868 a Liberal member of Parliament for the Universities of Edinburgh and Aberdeen; postmaster-general 1873–74; has held many other public positions of importance, and been the recipient of many honors, British and foreign.

Playing Cards. A pack of playing cards, as used in modern times and for the most common games, numbers

52 cards, and consists of four suits, two red (hearts and diamonds), and two black (spades and clubs), each suit comprising 13 cards—three picture-cards, the king, queen, and knave; and ten plain cards numbered from one, the ace, to ten. Chinese packs have only 30 cards—three suits of nine cards each, and three single cards, which rank higher than the others. Like chess, cards were introduced into Europe from Asia; but while the game of chess evidently originated from the warlike disposition and occupations of ancient nations, cards seem originally to have been used only for fortune-telling and similar purposes. The first games practised in Europe were those of mere chance, and there are no vestiges of any real application to them of the historical and symbolical associations connected with the cards; the four suits representing the four classes—hearts, the clergy; spades, the knights; diamonds, the burghers; and clubs, the serfs; the four kings representing David, Alexander, Cæsar, and Charlemagne; etc. The Saracens first brought cards to Spain and Italy, whence they soon spread to France and Germany. At the close of the thirteenth century the manufacture of playing cards was a considerable branch of industry in Nuremberg and other German cities. In the time of Richard III. and Henry VII. card-playing became a favorite amusement among the higher classes in England. But the golden age of this kind of entertainment was the middle and latter part of the eighteenth century. One of the most beneficial influences of Louis XIV. and his gay court was the greater sociability which they introduced into European life—the general taste for social gatherings for the mere purpose of entertainment, without any grand occasion, such as the celebration of a wedding, a funeral, etc. But in other countries that vivid interest for literature and art was wanting which in France made social gatherings a noble intellectual enjoyment; and in France, too, this interest slackened considerably during the latter part of the reign of Louis XIV. and during the next generation. The materials for a good conversation given up, soon even the faculty became lost, and people began to feel as if they did not know what to do with themselves. In this emergency cards were eagerly resorted to as the panacea against *ennui*. Card-tables were arranged in long rows through the saloons; ladies and gentlemen were seated around them according to their rank, and for several hours, between the heavy dinner of sixteen courses and hot wines and the light supper of eight courses and mild wines, nothing was heard in the crowded rooms but the rustling of the cards, the ringing of money, and now and then a burst of anger or exultation. Goethe played, at one time of his life, his game of *L'ombre* every day after dinner. Then came the French Revolution with its passionate debates, and swept away, like a whirlwind, the cards, the card-tables, and the card-players.

Plea (law), the name given in the common-law system of pleading to the first defence or statement of fact interposed by the defendant in an action at law. Pleas are divided into two general classes—those in abatement, and those in bar. The former allege facts showing that the plaintiff ought not to recover in the particular action, but do not attack the cause of action itself; the latter controvert the very cause of action, and show that the plaintiff ought not to recover at all. Pleas in bar are subdivided into those by way of traverse and those by way of confession and avoidance. Traverses are general or special—general when they deny all the allegations made by the plaintiff; special when they deny some particular allegation. Pleas in confession and avoidance admit the truth of the plaintiff's averments, but at the same time set up other facts which destroy their legal effect, and show that notwithstanding them the plaintiff is not entitled to recover. The term, with the general system to which it belongs, has been abandoned in England and in a majority of the States of this country, but is still used in those States where the ancient methods of procedure are preserved. (See PLEADING and PROCEDURE.) JOHN NORTON POMEROY.

Plead'ing (law), the written allegations of the parties to an action, by which they state their respective claims and defences, and finally arrive at an issue of fact or of law, the decision of which will determine the judicial controversy between them. Prior to the comprehensive reforms recently effected by statute there had long existed in England and in this country three different types or species of pleading in civil suits—namely, the common law, the equity, and that by allegation. The common-law method prevailed exclusively in the courts of law. At a very early period the parties to a suit appeared in open court and made oral statements of their claims and defences in the actual presence of the judges, which were at once written down by an officer of the court; and this official transcript constituted the record of the proceedings. It is plain from the writings of Bracton that this oral mode was universal in the time of Henry III., and it seems to have continued until about the middle of the reign of Edward III. The common-law system, as it was subsequently perfected, arose from the substitution of written allegations in the place of these oral ones; and such writings, instead of being presented to the judges themselves sitting in court, were filed by the attorneys in the offices of the proper clerks. The first pleading by the plaintiff was the "declaration," which contained a statement of the cause of action made in a highly artificial, formal, and technical manner, and in language which differed widely from the English of ordinary narrative, and also indicated the particular form of action which the plaintiff had adopted. If the defendant admitted the truth of the facts set forth by the plaintiff, but denied that in law they constituted the cause of action against him, his pleading was termed a "demurrer," and formed merely an issue of law to be decided by the court. If, however, he desired to present an issue of fact, his pleading was styled the "plea." The "pleas" by the defendant, and all subsequent pleadings in the suit by either of the parties, were separated into two classes—those by way of traverse, which directly denied all or the essential statements of fact contained in the preceding pleading of the adverse party; and those by way of confession and avoidance, which admitted such statements to be true, but alleged other and new facts obviating and destroying their legal effect. If the defendant's plea was a traverse, an issue of fact was formed at once; if it was in confession and avoidance, the plaintiff must interpose a "replication" or a demurrer. In this manner the alternate allegations were conducted until either an issue of law was presented by a demurrer, or an issue of fact by a direct affirmation on the one side and a denial thereof on the other; in actual practice, however, the series seldom was extended beyond the "replication." The rules which governed the common-law system and regulated the manner of making the averments were exceedingly refined, precise, and formal; and the result was, that litigations were often decided upon the most technical questions, having no connection whatever with the merits of the controversy, and the amount of wrong and injustice thus done to suitors was simply incalculable. The method of pleading in courts of equity was very different from that prevailing in courts of law. The complainant's case was stated in a "bill of complaint" and the defendant's in an "answer," and these ordinarily constituted the only pleadings, although a few particular defences were set out in a form known as the "plea." The parties were not subjected to the technical rules of the common law, but used a more natural mode of statement. The pleader averred not only the principal facts constituting the ground for relief or the defence, but also the evidence by which these facts were substantiated, and thus spread out in his bill or answer a full and detailed narrative of the entire transaction which formed the subject-matter of the controversy, so that the cause could often be decided upon these averments alone, without the aid of evidence. The mode of pleading in the court of admiralty and the ecclesiastical courts was substantially identical, in respect to the matters required to be stated, with the equity method, and differed from that simply in the external form of the averments. Each important fact, together with the detail of evidence concerning it, was contained in a separate paragraph, technically termed an "allegation," so that the "libel" of the complaining party, which corresponded to the "declaration" and the "bill" of other courts, was separated into a number of distinct paragraphs or allegations, each relating to a single fact or occurrence. In 1848 the legislature of New York effected for that State a radical change in these modes of pleading by adopting the code of civil procedure; the reform thus inaugurated has extended into more than twenty other States and Territories of this country, and has even been adopted as to all of its essential features in England, where it went into operation during the year 1875. By this system the distinction between legal and equitable suits is abolished, and the rules which governed the common-law pleading are abrogated. The parties in all actions are required to state the facts constituting the ground of relief or the defence as they actually existed, in ordinary language, without any technical formality, and without any averments of evidence or of legal conclusions. In some of the States the first pleading by the plaintiff is denominated the "complaint," in others the "petition," while in England it is called the "statement of claim." The only pleading of fact by the defendant is styled the "answer" in all of the several States, but the "statement of defence" in the English practice. Under certain circumstances the plaintiff must put in a "reply," but the pleadings of fact can never extend beyond this point. The defendant may demur to the plaintiff's complaint, petition, or statement of

claim, and to his reply; and the plaintiff may demur to the defendant's answer or statement of defence. The underlying principle of this reformed system is natural, correct, and at the same time truly scientific; if its full beneficial results have not been attained in all of the States, the fault does not inhere in the system itself, but in the loose manner of its enforcement by the courts and the bar. (See PROCEDURE.) JOHN NORTON POMEROY.

Pleas'ant, tp., Fulton co., Ill. P. 1685.

Pleasant, tp., Allen co., Ind., on St. Mary's River and Fort Wayne Muncie and Cincinnati R. R. P. 1280.

Pleasant, tp., Grant co., Ind., on Mississinewa River. P. 1575.

Pleasant, tp., Johnson co., Ind., on Jeffersonville Madison and Indianapolis R. R. P. 2170.

Pleasant, tp., La Porte co., Ind., on Indianapolis Peru and Chicago R. R. P. 814.

Pleasant, tp., Porter co., Ind. P. 615.

Pleasant, tp., Steuben co., Ind., includes Angola, the county-seat. P. 2071.

Pleasant, p.-v. and tp., Switzerland co., Ind. P. 2145.

Pleasant, tp., Wabash co., Ind., on Eel River. P. 2553.

Pleasant, tp., Appanoose co., Ia. P. 1101.

Pleasant, tp., Hardin co., Ia. P. 842.

Pleasant, tp., Lucas co., Ia. P. 632.

Pleasant, tp., Monroe co., Ia., on Des Moines River, and on Central Iowa and Burlington and Missouri River R. Rs. P. 1299.

Pleasant, tp., Poweshiek co., Ia. P. 646.

Pleasant, tp., Union co., Ia. P. 563.

Pleasant, tp., Wapello co., Ia., on Burlington and Missouri River R. R. P. 1166.

Pleasant, tp., Winnebago co., Ia. P. 301.

Pleasant, tp., Winneshiek co., Ia., on Upper Iowa River. P. 994.

Pleasant, tp., Wright co., Ia., on Iowa River. P. 332.

Pleasant, tp., Brown co., O., on Ohio River, includes Georgetown, the county-seat. P. 2605.

Pleasant, tp., Clark co., O. P. 1553.

Pleasant, tp., Fairfield co., O. P. 2327.

Pleasant, tp., Franklin co., O., on Darby Creek. P. 1833.

Pleasant, tp., Hancock co., O. P. 1366.

Pleasant, tp., Hardin co., O., on Scioto River and Cincinnati Sandusky and Cleveland R. R., includes Kenton, the county-seat. P. 4002.

Pleasant, tp., Henry co., O. P. 860.

Pleasant, tp., Knox co., O., includes Gambier Village, site of Kenyon College. P. 851.

Pleasant, tp., Logan co., O., on Miami River. P. 994.

Pleasant, tp., Madison co., O. P. 1330.

Pleasant, tp., Marion co., O. P. 1078.

Pleasant, tp., Perry co., O. P. 655.

Pleasant, tp., Putnam co., O., on Dayton and Michigan R. R. P. 1953.

Pleasant, tp., Seneca co., O., on Sandusky River and Cincinnati Sandusky and Cleveland R. R. P. 1352.

Pleasant, tp., Van Wert co., O., includes Van Wert, the county-seat. P. 3683.

Pleasant, tp., Warren co., Pa., on Allegheny River. P. 385.

Pleasant, tp., Barbour co., West Va. P. 1395.

Pleasant, tp., Clay co., West Va. P. 488.

Pleasant, tp., Preston co., West Va. P. 1570.

Pleasant Branch, v., Middleton tp., Dane co., Wis. P. 173.

Pleasant Gap, p.-v. and tp., Bates co., Mo. P. 1634.

Pleasant Grove, tp., Jackson co., Ala. P. 730.

Pleasant Grove, tp., Limestone co., Ala. P. 649.

Pleasant Grove, tp., Coles co., Ill., on Embarras River. P. 1573.

Pleasant Grove, p.-v. and tp., Des Moines co., Ia. P. 1023.

Pleasant Grove, tp., Floyd co., Ia. P. 442.

Pleasant Grove, tp., Mahaska co., Ia. P. 875.

Pleasant Grove, tp., Marion co., Ia. P. 1445.

Pleasant Grove, tp., Greenwood co., Kan. P. 462.

Pleasant Grove, p.-v. and tp., Olmstead co., Minn. P. 1071.

Pleasant Grove, tp., Alamance co., N. C. P. 1246.

Pleasant Grove, tp., Johnston co., N. C. P. 1535.

Pleasant Grove, tp., Randolph co., N. C. P. 1218.

Pleasant Grove, p.-v., Utah co., Ut. Ter. P. 930.

Pleasant Grove, p.-v. and tp., Lunenburg co., Va. P. 1778.

Pleasant Grove, tp., Norfolk co., Va. P. 2429.

Pleasant Hill, tp., Clarke co., Ala. P. 520.

Pleasant Hill, p.-v. and tp., Dallas co., Ala. P. 2003.

Pleasant Hill, tp., Pike co., Ala. P. 640.

Pleasant Hill, tp., Newton co., Ark. P. 352.

Pleasant Hill, p.-v. and tp., Pike co., Ill., on Louisiana branch of Chicago and Alton R. R. P. 230; of tp. 1411.

Pleasant Hill, p.-v., Mercer co., Ky. P. 362.

Pleasant Hill, tp., Winona co., Minn. P. 643.

Pleasant Hill, p.-v. and tp., Cass co., Mo., on Missouri Pacific R. R., 248 miles W. of St. Louis, has a public library, 12 churches, 1 bank, 2 flouring and 3 grist mills, 3 newspapers, and 3 hotels. P. of v. 2554; of tp. 3502. GEO. H. PRESTON, ED. "REVIEW."

Pleasant Hill, tp., Sullivan co., Mo. P. 634.

Pleasant Hill, p.-v., cap. of Saline co., Neb., has excellent schools, 3 churches, 1 newspaper, a court-house, lime and cement works, and 2 hotels. Large quantities of grain and vegetables are raised here. P. about 300. W. O. ELLIS, ED. "NEWS."

Pleasant Hill, p.-v. and tp., Miami co., O. P. 324.

Pleasant Hill, p.-v. and tp., Lancaster co., S. C. P. 1624.

Pleasant Mills, p.-v., St. Mary's tp., Adams co., Ind., on St. Mary's River. P. 80.

Pleasant Mounds, p.-v. and tp., Blue Earth co., Minn. P. 448.

Pleasanton, post-v. of Linn co., Kan., on Missouri River Fort Scott and Gulf R. R., 75 miles S. of Kansas City, has good schools, 2 churches, 1 bank, 1 newspaper, 2 mills, 2 hotels; rich deposits of lead and coal exist here. P. about 1100. E. H. BROWN, ED. "OBSERVER."

Pleasanton, p.-v. and tp., Manistee co., Mich. P. 283.

Pleasanton, v., Wesley tp., Washington co., O. P. 109.

Pleasanton, p.-v., cap. of Atascosa co., Tex., on Atascosa River. P. 206.

Pleasant Prairie, p.-v. and tp., Martin co., Minn. P. 408.

Pleasant Prairie, p.-v. and tp., Kenosha co., Wis. P. 1377.

Pleasant Ridge, p.-v., Greene co., Ala. P. 1547.

Pleasant Ridge, tp., Fulton co., Ark. P. 330.

Pleasant Ridge, tp., Livingston co., Ill. P. 809.

Pleasant Ridge, tp., Lee co., Ia., on Skunk River. P. 972.

Pleasant Ridge Plantation, tp., Somerset co., Me. P. 135.

Pleasant Run, tp., Lawrence co., Ind. P. 699.

Pleas'ants, county of West Virginia, separated from Ohio on the N. W. by Ohio River. Area, 280 sq. m. It is hilly, and for the most part fertile. Chief product, grain. Cap. St. Mary's. P. 3012.

Pleasants (JAMES), b. in 1769 in Virginia; in Congress 1811–19; in the U. S. Senate 1819–22; governor of Virginia 1822–25, and declined other important positions. D. in Goochland co., Va., Nov. 9, 1836.

Pleasant Site, p.-v., Franklin co., Ala. P. 1053.

Pleasant Vale, tp., Pike co., Ill., on Mississippi River. P. 1188.

Pleasant Valley, p.-v. and tp., Jo Daviess co., Ill. P. 943.

Pleasant Valley, tp., Fayette co., Ia. P. 1119.

Pleasant Valley, tp., Grundy co., Ia. P. 402.

Pleasant Valley, tp., Johnson co., Ia., on Iowa River. P. 1189.

Pleasant Valley, p.-v. and tp., Scott co., Ia., on Mississippi River. P. 751.

Pleasant Valley, tp., Wilson co., Kan. P. 470.

Pleasant Valley, tp., Washington co., Md. P. 1183.

Pleasant Valley, tp., Mower co., Minn. P. 319.

Pleasant Valley, p.-v. and tp., Dutchess co., N. Y. P. 1963.

Pleasant Valley, v., Whitestown tp., Oneida co., N. Y. P. 87.

Pleasant Valley, tp., Madison co., O. P. 467.

Pleasant Valley, tp., Potter co., Pa. P. 140.

Pleasant Valley, tp., Eau Claire co., Wis. P. 348.

Pleasant Valley, p.-v. and tp., St. Croix co., Wis. P. 592.

Pleasant View, tp., Macon co., Ill. P. 899.

Pleasant View, p.-v. and tp., Cherokee co., Kan. P. 971.

Pleasantville (formerly CLARK'S CORNERS), p.-v., Mt. Pleasant tp., Westchester co., N. Y., on New York and Harlem R. R.

Pleasantville, p.-b. and tp., Venango co., Pa. P. 1598.

Pleas'onton (ALFRED), b. in the District of Columbia Dec., 1823; graduated at the U. S. Military Academy July, 1844, when he was appointed brevet second lieutenant 1st Dragoons; major 2d Cavalry Feb., 1862. He took part in the war against Mexico, gaining the brevet of first lieutenant for gallantry at Palo Alto and Resaca de la Palma; subsequently, prior to 1861, served on frontier duty with his company and as acting assistant adjutant-general. In the civil war he commanded his regiment on its march from Utah to Washington, with which he continued to serve throughout the Virginia Peninsular campaign of 1862; appointed brigadier-general of volunteers July 16, 1862, he commanded in September the division of cavalry (Army of the Potomac) following Lee's army invading Maryland; engaged at Boonsboro', South Mountain, Antietam, and subsequent pursuit, and constantly engaged the enemy's cavalry at Fredericksburg; at Chancellorsville, by his brilliant action, he stayed the further advance of Stonewall Jackson's corps, which threatened to carry all before it. Promoted for this valuable service to be major-general in June, he was engaged in the numerous actions preceding Gettysburg, where he also commanded in chief the cavalry; transferred to Missouri in 1864, he drove the invading forces of Gen. Price from the State. Mustered out of the volunteer service Jan., 1866, he resigned in 1868 his commission in the regular army, and for several years was U. S. collector of internal revenue.

Plébiscite' [Lat. *plebiscitum*]. In the Roman republic, a *plebiscitum* was a law passed at the *comitia tributa* by the *plebs* or commons on the rogation of a tribune, and was different from a *lex*, which was passed at the *comitia centuriata* by the *populus* or patricians on the rogation of a consul or other senatorian magistrate. In modern France, *plébiscite* denotes a decree of the whole nation obtained by universal suffrage, a proceeding which both Napoleon I. and Napoleon III. used in order to legitimize their *coups d'état.* After the dissolution of the Directory, Nov. 9, 1799, Napoleon I. appealed to the nation in this way, and Napoleon III. did the same after the dissolution of the National Assembly, Dec. 2, 1851. But, although in both cases the appeal was made by means of universal suffrage, the tendency of the proceeding was both times to despotism, and the measure itself nothing but a preparation for the establishment of the Empire, which then was confirmed by new *plébiscites*—the first, in May, 1804, giving a majority of 3,572,399 votes; and the second, in Nov., 1852, giving a majority of 8,157,752 votes.

Plebs and **Plebeians.** See PATRICIANS.

Plectog'nathi [Gr. πλεκτός, "intertwined"—*i. e.* "connected"—γνάθος, "jaw"], an order of teleost fishes comprising the file-fishes, trunk-fishes, swell-fishes, etc. They are distinguished by the greater or less co-ossification of the premaxillary and supramaxillary bones, and especially by the coalescence of the elements of the lower jaw; the cranium is posteriorly normal, and essentially resembles that of the teleocephalous fishes; the interoperculum is a slender bone; the scapular arch is destitute at least of the mesocoracoid bone; the post-temporal is undivided and co-ossifies with the epiotic; the vertebræ are generally in small number; the gills normal and pectinated; the pharyngeal bones also normal; the scales are more or less aberrant in type, and tend to development as angular scutes or spines; the ventral fins are absent. The order is really a natural one, although its various species are remarkably unlike in external appearance. This dissimilarity has led to skepticism lately as to its homogeneous character, and necessitates a differentiation into three suborders—viz. (1) Gymnodontes, including the swell-fishes (Tetrodontidæ and Tridontidæ) and short sunfishes (Orthagoriscidæ); (2) Ostracodermi, with the trunk-fishes (Ostraciontidæ); and (3) Sclerodermi, with the file-fishes (Balistidæ and Triacanthidæ). THEODORE GILL.

Pledge, or **Pawn** (law), a species of bailment by which personal property is delivered by a debtor to his creditor, to be held as a security for the payment of the debt or the discharge of the obligation. Anything which is tangible and movable may be the subject of a pledge, and this includes all species of chattels and all things in action in the form of written instruments, such as bonds, mortgages, notes, certificates of stock, bills of lading, warehousemen's receipts, and other written promises or engagements. There must be either an actual delivery of the article pledged into the possession of the creditor, or the delivery of its muniments of title or the written means and authority by which the actual possession may be obtained. Thus, goods on shipboard may be pledged by a delivery of the bill of lading, and those in a warehouse by a delivery of the warehouseman's receipt. The pledgor—that is, the debtor who makes the pledge—retains the general property in the article, subject to the possession and other rights of the creditor, and on payment or performance his property becomes again perfect and absolute. His interest may be transferred, will pass to his executors or administrators at his death, and may generally be sold on execution if the article itself is subject to such sale. The creditor, or pledgee, acquires the right of possession as long as the debt remains unpaid or obligation unperformed, and such a qualified property in the thing as enables him to maintain actions against third persons to recover its possession from them or damages for injuries done to it or for its wrongful conversion. Upon the debtor's failure to pay or to perform at the stipulated time, the property of the creditor or pledgee does not become absolute; he has then merely the right to maintain an action and to procure a judicial sale of the article, or to sell it himself without suit, and apply the proceeds in payment of his claim. If he resorts to the latter proceeding, he must, in the absence of express stipulations between himself and the debtor authorizing another course, first make a demand of payment from the pledgor, and secondly give him a reasonable notice of the time and place of the sale; and the sale itself must be public and in the usual course and custom of business. It is held, however, in New York and in some other States that certain things in action—as, for example, negotiable paper—when pledged, cannot be sold by the creditor in satisfaction, but must be collected in the ordinary manner and the proceeds applied upon his claim. While the possession of the pledgor continues he is bound to use ordinary care and diligence in respect to the articles, and is responsible for any losses or injuries caused by ordinary negligence. JOHN NORTON POMEROY.

Ple'iades, or **Plei'ades** [Gr. Πλειάδες or Πληϊάδες], in astronomy, a group of stars in the shoulder of Taurus, called "the seven stars," though to most eyes only six are visible. But there are hundreds of telescopic stars in the group; and Herschel has shown that they are, physically, closely related to each other. According to the ancients, the seven stars were seven daughters of Atlas and Pleïone, one of whom (Sterope or Electra) became invisible from shame, because she had been embraced by a mortal. Their myth is variously given, but their transfer to the heavens was generally believed to have followed their death from grief.

Pleistocene, a term used to denote the newest tertiary deposits. (See GEOLOGY.)

Plesiop'idæ [*Plesiops*, πλησίος, "near," and ὤψ, "an eye"], a family of fishes of the order Teleocephali. In external appearance they have some resemblance to the American sunfishes, the body being oblong, compressed, and covered with moderate scales; the lateral line is interrupted; the head rounded anteriorly; the opercula unarmed; the mouth has a lateral cleft, and the upper jaw is moderately protractile; teeth small, on the jaws as well as palate; branchial apertures continuous below; branchiostegal rays six; dorsal elongated, with the spinous portion longer than the soft (11–14 + 7–16); anal with its soft part opposite that of the dorsal, and armed with three spines; pectorals with branched rays; ventrals each with a spine and four soft rays. The family is especially recognizable by the development of only four soft rays in the ventral fins. They inhabit the salt water, and extend from the Red Sea to the Pacific Ocean. The scientific name alludes to the approximation of the eyes, resulting from the narrow frontal bones. THEODORE GILL.

Plesiosaurus. See GEOLOGY, by PROF. JOHN W. DAWSON, LL.D., F. R. S.

Pleskov. See PSKOV.

Plessis' (JOSEPH OCTAVE), b. at Montreal, Canada, Mar. 3, 1762; became a Roman Catholic priest 1786; bishop of Canatha *in partibus* 1800; translated to the see of Quebec 1806; received the archbishop's title 1819; was the first titular archbishop of Quebec, though the see did not become truly archepiscopal until 1844. D. at Quebec Dec. 4, 1825.

Plethodont'idæ [Gr. πλῆθος, "crowded," ὀδούς, ὀδόντος, "tooth"], a family of urodele amphibians or salamanders

characteristic of the North American fauna. The cranium has no anterior axial bone; the palatines are not prolonged over the parasphenoid, and have teeth on the posterior portion; the prefrontals are generally present; the pterygoids wanting; the frontal is slightly embraced by the parietals, but not by the prefrontals; the orbito-sphenoids separated by membrane from the proötic; the occipital condyles are sessile; the premaxillaries always embrace a fontanelle; on the parasphenoid are dentigerous plates; the vertebræ are biconcave, the carpus and tarsus cartilaginous. Such are the characters attributed to the family by Prof. Cope, who combines in it the North American genera *Batrachoseps*, with three species; *Hemidactylium*, with one; *Plethedon*, with six; *Stereochilus*, with one; *Manculus*, with two; *Spelerpes*, with six; *Gyrinophilus*, with one; and *Anaides*, with two. Outside of America occurs the genus *Geotriton*, with species in Europe and Northern Siam. The larval condition is long retained. The species are mostly found in brooks and damp places in forests. THEODORE GILL.

Pleth'ora [Gr. πληθώρη], a condition in which the supply of blood is excessive. It usually occurs in overfed persons of inactive habits; but medical writers speak of a *sthenic* plethora occurring in robust and active young persons, who by it are rendered peculiarly liable to acute inflammatory attacks. Such persons should follow an outdoor occupation and avoid excesses of all kinds, for they may determine such inflammatory disease. Far more common is the *asthenic* plethora of overfed and inactive persons, whose muscles, and especially those of the heart, are weakened and atonic, often in consequence of excessive use of alcoholic drinks. Apoplexy and organic diseases of the viscera frequently occur in such subjects. A sparing diet and the judicious use of saline mineral waters, with correct hygienic conditions, may greatly relieve the evil tendencies.

Pleura. See APPENDIX.

Pleu'risy [Gr. πλευρά, "the side"], an inflammation of the pleura, the closed serous sac which invests the lung, separates it from the bony wall of the chest, and enables it to move freely with the alternating expansions and contractions of respiration. The causes of pleurisy are exposure to damp and cold, congestion in the course of acute febrile diseases, and extension of inflammation from the lung when the seat of pneumonia or superficial tuberculosis. Local pleurisy over a mass of tubercle in the lung-surface is a conservative process, since by pleuritic thickening and adhesions perforation of the pleura and collapse of the lung are prevented. The pleura is, in health, bathed by a slight secretion of clear serum, which lubricates the opposed surfaces and favors ease and freedom of lung-movement. Evanescent and slight attacks of pleurisy, consisting in a temporary suppression of this normal secretion and a dry congested state of the opposed pleural walls, is of frequent occurrence: it will be indicated by a slight stitch and soreness in one side of the chest, a slight, dry cough, and slight febrile disturbance, quickly dissipated by rest, warm clothing, hot drinks, and evacuation of the bowels—agencies which establish the equilibrium of the circulation. Acute pleurisy is announced by an initial chill, by marked elevation of temperature, frequent pulse, rapid, shallow, and checked breathing, each inspiratory act producing a lancinating or stabbing pain in the side of the chest, the result of attrition of the dry, swollen, and sensitive inflamed surfaces. There is a dry, irritative, hacking cough, without expectoration, the effort of coughing producing the local pain or "stitch" in the side in its greatest intensity. Soon the distended blood-vessels of the pleura are relieved by the escape of the serous or watery element of the blood, transuding their coats into the cavity of the pleural sac. This "effusion" may be abundant and consist of pure serum, filling the entire cavity and compressing the lung. In other cases it is sero-plastic, leaving an element of plastic matter or products of rapid cell-formation on the inflamed surfaces. Still other cases have only plastic exudation, agglutinating the two pleural surfaces, and liable to organize and form permanent adhesions, which bind down and cripple the lung and render it liable to certain forms of phthisis. When effusion or exudation takes place, the pleuritic stitch ceases. But the presence of fluid in the pleura causes shortness of breath, disturbed circulation, and impaired health. In vigorous constitutions the fluid is soon removed by absorption, but in the feeble and sickly it remains and becomes purulent. Acute pleurisy is treated by antiphlogistic measures, anodynes to relieve pain, counter-irritants, and rich diet, tonics, iodide of potassium, during convalescence to ensure the absorption of the effusion. When the fluid is purulent it has to be evacuated by puncture with the trochar and canula, or more safely by the aspirator, a force-pump withdrawing fluids through tubes of small calibre. When pleurisy has left adhesions, counter-irritation by iodine, comp. iodine ointment, etc., must be resorted to, and the lungs systematically and persistently inflated to prevent compression by the organizing deposit on their surface. When such deposits and adhesions are established, they are liable to increase by fresh congestive or inflammatory attacks from time to time—a condition of chronic pleurisy. Chronic pleurisy causes persistent cough, congestion of adjacent lung-substance, spitting of blood, and various steps of fibrous or interstitial phthisis, or the development of specific tubercle when the person has the inherited specific taint. Pleurisy in a majority of cases is harmless and recovered from; in the feeble, scrofulous, and consumptive, and in cases of unusual severity, it is fatal by exhaustion or the subsequent development of consumption.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Pleurisy-root. See ASCLEPIAS.

Pleurobranch'idæ [Gr. πλευρόν, "side," and βράγχια, "gill"], a family of nudibranchiate mollusks. The body is somewhat slug-like, but shorter and convex; the mantle large and covering the body above; the head not produced, but in great part hidden under the mantle, with the frontal veil extending more or less between the base of the tentacles and the mouth; the tentacles rather narrow and slit on the outer side; the eyes on the outer side of the base of the tentacles; lingual ribbon with teeth uniform and in numerous longitudinal series; the foot large and expanded; the gill is lateral (whence the name) between the mantle and foot; the shell is either absent or limpet-like, and enclosed in the mantle; the organs of generation are close together in one tubercle. The family has a number of species distributed in the seas of various regions and representing some half dozen genera. The animals feed chiefly on algæ, and have very complicated stomachs.

THEODORE GILL.

Pleurodel'idæ [*Pleurodeles*, πλευρόν, "the side," and δηλέομαι, "to wound"], a family of salamanders chiefly developed in the Old World. The skull is destitute of an anterior axial bone; the palatines have posterior separate processes extending over the parasphenoid, and bear teeth on the inner margins; the prefrontals as well as pterygoids are present; the frontals are broad, and not embraced by the parietals; the occipital condyles are sessile; the parasphenoid has no dentigerous plates; the vertebræ are only concave behind; the carpus and tarsus are ossified. The family embraces the genera *Hemisalamandra*, *Neurergus*, *Lissotriton*, *Lophinus*, *Euproctus*, *Cynops*, *Notophthalmus*, *Pleurodeles*, *Glossolega*, and *Siranota*, peculiar to the Old World, and *Notophthalmus*, with three species, in North America. THEODORE GILL.

Pleurod'ira [Gr. πλευρόν, "the side," and δειρή, "neck"], according to some authors a sub-order of the order Testudinata, or tortoises, distinguished by the neck bending sideways and the incapability of retraction of the head completely under the carapace, and thus contrasting with the tortoises of the northern hemisphere, in which the neck bends in a vertical plane. The pelvis is fixed to the carapace and plastron. The group embraces families peculiar to the southern hemisphere and related forms found in the early epochs of the northern. The generally recognized families are Podocnemididæ, Chelydidæ, Hydraspididæ, Pelomedusidæ, and Sternothæridæ. THEODORE GILL.

Pleuronect'idæ [*Pleuronectes*, πλευρόν, "the side," νήκτης, "a swimmer"], a family of fishes including the ordinary flat-fishes, such as flounders, turbots, halibuts, etc. It belongs to the order Teleocephali and sub-order Heterosomata. The body is always strongly compressed, more or less oval or rhomboid, and with one of its sides (which is upward when the animal is reclining on its side) colored, and the other (which is downward) generally colorless; the scales are variously developed (sometimes ctenoid, sometimes cycloid, and sometimes wanting); the lateral line is continuous behind; the head compressed, more or less rhomboid, and with the snout pointed; both eyes are on the same side, one being on or near the forehead, the other comparatively low down; opercula normal, unarmed; mouth terminal, and with an oblique lateral cleft and of various extent; branchial apertures continuous below; branchiostegal rays five to eight; dorsal elongated, extending generally from about the rostral region to near the caudal fin; anal fin also elongated, and extending about as far back as the dorsal; both are composed almost solely of articulated rays; caudal fin distinct from the dorsal and anal; pectorals on both sides; ventrals jugular. The skeleton has numerous vertebræ; piloric cæca are generally developed, but in small number. The species of the family thus defined are distinguishable into three sub-families—(1) Pleuronectinæ, in which the mouth is small, and the supramaxillary ends before or under the front of the eye; (2) Hippoglossinæ, in which the mouth is large,

and the supramaxillaries extend more or less under the eye, and the ventrals are lateral; and (3) Rhombinæ, in which the mouth is large, and the ventral fin on the dark side inserted on the ridge of the abdomen. The species are numerous, and found distributed in every sea, and some of them ascend rivers. They live chiefly on sandy bottoms, and rest with their white side below and the dark one upturned. Although almost all have the eyeless side white or colorless, a few have dull spots on that side, and in one species (*Reinhardtius hippoglossoides*) it is colored like the eyed side. Over 100 species are known, of which 15 inhabit the waters of the Atlantic, and 16 those of the Pacific U. S. The most common species in the markets of the Eastern States are the small-mouthed flounder (*Pseudopleuronectes Americanus*), a large-mouthed flounder (*Chænopsetta ocellaris*), and the halibut (*Hippoglossus Americanus*). Within a few years past the *Reinhardtius hippoglossoides*, already noticed, has been brought to the New York markets from the Banks of Newfoundland, and is sold under the name of turbot, although it is most closly related to the halibut. Neither the turbot nor sole is found in the American waters, although a worthless species allied to the turbot (*Lophopsetta maculata*), and a still more worthless one related to the sole (*Achirus lineatus*), are their respective representatives. THEO. GILL.

Pleu′ro-Pneumo′nia (see PLEURISY and PNEUMONIA). In seasons of unusual severity, of great cold and high winds, when influenza prevails in epidemics and fevers tend to the malignant and asthenic forms, acute pneumonia with co-existing pleurisy, attacking one or both lungs, seems to arise from general atmospheric causes, which depress the individual vitality, and to share in the low type and unusual fatality of other prevailing diseases. The aged, feeble, and consumptive are most in danger. The symptoms and physical signs of pleurisy and pneumonia may be clearly present, but often are vague, and marked by the extreme prostration and other features resembling typhoid or typhus. Pleuro-pneumonia of widespread prevalence and fatality occasionally occurs among domestic animals.
E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Pleurotom′idæ [*Pleurotoma*, πλευρόν, "side," τομή, "a slit"], a family of gasteropod mollusks of the order Pectinibranchiata and sub-order Toxoglossa. The form is normal; the mantle moderate, and with a slit in the hinder part of the outer side; the head small and produced; tentacles well developed; the eyes inserted on the outer sides of the tentacles; the lingual ribbon is armed with two longitudinal rows of elongated subulate teeth with enlarged bases; the shell is spiral and more or less fusiform, and with the anterior canal straight; the aperture oblong; the outer lip with a notch at or not far from the suture; the operculum is in some present (and then horny and annular), and in others wanting. The family is composed of over 500 species, representing a number of genera (*e.g. Pleurotoma, Clavatula, Drillia, Bela, Defrancia*, etc.). The species are mostly of small size, especially those living in the colder waters, but some tropical species of *Pleurotoma* attain considerable dimensions. Species of the family lived at least as early as the Cretaceous epoch, and flourished during the Miocene. THEODORE GILL.

Pli′ca Polon′ica, a disease of the hair and scalp, chiefly seen in Poland and Lithuania. A foul secretion mats the hair, which becomes the seat of a *Trichophyton*, a microscopic fungus-parasite. It is believed that cutting off the hair and the free use of soap will cure the disease, but it is regarded as a sign of good luck, and a cure is therefore not often desired.

Plin′y (CAIUS PLINIUS SECUNDUS), generally called **Pliny the Elder,** b. at Verona or at *Novum Comum*, 23 A. D., of a noble and wealthy family; served in the army under L. Pomponius Secundus in Germany, where he composed a work, *De Jaculatione Equestri*, and commenced another on the history of the Germanic war; returned to Rome in 52; studied jurisprudence and commenced to practise, but without success; retired to Verona, where he composed his *Studiosus*, in three books, and *Dubius Sermo*, in 8 books; was appointed *procurator provinciæ* of Spain in 71; returned in 73 to Rome, where he lived in great intimacy with the emperor Vespasian, and was suffocated by the eruption of Vesuvius in 79. There is a detailed and very interesting account of his death by his nephew, Pliny the Younger, in a letter to Tacitus (*Epist.*, vi. 16). He was a very prolific writer, but of his works only the *Historia Naturalis*, in 37 books, is still extant, edited in 20 vols. by Panckoucke, with commentaries and notes (Paris, 1829–33), and by Sillig (8 vols., Gotha, 1851–58; translated into English by Philemon Holland, London, 1601, and in Bohn's *Classical Library*, 6 vols., 1855).—His nephew, CAIUS PLINIUS CÆCILIUS SECUNDUS, generally called PLINY THE YOUNGER, was adopted and educated by his uncle; served in the army in Syria; held several high offices, but devoted most of his time to literary studies. He was an intimate friend of Tacitus and Trajan. Nothing is known of him after 107. His *Panegyricus* and his *Epistolæ*, 10 books, were edited by G. H. Schäfer (Leipsic, 1805): the *Epistolæ* were translated into English by Melmoth (1746), Lord Orrery (1759), and a summary is given in *Ancient Classics* (1872).

Pliocene. See GEOLOGY, by PROF. JOHN W. DAWSON, LL.D., F. R. S.

Pliohippus. See HORSE, FOSSIL.

Ploce′idæ [*Ploceus*, πλοκή, a "web"], a family of birds framed by recent ornithologists for certain species inhabiting the tropical regions of the Old World. The form is essentially similar to that of the finches, to which they are closely related; the bill is strong and conic, with the culmen advancing backward on the forehead and arched to the tip, which is entire; the wings are somewhat rounded, with the first quill remarkably short; the tarsi with long scutellæ in front; the toes three, with large scales, the posterior nearly as large as the median anterior one. The family, according to Gray, contains 260 species, which he has distributed in three sub-families—viz. (1) Ploceinæ, with seven genera; (2) Viduanæ, with two; and (3) Spermestinæ, with four. Most of these genera are further subdivided into numerous sub-genera. The family, however, is not well established, and must be considered as a provisional one. The species are by far the most numerous in Africa. THEODORE GILL.

Plock, government of Poland, bounded N. by Prussia and W. by the government of Warsaw, comprises an area of 6600 sq. m., with 490,291 inhabitants. The surface is level, covered to a great extent with forests, lakes, and marshes. Agriculture and rearing of cattle and sheep are the principal branches of industry.

Plock, town of European Russia, capital of the government of Plock, Poland, on the right bank of the Vistula, is the seat of the governor, the see of a bishop, has many educational institutions, and carries on a large transit-trade. P. 21,843.

Ploëmeur′, town of France, department of Morbihan, has 9219 inhabitants, mostly engaged in the catching and preparation of sardines.

Ploërmel′, town of France, department of Morbihan, carries on an active trade in cattle, flax, hemp, honey, and woollen and linen fabrics. P. 5478.

Ploeuc′, village of France, department of Côtes-du-Nord, noticeable for its manufactures of wool-cards and nails, and trades much in cattle, corn, and hemp. P. 5052.

Plojesh′ti, town of Wallachia, the seat of the civil authorities of the district, has several educational institutions and carries on an extensive trade in wool. P. 24,400.

Plombières′, small town of France, department of Vosges, is beautifully situated in the valley of the Angronne, a tributary of the Saone, and noted for its thermal springs, much recommended for diseases of the liver, the digestive organs, and the skin. The springs have been used for medicinal purposes for centuries, but the present very elegant bathing establishments were founded by Napoleon III. P. about 1500.

Plot′idæ [*Plotus*, πλωτης, a "swimmer"], a family of swimming birds whose species are known under the name of darters. They have the body somewhat like that of the pelicans; the neck very long and slender; the head continuous with the neck; the bill rather long, compressed, straight, and graduated toward the tip, which is much pointed; the nostrils near the base and inconspicuous; the wings long and pointed, with the second and third quills largest; the tail long; tarsi short and robust, covered with reticulated scales all around; toes three in front, one behind, united together by a broad web; the claws short and curved; the skull is of the desmognathous type of Huxley. The family is represented by but a single genus (*Plotus*) and four species. The American species, which is found in the Southern States and ascends far up in the Mississippi Valley and Southern Illinois, is the *Plotus anhinga*; it is sometimes known under the name of snake-bird, on account of its long, flexible neck. THEODORE GILL.

Ploti′nus, b. at Lycopolis, Egypt, about 203 A. D.; went to Alexandria in 232, and spent there ten years under the tutelage and instruction of Ammonius Saccas. In 242 he accompanied the emperor Gordianus on his expedition against the Persians, in order to make himself acquainted with the philosophy of Persia and India; but the emperor was murdered in Mesopotamia in 243, and Plotinus now repaired by Antiochia to Rome. Here he applied himself to the teaching of philosophy, attracted immense audiences, gained numerous disciples, and enjoyed great respect and

confidence. In 269 he retired into solitude. D. at Puteoli, in Campania, the following year. The most famous of his disciples, Porphyrius, collected his works and wrote a biography of him. The collection comprises a great number of treatises on different subjects—on beauty, the immortality of the soul, the supreme good, the genesis of ideas, against the Gnostics, etc.—arranged in six divisions, each consisting of nine books, for which reason they are called *Enneads*. Parts have been translated into German and English, the whole into French. The easiest to understand and the most interesting to general readers are the treatises on beauty and against the Gnostics.

The philosophy of Plotinus is a vision rather than a system. The centre of all that exists is the One, the All-intelligence, God. From God emanates the soul of the world; from the soul of the world emanates the soul of man; and in this way the divine descends from sphere to sphere, forming itself into time and space, and building up its own body, until at last it meets with matter. The divine can form matter, but not penetrate it so as to prevent it from collapsing and returning into chaos. Matter is the seat of imperfection, the source of evil; and the aim of life is to return from the polluting contact with it into the All-intelligence. Thus, the connection between the soul and God is much deeper and much more intimate than that between the soul and the body. Although the soul, with its power of vegetative, sensitive, intellectual, and rational life, actuates the body even in the most minute details of life, still it does not form one composition with it; the soul only rests on the body as the light on the air. Otherwise with respect to God. "We move round him like a choral dance; even when we look from him we revolve about him; we do not always look at him, but when we do we have satisfaction and rest, and the harmony which belongs to that divine movement. In this movement the mind beholds the fountain of life, the fountain of mind, the origin of being, the cause of good, the root of the soul. There will be a time when this vision shall be continual, the mind being no more interrupted, nor suffering any perturbation from the body." For it is the body which disturbs that contemplation of God in which our soul unites with the universal soul, a union which cannot be effected by the reason, as the reason is incapable of grappling immediately with things divine, but which must be effected by an immediate intuition, by an ecstasy, in which "the soul sinks into a deep silence, and all around her the tumult of the senses and the agitations of the body grow still."

The most mystical part of the philosophy of Plotinus is his treatment of dæmons, magic, astrology, etc. Concerning the dæmons his writings contain contradictory utterances. At one time he describes them as parts and powers of our soul; at others he calls them the instruments of the universal soul, and ascribes to them an independent existence. In the later development of the philosophy of the Neo-Platonic school the dæmons became individual beings, but with Plotinus they oscillate between symbols and visions. CLEMENS PETERSEN.

Plotos′idæ [*Plotosus*, πλωτός, "swimming"], a family of salt-water teleost fishes of the order Nematognathi and related to the Siluridæ (catfishes, etc.). The body is elongated and almost eel-like; the skin naked; lateral line simple; head oblong and depressed; operculum present; mouth with its cleft transverse; teeth on the jaws as well as palate; branchial apertures nearly or quite confluent, the branchial membrane not being confluent with the isthmus, or only united with it by a narrow area; branchiostegal rays in considerable number (9–12); dorsal fin divided into two portions, a short anterior one above the pectoral region, and a long posterior one; the latter and anal are confluent with the caudal; pectorals simple; ventrals with many rays; the skeleton has numerous vertebræ (12–15 + 35–65); the anterior ones are coalesced into a compound piece. The family is composed of species inhabiting the coasts of the Indian Archipelago as well as Western Polynesia and Australia. By Günther three genera are recognized—*Plotosus*, *Copidoglanis*, and *Cnidoglanis*, each with three species. The aspect of the fish somewhat reminds one of the fresh-water cusk (*Lota*). The head is provided with barbels, as in ordinary catfishes. THEODORE GILL.

Plott's, tp., Cabarrus co., N. C. P. 913.

Plouaret′, town of France, department of Côtes-du-Nord, trades in corn, wine, hemp, and butter. P. 5498.

Plougastel′, village of France, department of Finistère, is noticeable for its linen manufactures and trade in wine, corn, and flour. P. 6840.

Plough, an implement for breaking up the soil, was used, though in a primitive form, as far back in ancient time as history reaches. The Old Testament speaks of ploughs with shares shod with socks of iron or bronze. The Greeks knew the wheel-plough. The modern plough, with its mould-board to turn over the broken-up soil, was invented in the Netherlands in the seventeenth century, but has since been much improved. The first steam-plough was worked in England in 1832.

Plouguerneau′, village of France, department of Finistère, is noticeable for its linen manufactures. P. 5868.

Plouha′, town of France, department of Côtes-du-Nord, is noted for its plantations and nurseries. P. 5112.

Plouigneau′, village of France, department of Finistère, trades in wine and iron, and has 5017 inhabitants.

Plover. See CHARADRIADÆ.

Plov′er, p.-v. and tp., Portage co., Wis., on Wisconsin River and Green Bay and Lake Pepin R. R., has 1 weekly newspaper and a considerable lumber-trade. P. 881.

Plow′den's Mill, v., Clarendon co., S. C. P. 853.

Plum, a name given to the tree and fruit of those species of *Prunus* (order Rosaceæ) which differ from the cherries in having a richer fruit, ripening later in the season; for though the Old-World plums have leaves convolute in the bud, while cherries have folded leaves, and while most plums have oblong, flattened, and pointed stones, those of cherries being almost globular, and while, again, most plums have a bloom upon the fruit, which cherries do not have, Prof. Gray has shown that none of these marks is constant, so that the difference between cherries and plums, while it is readily perceived, is hard to define. Plums of the better sorts, when fully ripe, are among our most delicious fruits. They are extensively cultivated in Europe, but less so in the U. S. than in former times, chiefly on account of the ravages of the curculio and of the disease called black wart. The principal varieties are referred to *Prunus domestica*, a small tree of Old-World origin. The Chickasaw plum (*P. Chicasa*) and the common wild plum (*P. Americana*) are receiving considerable attention as cultivated fruit trees. PRUNES (which see) are made by drying certain kinds of plums. Plum-wood is very hard and handsome, and in Europe is much sought for by turners and carvers.

Plum, tp., Allegheny co., Pa. P. 1300.

Plum, p.-v. and tp., Venango co., Pa. P. 1140.

Plu′mas, county of California, bounded N. E. by the main Sierra Nevada. Area, 2700 sq. m. It is very mountainous and elevated, with fertile valleys. Wool is an important product. Quartz and placer gold-mining are the principal industries. Traversed by Feather River and its tributaries. Cap. Quincy. P. 4489.

Plumas, tp., Plumas co., Cal. P. 640.

Plumb (JOSEPH), b. probably in New York in 1791; was an early settler of Western New York, where he acquired a large landed estate; resided for many years at Lodi (now Gowanda), Erie co., on the border of the Cattaraugus reservation of Seneca Indians, in whose welfare he took a deep interest; was prominent in all benevolent and educational movements; was one of the organizers of the Liberty party of 1840, accepting its candidacy for lieutenant-governor 1844; was the owner of the land upon which the village of Cattaraugus was built on the completion of the Erie Railway, and sold all the lots with a clause of forfeiture in case any intoxicating liquors should ever be sold thereon. D. at Cattaraugus May 25, 1870.—His son, EDWARD LEE PLUMB, b. about 1826, has been secretary of legation and chargé d'affaires in Mexico, consul-general at Havana, and agent in procuring the charter of the International Railway of Mexico.

Plumbagina′ceæ, or **Leadworts,** a natural order of herbs and small shrubs, mainly salt-marsh plants, found in all parts of the world. Many have acrid properties; marsh-rosemary (*Statice limonium*) is a valuable astringent, and the typical genus, *Plumbago*, with one or two allied genera, affords some good garden-flowers; but the order is otherwise one of small economic importance.

Plumbago. See GRAPHITE.

Plum Bayou, p.-v. and tp., Jefferson co., Ark. P. 1597.

Plumb′ing [Lat. *plumbum*, "lead"]. Lead has been used from the earliest ages, and is frequently mentioned in the oldest books of the Bible. (See the article on LEAD for a description of this metal.) The terraces of Nebuchadnezzar's hanging gardens were covered with sheets of lead soldered together to retain moisture in the soil. Lead pipes have been more or less common in all the celebrated nations of old—in the cities of Asia, Egypt, Greece, Syria, etc. They were employed to convey water wherever the pressure was too great to be sustained by those of earthenware or pottery. Other pipes were sometimes made of stone, wood, or leather, but most generally of lead and copper. Vitru-

vius says Roman plumbers usually made their pipes from sheets of lead about ten feet long, and soldered together with a composition of lead and tin, some of which were of very large size, having a corresponding weight to suit their respective diameters. Leaden pipes were extensively used in the old city of Rome, the water being conveyed to it by aqueducts (see AQUEDUCT) built of strong masonry, and collected for household purposes in large tanks, and frequently in an ancient sarcophagus of stone or marble, but the water was rarely carried to the upper stories. The waterworks of Rome were constructed on a substantial and extensive scale. Besides the strongly-built aqueducts, there were used earthenware or clay pipes, further extended by lead pipes. Brass faucets, very strong, were used for the same purpose as they are at present. Plumbing with the Romans had arrived at considerable perfection as a science. Samples of their handiwork have been found extended to other countries. Lead pipes were found in Spain in the ninth century which had been worked by the Romans. Several Roman mining-tools and pigs of lead were found in Yorkshire, England, in 1741. From the ruins of Herculaneum many lead pipes have been extracted, and in Pompeii large quantities of lead have been found which had been manipulated by the Romans or Syrians.

Pumps have been extensively improved since their introduction, and their designs have been various. (See PUMPS.) From the atmospheric pump there is the HYDRAULIC RAM (which see). It has a self-acting or reactionary movement, impelled by the water from a pond or reservoir gradually rising at the distance of eight or nine yards to a height of ten feet from the level of the ram, giving power enough to drive water 100 feet high into the tank in a house. A ram can only be used in locations suitable to drain away the surplus water flowing from the operating valve, as only about one-third of the water used to drive it passes up to the house, two-thirds being wasted, and must be drained away. A 2-inch supply-pipe will supply a ⅜-inch stream at a velocity of 5 gallons per minute, having to flow 100 feet high, ensuring the amount of 7200 gallons every twenty-four hours—a sufficient supply for a pretty large house. The overflow water, after filling the tank in the house, may be economized by running it to the stables, coach-house, barn, etc., placing a tank in the most convenient place in the centre and on the rafters of the building, taking care to box it all round and at top and bottom, and fill in with sawdust or charcoal to prevent freezing, and distribute the water through lead pipes, leaving the ends open, that no water may remain in the pipes. In the tank place a valve on top of the pipe, and connect the necessary cranks and wire to lead to each place required to be drawn from, keeping the pipes entirely free from frost. The same system is applicable to all buildings having no heat radiating through them.

Siphons are very useful applications when water cannot be got readily, principally where hills intervene. Quarries can be emptied and houses supplied by them, but in all cases the end of the pipe out of the water must be several feet lower than that in the water. To fill a siphon with water to start it for use, place on both ends a stop-faucet, close them, and at the highest point connect a pipe and funnel and fill with water. When full, shut the top faucet and simultaneously open both faucets at the ends, and the siphon will work. The moment any air enters the siphon it stops, and must be filled again.

Hydraulic presses are powerful machines for compressing goods. Where no steam is applied the force-and-lift-pump is used, forcing the water through a very small pipe. The smaller the pipe the more powerful is the force-pump. (See HYDROSTATIC PRESS.) In the same manner is the HYDRAULIC ELEVATOR (which see) constructed. It is formed like a telescope, and the water is admitted and emptied by the bottom. The pressure of water from a high tank will operate it as well as a force-pump. Hydraulic pressure in connection with steam operates the machine which makes lead pipes. The machine consists of a large cast-iron cylinder, containing melted lead heated by a furnace. On the top is fitted a cover or piston, and through this piston is a hole over which is fastened an iron pipe, the outside size of pipe to be made. Inside is a rod the size of the bore. The pressure having been put on, the hot lead is driven through and up the space between the rod and pipe gently, and, passing through a vessel of liquid to cool, it is passed over a wooden drum and coiled for transportation. The first improvement in leaden pipes was made in England in 1539. The first machine for making lead pipes by hydraulic pressure was patented in England by Mr. T. Burr in 1820. Several improved machines are now in use in this country.

The city of New York is supplied with water by aqueduct from Croton River, about 40 miles distant, collected into reservoirs, and distributed, and conveyed through cast-iron pipes from one to four feet in diameter. The lower part of the city is very scantily supplied, the water being consumed as fast as it comes into the pipes. The water rarely reaches above the first floor, thus necessitating the use of pumps to drive it to the top of the houses and collecting it in cisterns. The upper part of the city, having been connected to the higher reservoir, has now the benefit of about 50 pounds pressure, the lower part not having more than 10 pounds. Hanson's hydraulic pump was formerly much used to drive the water to the top of the houses, but having been found to waste too much water, it was prohibited. It worked by the pressure of the Croton, and wasted much more water than it pumped up.

Chicago is supplied with water from Lake Michigan driven into a large cylindrical pipe or water-tower by steam-pumps the height of the tower, giving about 50 pounds pressure throughout the city, which lies only a few feet above the level of the lake, in consequence of which it has always been a difficult problem to get perfect drainage for Chicago; and the houses were raised about 10 feet, and the streets filled in to accommodate the sewerage of the city.

The Palace Hotel in San Francisco, the largest in the U. S., is supplied from an artesian well bored in the centre of the building. The water is distributed from reservoirs or tanks on the upper stories, furnished with steam-pumps; they supply hot and cold water to 1000 wash-hand basins, 400 water-closets, 400 bath-rooms, the wash-rooms, culinary department, and steam apparatus. The same well supplies the Grand Hotel in the neighborhood.

New Orleans is very poorly supplied from the Mississippi River. The water is always muddy, and has but a few pounds' pressure, being used only on the ground floors. The other parts of the houses are supplied from large lead tanks, usually built on the tops of the houses, collecting all the rain-water from the roofs for general use. For drinking purposes stone filters are frequently used. The water from the Mississippi, drawn from faucets or hydrants, is used by drawing off into a large vessel the quantity expected to be required next day, and letting the mud settle by dropping in a small piece of alum.

Paris, France, is supplied from the river Seine. One pipe is usually taken into the houses direct from the river and used for washing purposes; another is filtered for drinking purposes before entering the houses, requiring two pipes. All the water used up stairs is carried there by pumps. Plumbing-work, in consequence, is not so prominent a feature of convenience as in the U. S.

Boston has an extra pressure of water from the Cochituate River, requiring all the plumbing-work to be executed with heavier pipes and heavier brass faucets than in any other city in the U. S. There is from 50 to 100 pounds' pressure. Having little or no use for pumps, every house is fitted up with all the improvements and in a very substantial manner. Brooklyn has an excellent supply of water from Ridgewood Lake, with a pressure as great as in Boston, allowing plumbing in all its forms. Long Island City, Hunter's Point, is supplied by steam-pumps, which force the pressure of water direct into the pipes, and are so automatically arranged that, if an extra pressure is required, caused by a fire or other emergency, there are other rotary pumps connected to assist, whereby a hose attached to any fire-hydrant can convey water over any house or any ordinary steeple. The hose must be able to stand 400 pounds pressure.

Philadelphia is supplied from the Schuylkill River by six pumping-works, operated by steam and water power. Fairmount, Schuylkill, Belmont, and Roxborough and Chestnut Hill works are supplied from the Schuylkill River. The north-eastern portion of the city is furnished with water from the Delaware River. Plumbing-work in that city has improved rapidly in twenty years. Buffalo is supplied with water by steam-pump power. (For velocity and pressure of water under various conditions see HYDRODYNAMICS.)

Plumbing-work throughout the U. S. is executed in the same manner as in New York City. The largest number of workmen have learned their business in New York City, or have been under the tuition of New York plumbers.

Water-closets are of Asiatic origin. Those constructed in the palace of the Cæsars were adorned with marble, arabesques, and mosaics. The pipe and basin of one were discovered near the theatre in Pompeii, where they still remain. In the city of Fez "round about the mosques are 150 common houses of ease, each furnished with a cock and a marble cistern which scoureth and keepeth all clean and neat, as if these places were intended for some sweeter employment." Sir John Harrington is said to have introduced water-closets into England in the reign of Elizabeth. M. Roubo, a French author, says they were used in France much ear-

lier than they were known in England. Within the last thirty years water-closets have been multiplied into such a vast number of designs, and improved upon to such an extent, that there is hardly any room left for improvement; nevertheless, the same style that has been in use for a century is as good as any modern "improved" one. All water-closets should have a good supply of water, and the best way to get it is to use tanks large enough to hold from 50 to 100 gallons. The common copper pan water-closet is the most serviceable: by making the seat movable by hinges, and covering the basin with lead, it becomes a water-closet, urinal, and slop-closet. Under the seat there should be an attachment to a flue by a 4-inch galvanized iron pipe, to draw any smell emitted, also a ventilator at the ceiling for the same purpose. The tanks to supply these water-closets require to be 7 or 8 feet from the floor. The English Bramah closet is a very pretty one. It is supplied in the same way as the pan closet, and has instead of a pan a valve made of brass and ground water-tight. The Jennings patent has a diaphragm valve attachment, and must have a column of water of from 15 to 30 feet to operate it properly, and requires a good supply, as it runs nearly 16 gallons a minute. Water-closets, generally speaking, are a source of great trouble and annoyance in a house when not fitted up on correct sanitary principles. They should have good strong lead traps underneath, running into large cast-iron pipes, and in all cases the iron pipes should be extended to the roof of the building. (See also SEWER.)

Bath-rooms may consist of a bath-tub, a wash-basin, a bidet, and foot-tub, all fitted up with hot and cold water, having a trap to each, with a 2-inch waste-pipe, to be carried down separately to the sewer in the cellar. All wash-basins should be connected to the sewer in the cellar by a good-sized pipe, and each separately trapped. Where hot water is used, it should never be connected with water-closet waste-pipes. Bath-rooms may be fitted up in any degree of elegance. All bath-rooms should be placed in the centre of the house and above the parlor, and have a leaden safe under all the pipes in case of accident; in fact, the whole floor of a room should be covered. All hot-water pipes leading up stairs should, wherever placed, and more especially where there are any branches leading from them, have room for expansion, and not be carried up by the side of cold-water pipes. The sudden cooling of a hot-water pipe by coming in contact with a cold pipe breaks it. Not suspecting the cause, people generally attribute it to defective pipes. All pipes can be put into a house to be safe from freezing if the owners or architects will consult with an experienced plumber, who is best able to judge the most suitable location for all the conveniences of a family in a hygienic and sanitary point of view. A very serious complaint in most houses consists in not getting water up stairs at any and all times. The great evil lies in not putting in large enough pipes. To estimate the quantity of water to be drawn, ascertain the number of outlets to draw from. One $\frac{5}{8}$-inch pipe will run, at 50 pounds pressure, 16 gallons per minute. Find the number of outlets, and how much water they will run at once and together; then put in a pipe large enough to give that quantity, place it from cellar to top floor, and branch off from every floor. The whole house will thus be supplied alike and at the same time.

For wash-tubs place a small cistern by the end tub nearest to the range, supply it with a float and cock on the same level with the tub, and connect the two together by a 1-inch pipe from the bottom, lead the hot and cold water pipes from the range through a water-back to the tub, putting the hot-water pipe highest, and the water will boil in the tub as if it were on the fire. The hot-water pipes from the copper boiler in the kitchen should be carried up to the highest point of drawing water, and returned by a smaller pipe, so as to keep up a circulation, thereby allowing hot water at every place required without waiting for or wasting the water.

According to the census of 1870, there were in the U. S. 705 plumbing establishments, having a capital of $3,731,667, employing 4783 persons, and a production valued at $10,394,471. DAVID PATERSON.

Plumb-line [Lat. *plumbum*], a line or string having a conical piece of lead attached to one extremity; it is used for determining when one point is exactly over another.

Plum Creek, p.-v., cap. of Dawson co., Neb., on Union Pacific R. R., 230 miles W. of Omaha, has a good school system, a court-house, and newspaper. A bridge spans Platte River at this point. P. about 450.
F. J. PEARSON, ED. "PIONEER."

Plum Creek, tp., Armstrong co., Pa. P. 1738.

Plum'er (WILLIAM), b. at Newbury, Mass., June 25, 1759; removed to Epping, N. H., in 1768; became a successful lawyer 1787; was much in the State legislature, and took a prominent part in framing the constitution of 1792; was U. S. Senator 1802–07; governor of New Hampshire 1812–13, 1816–19, and afterwards engaged in literary occupations. D. at Epping Dec. 22, 1850.—His son WILLIAM (1789–1854) was in Congress 1819–25; published 2 vols. of poems (1841–43), and was author of a *Life* of his father (1856), edited by A. P. Peabody, D. D.

Plumer (WILLIAM SWAN), D. D., LL.D., b. at Griersburg (now Darlington), Pa., July 25, 1802; graduated at Washington College, Va., 1825; studied at Princeton Theological Seminary; was ordained 1827; organized in that year a Presbyterian church at Danville, Va.; afterward preached at several places in North Carolina and Virginia; became pastor of churches at Richmond (1834) and Baltimore (1847); conducted for eight years (1837–45) at the former city the *Watchman of the South;* was a professor in the Western Theological Seminary at Allegheny City, Pa., from 1854 to 1862, when he removed to Philadelphia; was pastor of a church at Pottsville, Pa., 1865–66, since which time he has been professor in the Theological Seminary of Columbia, S. C. Author of several works of theology or biblical criticism, of which the most important are *Studies in the Book of Psalms* (1866) and commentaries on the Epistles to the Romans (1870) and Hebrews (1872).

Plum'mer (Gen. JOSEPH B.), b. at Barre, Mass., in 1820; graduated at West Point 1841; served with distinction in the Florida and Mexican wars; rendered important aid to Gen. Lyon in the capture of Camp Jackson and in the battle of Wilson's Creek, 1861; became colonel of the 11th Missouri Vols. Sept. 25; defeated the Confederates at Fredericktown, Mo., Oct. 21; was appointed brigadier-general of volunteers Oct. 22, 1861, and participated in Gen. Pope's campaign in Tennessee and Mississippi. D. at Corinth, Miss., Aug. 9, 1862.

Plump'tre (EDWARD HAYES), D. D., b. in England Aug. 6, 1821; educated at University College, Oxford; became fellow of Brasenose College 1844; chaplain at King's College, London, 1847; professor of pastoral theology in that institution 1853; prebendary of St. Paul's 1863; professor of exegesis of the New Testament 1864; rector of Pluckley 1869, and vicar of Bickley 1873. He has been preacher at Lincoln's Inn and Boyle lecturer (1866–67), and is now one of the Old Testament company of revisers of the authorized text of the Bible. Author of several volumes of sermons, addresses, and classical translations, of many articles in Dr. Smith's *Dictionary of the Bible,* of *Biblical Studies* (1870), and editor of the *New Bible Expositor* (1875).

Plum'stead, tp., Ocean co., N. J. P. 1566.

Plumstead, tp., Bucks co., Pa., on Delaware River. P. 2617.

Plunk'et (WILLIAM **Conyngham**), BARON, b. at Enniskillen, Ireland, in July, 1764; graduated at Trinity College, Dublin; studied law at Lincoln's Inn; was called to the Irish bar 1787; became king's counsel 1798; was elected to the Irish Parliament in the same year; was suspected of sympathy with the Irish rebellion, but was in 1803, as solicitor-general, prosecuting attorney in the trial of Emmet; was attorney-general for Ireland 1805–07; sat in Parliament 1807–22, where he favored Catholic emancipation; became again attorney-general for Ireland 1822; chief-justice and baron 1827, and lord chancellor of Ireland 1830–41. D. in Wicklow co. Jan. 4, 1854.

Plunkett's Creek, tp., Lycoming co., Pa. P. 415.

Plu'ralism, a term used in canon law, denotes the possession of more than one ecclesiastical benefice by the same person and at the same time. In the earlier times of the Christian Church pluralism was considered unlawful, and it was forbidden by many councils, as, for instance, by those of Chalcedon (451) and Nicæa (787). Later, however, it became one of the most common and most vicious practices in the Roman Catholic Church, and in order to screen its unlawfulness very subtle distinctions were made by the canonists. Benefices were divided into compatible and incompatible—that is, such as could be held together, and such as could not. Incompatibility might arise, for instance, from the duty of residence; thus, it would be impossible for the same man to be bishop of Palermo and Trondhjem at the same time, because it was a bishop's duty to reside in his diocese. But then the pope could grant a dispensation from the duty of residence, and thereby the two benefices became at once compatible. In this, as in so many other cases, the sharp and circumstantial definitions of the law were nothing but dust by which to blind the eyes of truth; and the popes did not neglect to avail themselves of this circumstance. At one time it was very common to find Italian clergymen living at the court of Rome and enjoying the revenues of different bene-

fices in Spain, France, Germany, and Scandinavia. In our time this evil has disappeared almost entirely in the Roman Catholic Church.

Plush [Fr. *peluche;* Ger. *Plüsch*], a fabric which differs from velvet in not being shorn, and in having a long pile or shag. It is sometimes all worsted, sometimes worsted with a mohair pile, and most frequently of cotton with a silk pile. This last kind is used for hatmaking. The loops of the pile are cut with a long needle-like knife.

Plu'tarch, b. at Chæronea, in Bœotia, Greece; studied philosophy under Ammonius at Delphi when Nero visited Greece in 66 A. D.; travelled much in Italy and lived for some time in Rome, where he lectured on philosophy in the reign of Domitian, but returned subsequently to his native city, where he held an office as a magistrate, and d. at an advanced age in the reign of Hadrian. He was a very prolific writer: 60 works bearing his name and treating various subjects, mostly of a practical character, are still extant, and were collected under the common title of *Moralia*, edited by Wyttenbach (8 vols., Oxford, 1795–1821), and translated into English by Morgan and others (London, 1603); which translation was revised and corrected by W. W. Goodwin (5 vols., Boston, 1870). But the work which made his name so widely known in antiquity, and afterward in all ages up to our day, is his *Parallel Lives*, edited by C. Sintenis (4 vols., Leipsic, 1639–53), and translated into all European languages—into English several times, by North, by Dryden (that is, under his name), by John and William Langhorne; the Dryden translation was revised and corrected by A. H. Clough (5 vols., Boston, 1859). This work consists of forty-six biographies, divided into pairs—one from the Greek and one from the Roman history—and each pair accompanied by a psychological and moral comparison between the persons described. The biographies are—Theseus and Romulus, Lycurgus and Numa, Solon and Valerius Publicola, Themistocles and Camillus, Pericles and Q. Fabius Maximus, Alcibiades and Coriolanus, Timoleon and Æmilius Paulus, Pelopidas and Marcellus, Aristides and Cato Major, Philopœmen and Flamininus, Pyrrhus and Marius, Lysander and Sulla, Cimon and Lucullus, Nicias and Crassus, Eumenes and Sertorius, Agesilaus and Pompey, Alexander and Cæsar, Phocion and Cato the Younger, Agis and Cleomenes, Tiberius and Caius Gracchus, Demosthenes and Cicero, Demetrius Poliorcetes and Mark Antony, Dion and M. Junius Brutus. Besides these forty-six parallel lives, the editions contain biographies of Artaxerxes Mnemon, Aratus, Galba, and Otho. The charm which this book has exercised through centuries, and still exercises on all, young and old, educated and uneducated, rises partly from the subjects it treats of, partly from the character of the treatment. It speaks of great men who while living wrought out the destinies of their time, and who after death stood for centuries, and still stand, as models after which the aspiring soul tries to shape itself; and it describes these men not by subtle analyses of their genius and their influence, which would have required a considerable mental development in order to be fully appreciated, but, giving a rapid outline of the political and historical importance of the man, it portrays his character by a series of personal traits whose moral and psychological bearing may be instinctively felt by the least developed mind, at the same time that they strike the intelligent student with their powerful signification. Plutarch is no historian, but he is as little a gossip. A man of ready talent and superior education, of comprehensive knowledge and vivid sympathy with all that is great and good, he is always instructive and always entertaining. CLEMENS PETERSEN.

Plu'to, in ancient mythology, a son of Saturn and Rhea, a brother of Jupiter and Neptune, and married to Persephone or Proserpina, received the lower world when the universe was divided between Saturn's three sons, and was fierce and inexorable in character.

Pluton'ic (or **Igneous**) **Rocks,** those which have been formed by the cooling of molten materials, either cast up by volcanoes or in dykes, whether on the surface of the earth or at a considerable depth.

Plu'tus, in ancient mythology, the personification of riches, much used by the poets and often represented by art, but never worshipped.

Plym'outh, a seaport-town and parliamentary borough of Devon co., Eng., on the sound of the same name, between the estuaries of the Plym and Tamar. The South Devon Railway terminates here. Taken in its largest sense, it comprehends what are called the "three towns" —Devonport on the W., Stonehouse in the centre, and Plymouth (proper) on the E. The citadel, a large bastioned work, situated on a bold headland, forms one of the most noticeable features of Plymouth proper; it is, however, by no means the most interesting or important of the present (recent) system of fortification. Plymouth has important manufactures of soap, sailcloth, cement, etc.; also shipbuilding yards, foundries, etc. Its fisheries are productive, its trade, both coasting and foreign, important. But the chief importance of Plymouth is as a naval station, the naval arsenal of Devonport (on the Hamoaze, an expansion of the Tamar, near its entrance to Plymouth Sound) occupying about 360 acres, and comprising two of the finest dockyards in the world. These dockyards comprehend an area of 150 acres. Devonport and its arsenal are enclosed within a bastioned enceinte of old date, but the demands of modern warfare have transferred the defence of this great seaport to a line of forts, recently built, encircling the place at a distance of 3 miles. As a great naval station, Plymouth owes its prominence in great measure to the spaciousness and accessibility of Plymouth Sound. To protect the interior of this wide estuary the Plymouth Breakwater was constructed. The harbor is defended by the Breakwater Fort and the recent iron-armored batteries at Staddon Point, Picklecombe, Drake's Island, and Mount Edgecumbe. The first is an elliptical work with periphery entirely of iron, built in deep water close behind the breakwater. (See IRON PLATING, etc.) A few miles above Plymouth the Cornwall Railway crosses the Tamar by the Royal Albert Bridge, one of the most remarkable specimens of modern railway bridges. (See BRIDGE.) P. of the three towns (without reference to "boroughs") was over 80,000 in 1855; is supposed to exceed that now. J. G. BARNARD.

Plymouth, county in N. W. Iowa, bounded W. by Dakota, from which the Big Sioux River separates it. Area, 360 sq. m. It is a fertile rolling prairie-region, finely adapted to grain-culture. Traversed by Iowa Falls and Sioux City and St. Paul and Sioux City R. Rs. Cap. Lemars. P. 2199.

Plymouth, county in S. E. Massachusetts, bounded E. by Cape Cod Bay and S. by Buzzard's Bay. Area, 720 sq. m. Portions of its surface are sandy, rocky, or swampy, but under skilful cultivation the soil is for the most part productive. There are large tracts of cedar and hard pine forest, which furnish large amounts of lumber. Bog-iron ore was formerly mined extensively, and the iron manufacture is still important. Boots, shoes, boxes, nails, hardware, harnesses, cotton, woollen, straw, and metallic goods are among the other principal articles of manufacture. The county is traversed by Old Colony and Cape Cod R. Rs. and their branches. Cap. Plymouth. P. 65,365.

Plymouth, p.-v. and tp., Litchfield co., Conn., on Naugatuck River and R. R., has large manufactures. P. 4149.

Plymouth, p.-v., St. Mary's tp., Hancock co., Ill., on Galesburg and Quincy division of Chicago Burlington and Quincy R. R.

Plymouth, p.-v., Centre tp., cap. of Marshall co., Ind., on Yellow River, at junction of Chicago Cincinnati and Louisville with Pittsburg Fort Wayne and Chicago R. R., situated in a good timber-region, has 2 newspapers and some manufactures. P. 2482.

Plymouth, p.-v., Fall tp., Cerro Gordo co., Ia., at junction of Iowa and Dakota division of Milwaukee and St. Paul R. R. with the Burlington Cedar Rapids and Minnesota R. R.

Plymouth, tp., Plymouth co., Ia., includes Plymouth, the county-seat. P. 357.

Plymouth, p.-v. and tp., Penobscot co., Me. P. 941.

Plymouth, port of entry, p.-v. and tp., cap. of Plymouth co., Mass., situated on Massachusetts Bay and Old Colony R. R., 37 miles S. E. of Boston, is celebrated as the landing-place of the Pilgrim Fathers in 1620, who here founded the first settlement in New England. The climate is very healthy, the heat of summer seldom being oppressive or the cold of winter intense, while there is a remarkable freedom from heavy tempests and thunderstorms in their season. The town covers an area of nearly 18 miles in extent along the coast, varying from 5 to 9 miles in width. Plymouth is supplied with 5 waterworks, gas, an efficient fire department, Masonic and Good Templars lodges, a post of the Grand Army of the Republic, several clubs, with charitable and benevolent organizations. There are 12 churches and 7 chapels, a public library, excellent schools, 4 banks, and 2 newspapers, manufactories of cordage, cotton sail-duck, tacks, rivets, stoves, and hollow-ware, iron and zinc nails, cotton cloth and batting, steel shanks, hammers, and other articles. There is some commercial business, and a fleet of vessels engaged in the Newfoundland fisheries. The town contains many points of interest associated with the landing and subsequent lives of the Pilgrim Fathers. P. 6238.

C. C. DOTEN, ED. "OLD COLONY MEMORIAL."

Plymouth, p.-v. and tp., Wayne co., Mich., at junction of Detroit Lansing and Lake Michigan with Flint and Père Marquette and Holly Wayne and Monroe R. Rs. P. 969; of tp. 3016.

Plymouth, tp., Hennepin co., Minn. P. 872.

Plymouth, p.-v. and tp., cap. of Grafton co., N. H., on Boston Concord and Montreal R. R. Point of departure by stage for White Mountains. P. 1409.

Plymouth, p.-v. and tp., Chenango co., N. Y., on New York and Oswego Midland R. R. P. 179; of tp. 1523.

Plymouth, p.-v., cap. of Washington co., N. C., on an outlet of Albemarle Sound, has 2 newspapers and a brisk commerce. P. 1389.

Plymouth, tp., Ashtabula co., O. P. 657.

Plymouth, p.-v. and tp., Richland co., O., on L. and E. division of Baltimore and Ohio R. R., has a graded school, 4 churches, 1 bank, 1 newspaper, several large mills, a frame establishment, and 3 hotels. P. of v. 703; of tp. 1609.

Plymouth, v. (Bartlett P. O.), Palmer tp., Washington co., O. P. 84.

Plymouth, p.-b. and tp., Luzerne co., Pa., on E. branch of Susquehanna River and on Lackawanna and Bloomsburg R. R., 4 miles from Wilkesbarre, has 2 newspapers and an active business in coal-mining. P. 2648.

Plymouth, tp., Montgomery co., Pa., on Schuylkill River. P. 2025.

Plymouth, p.-v. and tp., Windsor co., Vt. P. 1285.

Plymouth, tp., Mercer co., W. Va. P. 1687.

Plymouth, tp., Juneau co., Wis. P. 795.

Plymouth, tp., Rock co., Wis. P. 1396.

Plymouth, p.-v. and tp., Sheboygan co., Wis., 52 miles N. of Milwaukee, on Wisconsin Central and Sheboygan and Fond du Lac R. Rs., has a bank, 1 newspaper, 3 extensive flouring-mills, several cheese-factories, and a plaster and saw mill. Large quantities of grain are shipped from this point. P. 2280. C. D. Wells, Ed. "Reporter."

Plymouth Brethren. In the end of 1827 four persons, led by the apprehension of the unity of the Church as the body of Christ, and the ruin of the professing body around them, to which may be added the expectation of the coming of the Lord, and the deep conviction that ministry flowed from gift from Christ on high, and not from ordination by man, met in Dublin in Ireland, breaking bread every Lord's day, and at first in a private house, feeling authorized and privileged so to meet by Matt. xviii. 20, as a resource in the midst of the confusion; demanding only soundness in the faith and godliness of life, and then only seeking for themselves what met the demand of their consciences, according to what they saw in the Word of God; preaching and teaching belonging to those who had the gift of one or the other. This spread from like wants in others, or the conversion of sinners. In 1831 one of those who thus began in Dublin began to work at Plymouth in England also with others who were now associated. About the same time, or very soon after, it began in London by another who had been there. Since then it has gradually spread. There are 500 or 600 gatherings, so called, in the British isles, a large number in France, particularly in the southern parts and the Cevennes, but also E. and W. There are a large number in Germany, and proportionately still more in Switzerland; a considerable number in Holland also. They have also a large number of meetings in Canada, where the work has spread rapidly; among the negroes also in the West Indies, and generally in all the British colonies and settlements. The work is more recent in the U. S., but there also it has spread E. and W., but the numbers are not as yet large. As regards their doctrines, they hold the great fundamental doctrines of Christianity. What may perhaps be said to distinguish them is a definite faith in the personal presence of the Holy Ghost as come down on the day of Pentecost, giving, on the one hand, the consciousness of being children or sons of God to all those who are sealed by his being given to them, and that they are in Christ; and, on the other, so uniting them to Christ that they are members of his body, hence, that the true Church began only on the day of Pentecost (though the ground of salvation be the same for all), and will continue till the Lord comes and takes it up to be with himself, and all things in heaven and earth will be gathered under Christ as head, the Jews being restored, and the earth blessed and in peace, Satan being bound. Afterwards will be the final separation on earth, Satan being let loose, and then the wicked dead judged before the great white throne. These are not presented as the terms of communion, but, and especially the presence of the Holy Ghost, characterize their teaching as distinguished from many. This presence of the Holy Ghost gives another character to the Church—namely, that it is the habitation of God through the Spirit on the earth. This is distinct from the body, and all manner of worthless materials have been built in. On this judgment will fall, the whole system being cut off as Judaism was, the saints constituting the body being caught up to heaven. They hold that all in whom the Spirit of Christ dwells constitute the Church or assembly of God in its truth; at least, are members of it, for they see them now scattered; hence, they do not call themselves the Church, but profess to meet on the principle of its unity. They use 2 Tim. ii. and iii. as guiding their conduct in the present state of things. They hold the full divine inspiration of Scriptures, and rest everything on the authority of the written word, while they believe in the necessity of the grace of the Holy Spirit to understand and profit by it. They profess to exercise a strict discipline as to faith and morals in their assemblies, and hold a practical unity of them all, so that one excluded from one is excluded from all. Their writers are numerous, and they circulate gospel and other tracts widely, and publish various periodicals in English, French, and German. Their most voluminous writers are Mr. McIntosh, Mr. Kelly, Mr. Darby, Mr. Bellett. But there are others as well esteemed amongst them. There is a large collection of papers called *The Present Testimony;* another called *Bible Treasury;* of a more popular character, *Things New and Old.* As a popular tract-writer, Mr. Stanley is well known under the initials "C. S." The original periodical was the *Christian Witness,* but that is now very difficult to procure. I. N. Darby.

Plymouth Sound, an inlet of the English Channel on the southern coast of England, between the counties of Devon and Cornwall, is 3 miles long, 4 miles broad, and forms, with the estuaries of the Plym and the Tamar, the harbors of Plymouth and Devonport, well known as one of the principal naval stations of Great Britain. In order to protect the shipping in the harbor against the heavy surge which sets into the sound from the Atlantic, an immense breakwater, 1700 yards long and built of massive stones, has been constructed.

Plymp'ton, p.-v. and tp., Plymouth co., Mass., on Plymouth branch of Old Colony R. R. P. 804.

Plympton (George W.), b. at Waltham, Mass., Nov. 18, 1827; graduated at the Rensselaer Polytechnic Institute at Troy, N. Y., 1847; was professor of engineering and architecture at Cleveland University 1852–53; of mathematics in the State Normal School, Albany, N. Y., 1853–55, and again 1858–60, and at the State Normal School, Trenton, N. J., 1860–63; became professor of physical science at the Brooklyn Polytechnic Institute 1863, and of physics at Cooper Institute, N. Y., 1869, which posts he still (1876) occupies. Author of a work on blowpipe analysis (1858) and of fugitive articles on engineering field-work, and editor of Van Nostrand's *Eclectic Engineering Magazine* since 1870.

Pneumatic Despatch and **Railway.** See Pneumatic Transmission, by William E. A. Axon.

Pneumat'ics [Gr. πνεῦμα, "air"] deals with the mechanical properties of elastic fluids, of which air is taken as the representative. A perfectly elastic fluid, or what is called a perfect gas, is characterized by this property: A fixed quantity of it by weight—as, for instance, a pound—may occupy any space, however great or small. Enclosed in a vessel of 1000 cubic feet capacity, it fills every part of it, while it may be compressed so as to occupy a volume of but 1 cubic foot or less. In either case, if it is kept at the same temperature, its volume multiplied by its pressure per square inch or per square foot is the same. In other words, its pressure is inversely proportional to its volume. A pound of air, for instance, at a temperature of 32°, enclosed in a vessel containing 12.387 cubic feet, exerts a pressure of 14.7 pounds per square inch, or 2116.8 pounds per square foot, upon the sides of the vessel. The product of 2116.8 multiplied by 12.387 is 26,221. If we force the same quantity of air into a vessel of 1 cubic foot capacity, its pressure at 32°, were it a perfect gas, would be 182.09 pounds per square inch, which is 26,221 pounds per square foot; and as its volume is represented by 1, the product of its pressure by its volume is 26,221. Again, if it be allowed to expand into a vessel of 1000 cubic feet capacity, it would exert at 32°, were it a perfect gas, a pressure of but 26.221 pounds per square foot, which multiplied by 1000 is 26,221. The idea of a perfect gas is not absolutely realized in nature, but air is sensibly so except at very high pressures.

The *density* of a gas is its weight per cubic foot. A cubic foot of air at the temperature of 32°, and under the average atmospheric pressure, weighs 0.08073 pounds, which is at the rate of 12.387 cubic feet to the pound, being

$\frac{1}{772}$d the weight of water. For common purposes we may reckon $12\frac{1}{2}$ cubic feet of air to the pound. The densities of several other gases at the same pressure and temperature are as follows:

Oxygen..........0.0893	lbs. per cub. ft., or	11.204	cub. ft. to the lb.		
Hydrogen......0.00559	"	"	179.	"	"
Carbonic acid.0.1234	"	"	8.101	"	"
Nitrogen........0.0784	"	"	12.753	"	"

Steam at a temperature of 212° and the pressure of the atmosphere weighs 0.0380 pounds per cubic foot, which is at the rate of 26.36 cubic feet to the pound. As ordinarily used, steam does not follow the law of perfect gases. Expanded in a cylinder to twice its original volume, it does not exert half its original pressure. Highly superheated steam is sensibly a perfect gas.

Temperature.—When air is maintained at a uniform pressure, its volume is increased 0.365 times, or $36\frac{1}{2}$ per cent., in passing from the temperature of melting ice to that of boiling water; and when air is maintained at a uniform volume—being, for instance, enclosed in a tight vessel—its pressure is increased by the same fraction in undergoing the same change of temperature. Otherwise stated: each degree of change of temperature in air at constant pressure changes its volume by one $\frac{1}{500}$th of its volume at 32°; and each degree of change of temperature in air at constant volume changes its pressure by $\frac{1}{500}$th of its pressure at 32°.

Pressure of the Atmosphere.—As in the case of liquids, the pressure of the atmosphere per square inch, at any point, is equal to the weight of a vertical column of air 1 inch square reaching from that point to the upper limit of the atmosphere. The difference of pressure between two points at different heights is the weight of a vertical column of air reaching from the level of the lower point to that of the higher. There is this difference between the pressure of water and that of air: the pressure of a column of water is known directly when its height is known, being the weight of so many cubic feet or so many cubic inches of the liquid. To find the pressure of a column of air requires an intricate calculation, as its density is not the same at any two points of its height. The average pressure of the atmosphere at the level of the sea is 14.7 pounds per square inch, being the pressure exerted by a column of mercury 29.92 inches high. This height is so near 30 inches that it is customary to speak of the pressure of the atmosphere as being equivalent to that of a column of mercury 30 inches high. It is also substantially equal to that of a column of water 34 feet high (exactly, 33.9). This would be the pressure at all times if the air were in a state of rest, but the continual heating and cooling of the air makes it impossible for it to remain long at rest. The pressure is therefore continually changing, being sometimes more and sometimes considerably less than 30 inches of mercury. Pressures are expressed in pounds per square inch, by the equivalent height of mercury in inches, or by the equivalent height of water in feet. Thus, we say, a pressure of 10 pounds per square inch, 20.36 inches of mercury, or 23.08 feet of water.

Instruments for measuring the pressure of the atmosphere are described in the article BAROMETER. Instruments for measuring higher gaseous pressures are constructed upon the same principles, and are called pressure-gauges, manometers, piëzometers, etc. The well-known suction-pump is a striking illustration of the atmospheric pressure. This machine, represented at Fig. 1, consists of a tube dipping into water, and rising above the same to any height not exceeding that of the least pressure of the atmosphere. The upper part is provided with an apparatus for exhausting the air consisting of two valves, one contained in a movable piston, the other in a fixed diaphragm. Each valve permits the passage of fluid in an upward direction, but not downward. (See VALVES, etc.) For the sake of definiteness, suppose the upper valve in its highest position to be 30 feet above the surface of the water in the well, and suppose the pressure of the atmosphere to be equal to 34 feet of water. Suppose, also, the piston to move 6 inches at a stroke. The water stands at the same level inside the tube or pump-barrel as outside. The weight of the atmosphere acts directly upon the surface of the water outside the pump-barrel, but not inside, being intercepted by the valves. The air inside the pump-barrel is in the condition of a spring which has been bent by a heavy weight, and being fastened in that position the weight is removed. It presses against its fastenings with a force precisely equal to the weight. The air has entered the pump-barrel in the state of compression due to the weight of the atmosphere, and though the latter no longer acts upon it, its tendency to expand, or what is called its elastic force, acts upon the sides of the barrel and the surface of the water with a pressure precisely equal to that of the atmosphere. A stroke of the pump is now made, removing $\frac{1}{60}$th of the air contained in the barrel. The pressure within the barrel is no longer equal to the external pressure. The preponderance of the latter forces the water to rise in the barrel to such a height that its pressure at the surface of the well, added to the pressure of the air in the barrel, will equal that of the atmosphere. This will be the condition after the first stroke: the air in the pump-barrel will exert a pressure equivalent to 33.749 feet of water. The water will have risen 0.251 feet in the barrel, making, together, 34 feet. The rise of the water will be a little greater for each successive stroke until the last, which will raise it 6 inches.

Determination of Heights by the Barometer.—The pressure of the air, as indicated by the barometer, furnishes the means of finding the heights of points upon the earth's surface. The accurate performance of this operation requires attention to several facts—viz. (1) The pressure of the mercurial column depends, in some degree, upon its temperature as well as its height. This temperature is usually somewhat different from that of the surrounding air. (2) It requires a knowledge of the temperature as well as the pressure of the air to give a correct indication of the height. (3) The scale, usually of brass, which serves to measure the height of the mercurial column, changes its length with the temperature, though not in the same degree as the mercury itself. (4) The force of gravity acts with greater intensity at the lower station than at the higher. This variation affects the column of mercury differently from the column of air. (5) The force of gravity changes somewhat with the latitude of the place, also affecting the mercury differently from the air. (6) The height indicated by a given pressure and temperature of the air depends, in some degree, upon the quantity of aqueous vapor contained in the air. Methods and tables taking account of all these minute sources of error are too complicated and voluminous to be introduced here. An observer who aims at minute accuracy must use the works of Guyot or Plantamour, or the *Practical Tables in Meteorology and Hypsometry*, by R. S. Williamson of the U. S. engineer department. The following very simple mode of computation, given in the *U. S. Ordnance Manual*, is sufficiently correct for ordinary purposes: The height of the barometer in inches and the temperature of the air in degrees of Fahrenheit's thermometer being taken at each of the two stations whose difference of altitude is desired, divide the difference of the heights by the sum of the heights, and multiply the result by 55,000. Multiply $\frac{1}{440}$th of this product by the difference between the mean temperature and 55°. Call this result the correction. If the mean temperature is more than 55°, add the correction; if less, subtract it. The result is the height of the higher point above the lower, in feet. As an example, suppose we find at the

Lower station, barom. 29.63 in., temp. 66°
Upper " " 29.12 " " 58°
Sum of heights, 58.75 in.; difference, 0.51 in.; mean temp., 62°. 62 − 55 = 7°. Dividing 0.51 by 58.75, and multiplying the quotient by 55,000, we obtain.. 477.45 feet.
477.4 divided by 440 is 1.08, and 1.08 times 7 is correction.. 7.56 "
The mean temperature being more than 55, we add the correction, giving.. 485 feet,
which is the height required. Had the mean temperature been 46°, the result would have been 477.4, less 9 times 1.08 = 467.7 feet.

Another method of finding altitudes consists in ascertaining the temperature at which pure water boils. The boiling of water consists in the formation of bubbles of steam below the surface and their escape at the surface. In an open vessel this occurs when the pressure of the steam is exactly equal to that of the atmosphere. If we know the temperature at which boiling occurs, we can ascertain the atmospheric pressure, and an apparatus for determining this temperature is a kind of barometer. The approximate rule in this case is: Multiply the difference between the temperatures of the boiling-point, in degrees of Fahrenheit's thermometer, by 540. The product is the difference of altitude in feet. This method requires thermometers of very great delicacy.

Pneumatic Machines.—Figs. 1 to 10 indicate different types of machines for altering the pressure of air. Though the distinction is verbal rather than real, they may for convenience be divided into two classes—(1) machines for rarefying the air; (2) machines for compressing the air. The suction-pump (Fig. 1) has already been referred to, and its action is too well known to need further comment. It is hardly necessary to observe that Fig. 1 is drawn to illustrate the action of the pump, not to show its ordinary construction. The barrel is usually much smaller below the lower valve than above.

Fig. 2 represents the mercury air-pump, the invention of Herman Sprengel. It consists of a vertical tube termi-

nating above in a funnel-shaped vessel, the bottom open and immersed in mercury; c is a cock; x is a branch com-

FIG. 1.

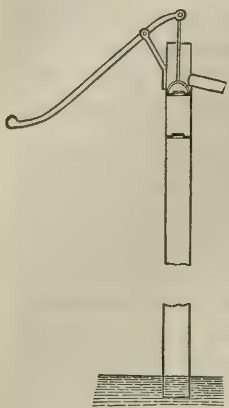
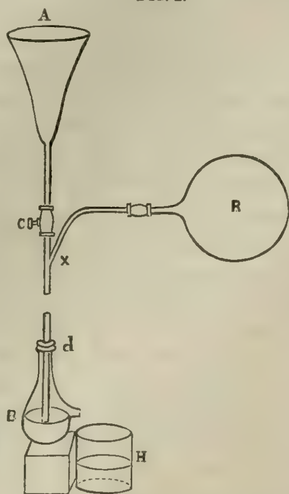


FIG. 2.



municating with the receiver R, in which the vacuum is to be created. Mercury is poured into the funnel A, and flows into the vessel B, and thence into the movable vessel H, from which it is again poured into A. The point x being more than 30 inches above the surface of the mercury in the vessel B, the mercury at x is under no pressure. The air from the receiver enters the vertical tube and is carried downward, escaping at the surface of the mercury in the reservoir B in the form of bubbles. When no air-bubbles are brought down by the mercury the vacuum is perfect. The most perfect vacuum can be produced by this instrument, but its use is somewhat laborious.

Fig. 3 is a section of the air-pump invented and manufactured by E. S. Ritchie of Boston. In air-pumps of ordinary construction, the valves being operated by the pressure of the air, they do not close till after the piston has commenced its stroke, which prevents the formation of a perfect vacuum. Mr. Ritchie's arrangement of the valves is designed to avoid this difficulty. The air is drawn from the receiver into the cylinder of the air-pump through the tube c and valve b. The piston contains a valve so formed that it is closed by a pull on the piston-rod. The valve b is operated by a rod a passing through a stuffing-box in the piston. The piston being at the bottom of the cylinder, the first upward movement of the piston-rod closes the valve e e. The first movement of the piston opens the valve b by the friction of the stuffing-box on the rod a. While the piston is ascending, the air from the receiver flows through the valve b, and the air above the piston is forced out through the valve f. When the piston reaches

FIG. 3.

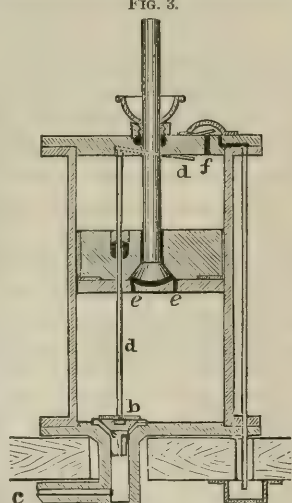


FIG. 4.

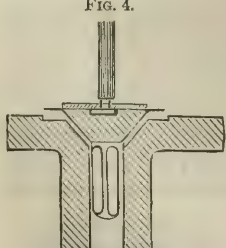
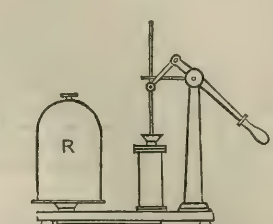


FIG. 5.



the top of its stroke it strikes the lever d and closes the valve b. The first downward movement of the piston-rod opens the valve e e. Fig. 4 shows the valve b on an enlarged scale. It is conical, and has a projecting disk of oiled silk. Fig. 5 shows the pump as mounted, the manner of working it, and the receiver R.

Fig. 6 shows a kind of air-pump much used where water under considerable pressure can be had, and where a perfect vacuum is not desired. The tube c communicates with the receiver, b with the water-reservoir. The stream of water escaping from b draws the air from c. A vacuum equivalent to 27 or 28 inches of mercury can be created with such an instrument.

FIG. 6.

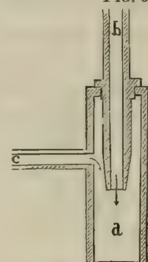


FIG. 7.

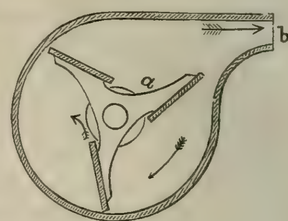
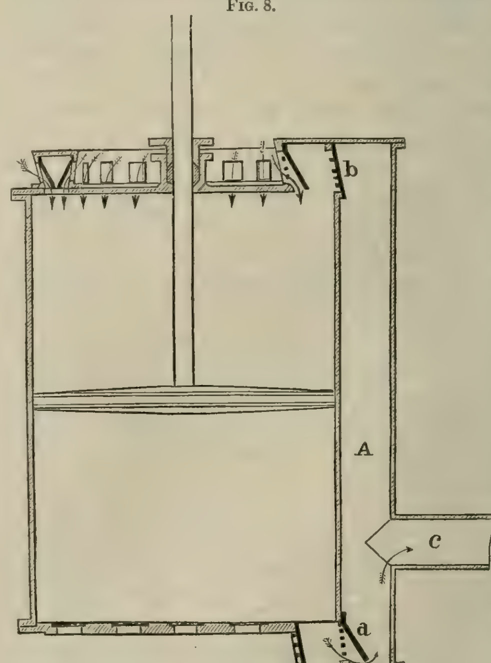


Fig. 7 is a fan much used in factories for creating a powerful current of air, which it does sometimes by rarefying, sometimes by condensing the air. It consists of a cylindrical drum in which radial floats revolve with great velocity. The air enters at the centres of the ends and passes out at an opening, one side of which is tangent to the drum. The centrifugal force developed in the whirling mass of air makes the pressure at the circumference considerably greater than at the centre, and causes the air to escape through the passage b with great velocity. Fans are often made with curved floats. They are used in cotton-mills for separating cotton from its impurities and for drying sized yarn. They are sometimes used for blast furnaces, though not so often as the blower (Fig. 8). Powerful fans are used in planing-mills to create a current of air for conveying the shavings to the boilers, where they are used for fuel. The air is taken in at the cutting-tool, and carries the shavings with it. Steam saw-mills are sometimes provided with similar arrangements for carrying off the sawdust.

Fig. 8 is a blower commonly employed for the large blast

FIG. 8.



furnaces of ironworks. It consists of a cylinder with a reciprocating piston, and large passages for the ingress and egress of air. During the downward stroke of the piston a series of valves in the top of the cylinder open by the preponderance of the external over the internal pressure. The valve a opens, admitting the air into the chamber A,

whence it passes to its destination through the pipe *c*. On the upward stroke the upper valves close by the excess of the internal over the external pressure; the valves in the bottom of the cylinder open; *a* closes, *b* opens, and the flow through *c* continues. The large valves are of the kind known as gridiron valves, resting, when closed, upon a sort of grating. The valves are usually of leather. This machine is operated by steam or water-power, as is the fan.

Fig. 9.

Figs. 9 and 10 show an air-compressor operated by hand. It consists of a piston closely fitting a cylinder which has valves for the ingress and egress of air. During the upward stroke of the piston the valve *b b*, consisting of an annular disk of oiled silk, rises and admits the air through the passages *a a*. At the same time a similar valve of oiled silk closes the passages *d d* from below. During the descent of the piston the valve *b b* falls, closing the passages *a a*. The air passes through the passages *d d*, and to its destination through *c*.

Fig. 10.

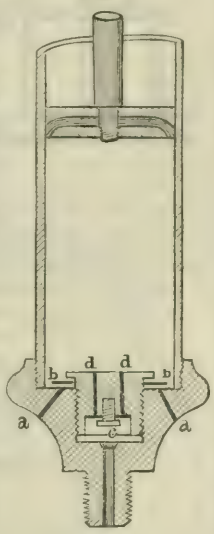
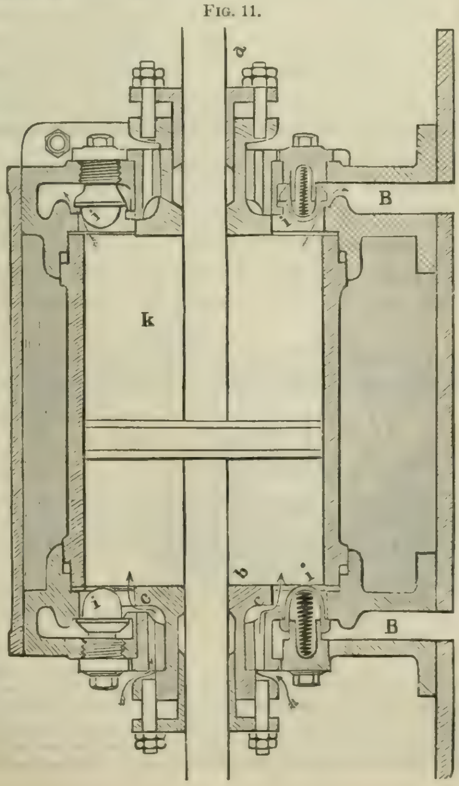


Fig. 11 is a section of the working cylinder of Sturgeon's air-compressor, a powerful machine driven by steam or water-power for furnishing highly compressed air. The air is admitted from the atmosphere through stuffing-box valves. The stuffing-boxes are so formed as to admit of a slight movement at each stroke of the piston. At the commencement of the upward stroke, for instance, the first movement of the piston-rod carries the stuffing-boxes with it a very short distance, opening the passages *c c* below the piston and closing similar passages above. When the piston has moved sufficiently to bring the air above it to the necessary state of compression, the spring-valves *i i* are lifted by the pressure, and the air passes through the passages B B to the tank *k*. The cylinder is surrounded by water to absorb the great heat developed in compressing the air. The piston of this machine moves with a velocity of 490 feet per minute.

Fig. 11.



Pneumatic Transmission.—The facility with which a piston is moved in a cylinder by the pressure of air has led to many devices for employing cylinders of great length for the transportation of passengers and merchandise. (See PNEUMATIC TRANSMISSION.)

Pneumatic caisson, a shallow inverted vessel used in constructing the foundations of the piers of bridges and in other operations requiring excavations in deep water. (See FOUNDATION.)

Compressed Air as a Means of Transmitting Power.—Power for driving machines cannot always be generated at the point where it is required for use. It is often required at points where, from the nature of the case, neither water-wheels nor steam-engines can be located. Compressed air conveyed in pipes is often employed in such cases. It is used in cylinders with pistons in precisely the same manner as steam. The use of highly-compressed air is necessarily attended with a great waste of power. Air, like all compressible bodies, develops heat when its volume is diminished, and absorbs heat when its volume is increased. To understand the reason of the loss of power, we must consider what takes place during the compression and expansion of the air. In the machine represented at Fig. 10, when the piston is fully raised the air below it is at the ordinary pressure of the atmosphere. Suppose its temperature to be 60° F. Let the piston be forcibly depressed to the extent of one-half its stroke. If we suppose the air to be kept at the same temperature of 60° during compression—that is, if the heat generated during compression is all taken away—its pressure will be twice that of the atmosphere, or 29.4 pounds per square inch. Now, if we allow the air to expand again, raising the piston, it will not exert the same pressure during expansion as during compression, for the reason that it has parted with a portion of its latent heat, and heat is power. If, on the contrary, no heat is allowed to escape from the air, then when its volume is reduced to one-half, its temperature will have risen to 230° F., and its pressure to 39 pounds per square inch. If, now, the air be cooled to 60°, and then allowed to expand, it will exert the same pressure during expansion as in the former case. Here is a twofold loss of power. The power required to compress the air is greater than in the former case, because the pressure is increased by the heat, while the power exerted in expansion is the same as before. If the air could be expanded before cooling, it would exert the same pressure that was required to compress it, but this can never occur in practice. The air is always cooled in the course of transmission. A third cause operates to diminish the power derived from compressed air. During compression the air enters the compressing cylinder at the atmospheric pressure and leaves it at the required pressure. It opposes an increasing resistance to the compressing piston at every stage of its compression. But it rarely happens that the air can be expanded down to the pressure of the atmosphere in the cylinder of the air-engine. These causes—viz. (1) heat abstracted from the air, naturally or artificially, (2) resistance to compression consequent on development of heat, and (3) imperfect expansion—reduce the work derivable from compressed air to but a fraction, sometimes a small fraction, of that expended in compressing it.

According to experiments made by Mr. William Daniel of Leeds, communicated by him to the British Institution of Mechanical Engineers (*Lond. Engineering*, Aug. 14, 1874), compressed air at a pressure of 40 pounds per sq. in. gives 25½ per cent. of the power expended in compressing it.

At 34 pounds per square inch the percentage is 27.
" 28 " " " " " " 28.
" 24 " " " " " " 35.
" 19 " " " " " " 45½.

Pressure above a vacuum, in pounds per square inch.	Temperature in degrees of Fahrenheit's thermometer.	Volume. Without change of temperature.	Volume. Without transmission of heat.	Pressure above a vacuum, in pounds per square inch.	Temperature in degrees of Fahrenheit's thermometer.	Volume. Without change of temperature.	Volume. Without transmission of heat.
5	—80	294.00	215.04	65	341	22.62	34.80
10	5	147.00	131.46	70	358	21.00	33.02
15	63	98.00	[illegible]	75	375	19.60	31.44
20	109	73.50	[illegible]	80	391	[illegible]	[illegible]
25	147	58.80	[illegible]	85	406	17.29	28.77
30	180	49.00	60.27	90	420	16.33	27.62
35	209	42.00	54.01	95	434	15.47	26.58
40	236	36.75	49.13	100	448	14.70	[illegible]
45	260	32.67	45.18	105	461	14.02	24.76
50	282	29.40	41.93	110	473	13.36	23.96
55	303	26.73	39.19	115	485	12.79	23.21
60	322	24.50	36.84	120	497	12.25	22.52

The preceding table, giving the pressure, temperature, and volume of a quantity of air whose volume at the atmospheric pressure and at a temperature of 60° is represented by 100, is abridged from a larger table computed by Prof. Thurston of the Stevens Institute of Technology. According to this table, a quantity of air which at the atmospheric pressure and a temperature of 60° occupies a volume of 100 cubic feet, would, when compressed without change of temperature, so as to exert a pressure of 40 pounds per square inch, occupy a volume of 36.75 cubic feet. Compressed to the same tension without loss of heat, it would occupy a volume of 49.13 cubic feet, and its temperature would be 236°.

The following table was published by Prof. Frazier in the *Engineering and Mining Journal*, July, 1873. It gives, from theoretical considerations, the portion of the work lost in compressing air:

Pressure above vacuum in atmospheres.	Percentage of work lost with full expansion.		Percentage of work lost with no expansion.	
	Air completely cooled in compressor.	Air not cooled in compressor.	Air completely cooled in compressor.	Air not cooled in compressor.
2	0.09	0.18	0.28	0.35
3	0.14	0.27	0.39	0.48
4	0.18	0.33	0.46	0.56
5	0.20	0.37	0.50	0.61
6	0.22	0.40	0.53	0.65
7	0.24	0.43	0.56	0.67
8	0.25	0.45	0.58	0.69
9	0.26	0.47	0.60	0.71
10	0.27	0.49	0.61	0.73

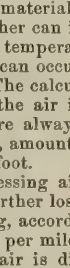
This table shows the great advantage of cooling the air completely during compression. It also exhibits in a striking manner the great losses of power to which the method is liable. Thus, for the case of air at a pressure of ten atmospheres, or 147 pounds per square inch, used without expansion and not cooled in the compressor, the loss is 73 per cent. That is to say, the power derivable from the air is but little more than one-fourth of that expended in compressing it.

It will be noticed that both tables give results calculated upon two suppositions—viz. (1) for air completely cooled or kept at a constant temperature during compression; (2) for air that parts with no heat during compression. Neither of these suppositions is exactly realized in practice. Heat generated during compression cannot all be confined to the compressing cylinder, since all materials conduct heat with greater or less rapidity. Neither can it be absorbed with such rapidity as to prevent the temperature of the air from rising. All the cases that can occur in practice, however, lie between these limits. The calculations also proceed upon the assumption that the air is dry, which is not strictly correct, the atmosphere always containing a certain quantity of aqueous vapor, amounting, in the extreme case, to 20 grains in a cubic foot.

In addition to the losses of power in compressing air consequent upon the waste of heat, there is a further loss in the course of transmission in pipes, amounting, according to the best authorities, to about 10 per cent. per mile. That is, the power derivable from compressed air is diminished 10 per cent. by transmission one mile, and that remaining at the end of one mile is diminished 10 per cent. by transmission another mile, etc. J. P. Frizell.

Pneumat'ic Transmis'sion. Our modern pneumatic despatch arrangement is the culmination of the efforts made from time to time to introduce what are popularly known as atmospheric railways. As early as 1684, Denys Papin seems to have suggested the first crude idea in a paper presented to the Royal Society; no trace can, however, be found that his arrangement was ever practically tried. No allusion to pneumatic transport is contained in the records for more than a century after, until M. van Estin amazed his friends, according to the *Dictionnaire Encyclopédique des Amusements des Sciences* (Paris), by sending them to the other end of the park, three-fourths of a mile distant, for the reply to a question just put to him, which they found concealed in a small ball in the drawer of a desk in a little summer-house. It was not until 1810 that Medhurst, a Danish engineer, took up the application of pneumatic transmission, issuing a pamphlet entitled *A New Method for transmitting Packets and Letters by Air*, and in 1812 his *Calculations and Remarks to prove the Possibility of a New Method of transmitting Packets and Letters by Air*. In 1824, Valoric proposed to establish a passenger service between London and Brighton with a wooden tube 6′ 6″ wide. This was impracticable. In 1824, Medhurst suggested what was the original idea of the first atmospheric railway—viz. a tube with a longitudinal slit on top for the passage of a connecting-rod between a piston in the tube and a carriage above it, the slit to be closed by a kind of continuous valve. This sort of construction has been the subject of numerous patents, beginning, according to the patent-office records, in 1834 with the American Pinkus, and almost without exception directed against the opening and closing of the continuous slit. Great ingenuity is displayed in some of the arrangements. Most of them were impracticable, and those few that have been practically carried out are now abandoned, we believe, in favor of the locomotive. (See *Engineering*, 1874, ii.) Joseph Ressel, an Austrian inventor, however, proposed, even before Pinkus—in 1832—to transmit postal communications in a hollow piston fitting in an iron pipe, from which the air being exhausted on one end, the pressure of the atmosphere acted on the other side of the piston, and propelled it. This system is now in successful operation in our largest telegraph-offices, having passed through numerous phases of development.

Fig. 1.



Section of carrier.

Fig. 2.

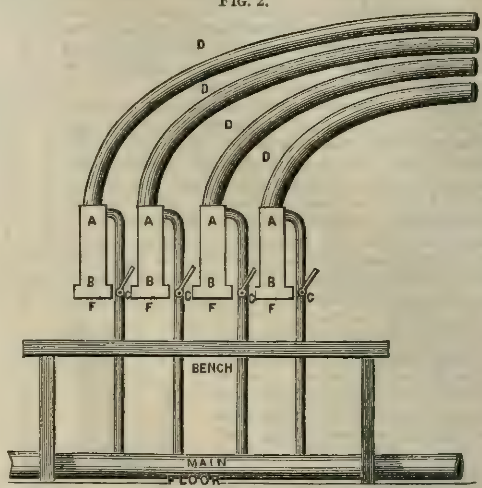
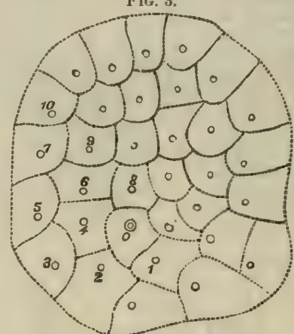
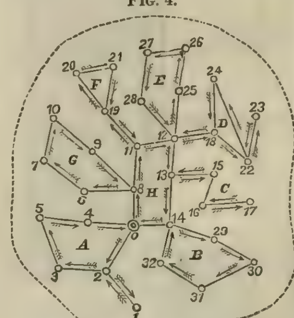


Fig. 3.



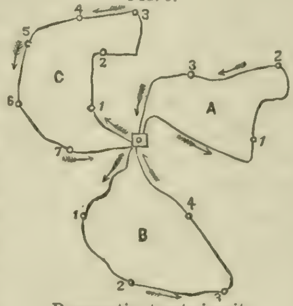
The modern pneumatic transmission exclusively used as a despatch arrangement—*i. e.* for sending communications on paper—may be generally described as follows: Two stations, the distance between which may be a mile and a half, though usually from one-fourth to three-fourths of a mile, are connected by an ordinary wrought-iron gas-tube, seldom exceeding $2\frac{1}{4}''$ internal diameter. The pipes are laid under the street pavement and terminate in the station building. Here an arrangement exists by which the air can either be sucked from the tube or the tube be filled with compressed air. Now, if some small object, fitting tolerably but not too tightly, be put into the tube, and compressed air be let in behind it, after the opening through which the insertion took place has been closed, that object will be propelled along the tube so long as the pressure continues to press it forward, and with a speed proportionate to such pressure, until it arrives at its destination. If the piston—or carrier, as it is called—is to be sent back, the attendant, after having placed the carrier in the tube, gives a signal, usually by means of an electric

Fig. 4.



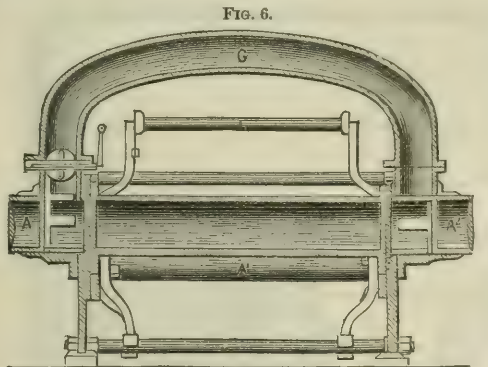
bell; the attendant at the other station (where the motive-power is) turns the vacuum-cock, thus exhausting the air from the tube, and the pressure of the atmosphere propels the carrier back to the station from which it originally came, and signals its arrival by a sharp click against the end-cover or flap of the tube. The carrier is hollow, and contains the objects transmitted. This simple carrier alone has caused much anxious thought and speculation. Iron, steel, tin, copper, brass, india-rubber, leather, felt, wood, and other materials have been tried, and mostly abandoned. The best we have seen, now used in the English offices (Fig. 1), is a very simple tube of india-rubber, open at one end, enclosed in a very stout wrapper of hair felt. At the closed end of the tube several felt washers, a little larger than the tube, are placed together, so as to well fill the tube in which they have to travel, the other part being about 4″ long, and fitting very loose into the pneumatic tube. A small elastic band across the open end of the india-rubber tube is the only safeguard

Fig. 5.



Pneumatic street circuit.

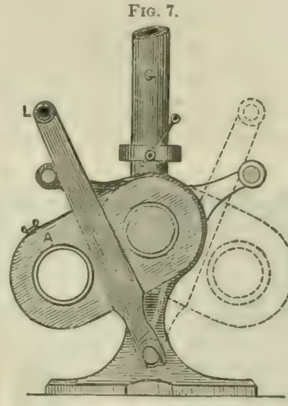
Fig. 6.



to prevent the messages—of which a carrier suitable for a $1\frac{1}{2}''$ tube will hold about ten—from falling out of the tube during transit—an accident now seldom occurring, but in the infancy of the system a fruitful source of annoyance. In Paris a tin case with a leather cover is used, the leather also forming a sort of collar similar to the felt collar on the one illustrated. A combination of tin and wood is also in use there.

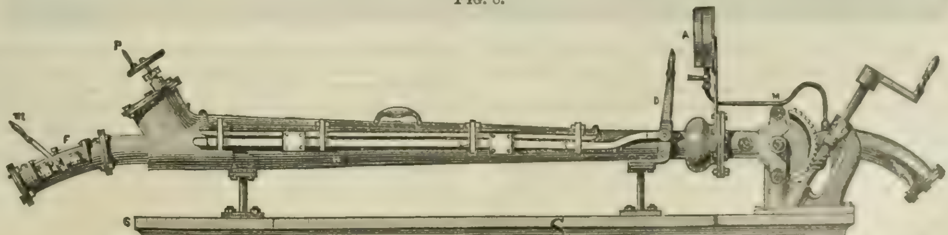
Although the practical success of the pneumatic despatch is of comparatively recent date, telegraph-office authorities would be sorely puzzled were they suddenly deprived of its use. It serves as a messenger or telegraph; it combines the certainty of the former with the speed of the latter if applied to short distances, such as the arrangement is now used for, although the necessary machinery and working expenses of the telegraph are much less than those of the pneumatic system. But the advantage of the latter lies in its greater capacity, and consequent saving of time and labor, as well as the almost absolute certainty. It is usually supposed that telegraphic messages handed in at any of the branch offices are telegraphed from that station direct to their destination; this is quite erroneous. They are first transmitted, either by telegraph, pneumatic tube, or other arrangement, to the central telegraph-station, from which all messages are telegraphed and at which all are received, and either distributed direct by messenger or sent by wire or pneumatic tube to the branch office in the district where they are to be delivered. The pneumatic carrier only requires something like a minute for its journey—according to distance and pressure employed. In Paris, where a train of ten is sent at a time, and the distances are pretty regular, varying from 1 to $1\frac{1}{4}$ kilometres. $2\frac{1}{4}$ to $2\frac{1}{2}$ minutes are allowed for a journey—viz. $1\frac{1}{4}$ or $1\frac{1}{2}$ minutes for the transit of the train itself, and 1 minute for discharging and re-charging. There, messages handed in at any of the offices are delivered to local correspondents in the original, a great advantage. We have no doubt whatever that before long a local postal service by means of pneumatic tubes will be introduced in all great business-centres, by means of which letters may be handed in at any of the central offices, and delivered at their destination a few minutes later: indeed, the emptying of the pillar-boxes by pneumatic means has already been suggested.

Fig. 7.



There are various kinds of receiving and despatch apparatus. The simplest is perhaps the one in use in English offices, designed by Mr. Willmott, which we illustrate in Fig. 2. It is the one most suitable for systems in which each station is in direct connection with the central office. It consists of a brass box A connected with the pneumatic pipe D. B is a slide which may be drawn forward and backward, and closes the opening in the bottom of the box when in one position, at the same time turning

Fig. 8.



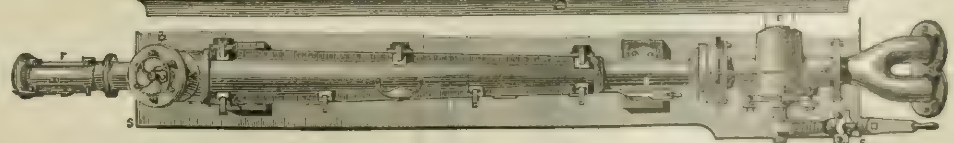


Fig. 9.

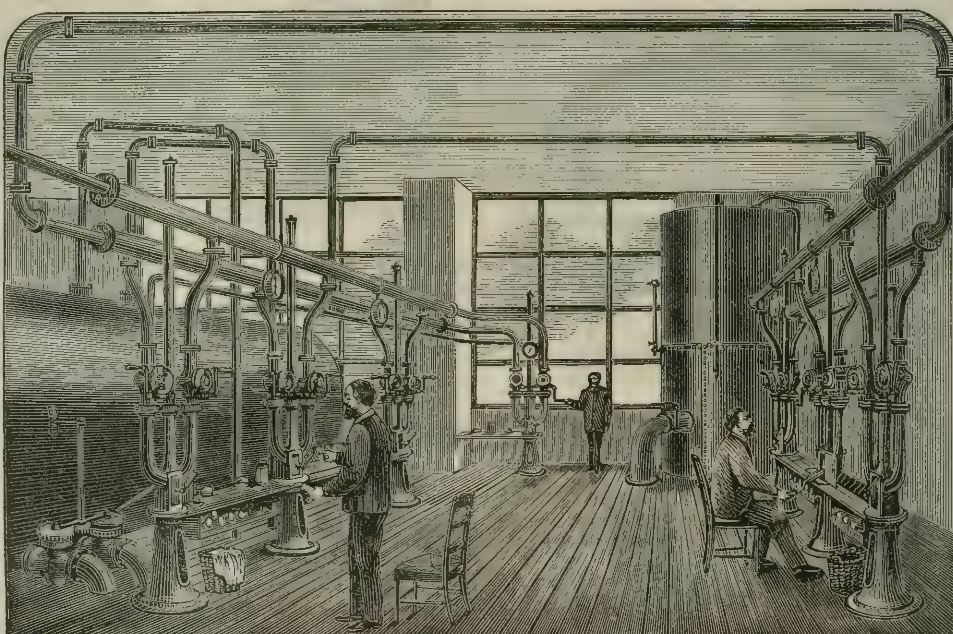
on the compressed air, the pipe for which is not seen in the sketch. This is the position for sending away; if a signal is given from the other station that they wish to send a carrier, the slide is moved, and thereby the compressed air turned off and the bottom of the box opened; the leather flap F is put over the opening, the tap C turned, and the tube put in connection with the vacuum main. The flap F is held against the opening by the pressure of the atmosphere until the carrier, arriving at great speed, strikes against it and keeps it open; the tap C is then closed and the carrier taken out. It will be seen that in this manner the carrier is sent forward and backward in

the same pipe; if, however, the traffic between two stations is very heavy, the circuit system is usually adopted—*i. e.* two tubes are used, one for the out, the other for the return journey. Recourse is also had to this mode of working if there are intermediate stations, or one behind the other, so that despatches coming from the farthest would have to pass others on the way. In such cases the tubes are connected from station to station, the lines forming a polygon which is called a "circuit;" and then the transmitting pistons are only sent in one direction, continually going round, each station taking out what is intended for it and putting in what it desires to send to the central or any other station. On this plan the very extensive system in Paris is worked which we illustrate in Figs. 3 and 4, also that of London, represented in Fig. 5. Fig. 3 shows how the ground is divided into districts, each having its station, O being the central one. Fig. 4 shows the tabular network, arranged into polygons or circuits A B C D E F G H, and their connections, and the direction in which the communications move. Fig. 5 shows the plan adopted in London, the letters denoting the circuits, and the figures the stations.

For the circuit system a different receiving and despatching apparatus from the one described in Fig. 2 is employed, as it is desirable to permit carriers to pass through stations without interruption or interference. In Figs. 6 and 7 we illustrate Siemens' arrangement in section and end view. With the aid of this a carrier may move through the station without interference, the valves being adjusted upon receiving a certain signal; or it may be that a number of carriers are moving in the circuit at the same time whose progress it is desirable not to arrest while removing from the pipes one intended for the station. In the latter case, the carrier drops in the box A^1—A and A^2 being the pneumatic tubes—while the circulation of the compressed air and vacuum continues uninterruptedly through the bypass G, the movement being effected by moving the slides with the handle L on the rocking frame to which A^1 is attached. Varley's apparatus, formerly employed, has now given way to those described.

In Paris two kinds of receiving and despatching apparatus, totally different from the above, are in use—the vertical and the horizontal. The latter (Figs. 8 and 9) is only used at stations where there is sufficient room; it offers some advantages not possessed by the vertical arrangement; viz. the train can be stopped, the lid opened, and only such carriers be removed as are intended for the station; when this is done, the cover is put on again, the air-taps turned, and the train moves on. The horizontal receiver consists of a conical box H mounted on a cast-iron plate S. The train arrives in the box H; the lever D is moved and releases the cover, which is lifted off, and the train is open to view, and may be removed, or the box is closed again, the tap M moved, and the train sent on. For despatch, the carriers are introduced through the opening F, which is uncovered by moving the lever *m*. The apparatus is provided with a pressure-gauge (A). The valve P is to facilitate examination in case of stop-

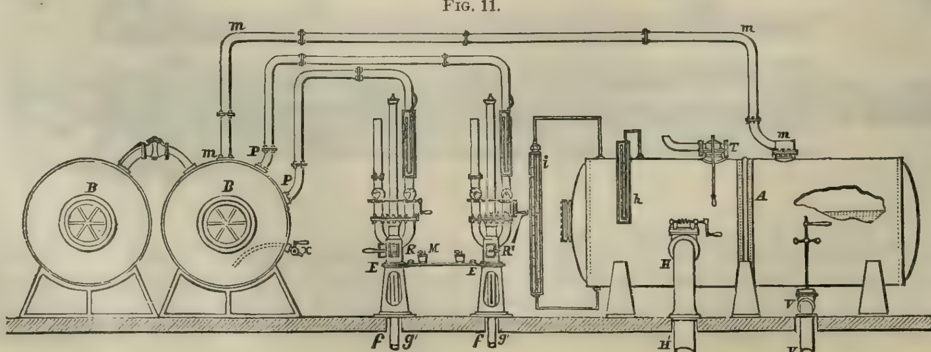
Fig. 10.



page. Fig. 10 shows the interior of a station at Paris fitted with *vertical* receiving apparatus; the huge cylinders seen in the cut are the air or vacuum reservoirs.

We come now to the motive-power. Various ways are employed to obtain both a vacuum and a plenum. In the new post-office, St. Martin's le Grand, London, three fine 50-horse compound beam-engines produce the required power for the thirty-four lines existing. Each has a high-pressure cylinder, 17″ in diameter, 4′ 1½″ stroke, the low-pressure cylinder being 25½″ in diameter, with a stroke 5′ 6″ long. Steam is supplied by four multitubular Lancashire boilers, 6′ 6″ in diameter, 20′ 2″ long, with two internal flues 2′ 6″ in diameter, 14′ 6″ long, terminating in seventy-four tubes 3″ in diameter, 5′ 9″ long. These en-

Fig. 11.



gines have each a compressing and vacuum pump of suitable size, connected with storage reservoirs from which the supply is drawn when wanted. No doubt this provision is also intended to supply future wants. In Paris water is the chief source of motive-power. There it is employed in many ways, the simplest being that of displacement—viz. having a vessel of sufficient capacity with air-tight valves connected with the water-mains. If, now, all air-outlets be closed, and the water in the lower part of the reservoir be turned on, the water will continue to flow in, and leave less and less room for the original quantity of air, which thus becomes confined, and consequently compressed, until of the same pressure as the water, when the one will balance the other and the flow of the latter cease. The water may now be turned off, or may be left on to urge still further the outflow after the proper valves have been opened. If the air is all expended, the water must be drawn off before a fresh supply of air can be compressed.* If this compressing apparatus is sufficiently elevated above the level where the water is to be finally discharged, that head of water may again be utilized for producing a partial vacuum: and this is done in Paris. These are the more simple arrangements in use there, and it will be seen that there are no moving parts about the whole arrangement; but turbines are also used to supply motive-power to exhaust and compression pumps. Even the injector or induced-current principle is turned to account, and several stations receive their power by means of these contrivances, worked by water. Steam is there used in only a very few instances, water costing something under 3*d.* per 1000 gallons.† The working pressure is about eight or nine pounds per square inch; that in England is much higher, attaining a vacuum of about eight pounds and a pressure of 30 to 40 pounds.

According to *Engineering*, the cost of the Paris establishment is about £965 per mile of line, and per station £600. This gives a capital of

39 lines	= £37,700
33 stations	19,800
	£57,500

The total working expenses per annum are—

Water	£16,850
Sinking fund	5,750
Station expenses	4,620
Maintenance, inspection	1,584
Employés	21,912
	£50,716
	7,150
Extraordinary	£57,866

There are sent 15,000 communications per day, averaging 267 per train; these at 4*d.* each would make £91,250 per annum, or a surplus of £33,348 per annum. In England the expenses are much less than the above.

Besides Paris and London, pneumatic despatch arrangements are in full operation in Berlin, Manchester, Liverpool, Birmingham, Glasgow, Dublin, and other large cities. WILLIAM E. A. AXON.

Pneumatic Trough or **Cistern,** an apparatus for collecting and preserving samples of different gases in the laboratory and chemical lecture-room. It was the invention of Dr. Joseph Priestley, the discoverer of oxygen gas, whose advances were so great in the department of science which relates to gases that he has been called the "father of pneumatic chemistry." The pneumatic trough consists of a vessel of water, with a shelf situated an inch or two beneath the surface of the water. This shelf often slides in grooves. It is sometimes perforated with holes. To collect a sample of a gas, a jar or bell is inverted under the water in the cistern, thus becoming filled with water. It is then turned mouth downward while beneath the water. If then raised vertically with proper care and placed on the shelf, it of course remains full of water, kept there by the atmospheric pressure. The tube conducting the gas is then brought up through one of the holes under the jar, or the jar may stand projecting a little over the edge of the shelf and the tube brought under it, so that the gas may bubble up and displace the water. The pneumatic trough was the first step toward the invention of our present gas-holders for illuminating gas. H. WURTZ.

Pneumogas′tric Nerve [Gr. *πνεύμων*, a "lung," and *γαστήρ*, "stomach"], so-called from its distribution to the lungs and stomach. It is the tenth cerebral nerve, though, physiologically speaking, it is a true spinal nerve. Its nucleus of origin is a mass of ganglion-cells lying deep in the posterior part of the medulla oblongata, in the floor of the fourth ventricle, and its fibres escape from the side of the medulla. It issues from the skull by the jugular foramens, at which point there is a ganglionic enlargement of the nerve. It then descends with the carotid artery to the chest, and after entering the thorax lies upon the œsophagus. Upon the lower part of the œsophagus the two nerves conjoin, pass through the diaphragm, and are distributed to the stomach and solar plexus. At the level of the jugular foramen the pneumogastric is joined by branches from motor nerves—the facial, hypoglossal, spinal accessory, etc. The branches of the pneumogastric are sent to the pharynx, to the larynx (superior laryngeal nerve, which is sensory, inferior laryngeal, which is motor), to the heart, lungs, œsophagus, and stomach. From its origin to its ganglion (analogous to posterior root of spinal nerves) the pneumogastric nerve is purely sensory, and its most important function—viz. the regulation of breathing by the transmission of sensations through its pulmonary branches to the medulla (centre of respiration)—is performed by that property. Below the ganglion it is a mixed nerve. The motor properties of the inferior laryngeal (actions of breathing and voice) are derived chiefly from the branch of the spinal accessory nerve, and the pharyngeal branch derives its motor power from the nerves which join the pneumogastric below the ganglion. The action of the pneumogastric on the heart (through cardiac branches and cardiac plexus) is checking or inhibitory, paralysis of the pneumogastric producing excessive rapidity of the heart's action (and slow respiration), while irritation of the nerve stops the cardiac movements. The movements of the œsophagus and stomach are under the control of the motor fibres of the pneumogastric.
E. C. SEGUIN.

Pneumo′nia [Gr. *πνεύμων*; pl. *πνεύμονες*, "the lungs"], inflammation of the lung, of the lining of the air-sacs, and of the interstitial framework of the lung. Pneumonia more recently has been classified into (1) catarrhal pneumonia, when only the air-sacs are involved, filled with products of catarrhal inflammation, extending from the bronchial tubes; (2) croupous pneumonia, where the air-sacs are filled with solid lymph exuded from their inflamed walls; (3) interstitial pneumonia, a slow and chronic inflammatory infiltration and consolidation of the fibrous structures which surround the air-sacs and minute bronchial tubes. But pneumonia, as commonly termed in England and this country, consists of the croupous form only, an inflammation of the air-sacs, which are the functional elements of the lung for the oxygenation of the blood and the liberation of carbonic acid gas. Pneumonia is usually confined to one lung, rarely is double. It is further designated as "vesicular pneumonia," as the air-sacs or vesicles are involved, and as "lobar pneumonia," one lobe only frequently inflamed, or the disease attacking the lobes successively. Primary pneumonia in healthy persons occurs more often in the right lung, beginning, as a rule, at the base of the lung and progressing upward toward the apex. In old and feeble persons it may begin at the apex, but pneumonia when local or commencing at the apex is usually secondary to tubercle in the lung, deposits by broncho-pneumonia or former plastic pleurisy. Pneumonia is a disease chiefly of adults, and more often of males. It results from catching cold, fatigue, impoverished condition of the blood, the congestions and perverted blood-states of acute and malignant febrile diseases. It is announced by a heavy chill, high fever, rapid respiration, frequent pulse, flushed cheek—on the side of the affected lung; in severe cases by delirium and symptoms of a typhoid nature. There is acute pain in the side, due to congestion of the pleura, and a duller, heavier pain or soreness of the side, with sense of weight, due to excess of blood and the solid products of inflammation in the lung. There is cough, with expectoration of mucus tinged with blood or rust-colored; and in grave cases brownish or dark sputa, resembling tobacco-juice or prune-juice, and indicative of a decomposed state of the blood, and the exuded elements filling the vesicles. The contents of the vesicles are gradually softened and expectorated, and the lung restored to its normal state. Acute pneumonia of adults, although grave in its symptoms, is usually recovered from, and, contrary to popular apprehension, seldom leads to subsequent consumption. Pneumonia, so called, in children is usually acute catarrhal inflammation of the minute bronchial tubes and air-sacs, occurring in one or many lobules of both lungs. It is liable to leave portions of lung-substance inactive, collapsed, or consolidated, and develop the catarrhal form of phthisis. Pneumonia is variously treated. Locally, cold water and ice-bags may abort or limit the inflammation

* In Fig. 11 is represented such an arrangement. A is the water-reservoir or compressor; H the valve for the admission of the water through the pipe H′; B B are air-storage reservoirs; *m* the supply-pipes from the compressor; P P the connecting pipes with the vertical receiving apparatus E E, through the opening R R of which the carrier is removed after having arrived by the lines *f g′*; *h* and *i* are pressure water-gauges; *v* and R the let-off valves and pipe.

† The cost for water per mile amounts to 4.3*d.*, and the cost per each complete tour of a train 197.8*d.*, or per day of fourteen hours and four trains per hour = 56 × 197.8*d.* = £46 3*s.*

at its commencement. When established, warm applications, as poultices, warm anodyne fomentations, cotton-batting, and oil silk afford the greatest comfort and favor resolution and removal of the exudation from the air-sacs. Carbonate and muriate of ammonia as diffusive stimulants and to liquefy the exuded lymph, calisaya bark or quinine, mild alcoholic stimulation, and rich liquid diet to sustain strength, veratrum viride to control the heart and lessen pulmonary congestion, are the most approved and successful agents.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Po [Lat. *Padus*, or, poetically, *Eridanus;* Gr. Ἠριδανός], the largest and most important river of Italy. A rivulet rising on the E. flank of Monte Viso, in lat. 44° 30′, at the height of 6560 feet above the sea, though neither the longest nor the most copious of the streams which unite to form the upper course of the river, is popularly regarded as the true Po, and takes that name at its very source. It flows N. E., receiving many affluents in its course, till its junction with the Dora Baltea near Chivasso. From this point its general direction, though with many sinuosities, is a little S. of E. to the Adriatic, into which it discharges by several mouths in about lat. 44° 30′. The total length of the Po, in a right line, is 260 miles, or, measured by its own channel, 360 miles. In the first 20 miles of its course it descends 5300 feet to a point near Revello, at the height of 1260 feet above the sea; and here, though it has now grown to a large stream, its bed is sometimes left dry for a considerable distance, the entire superficial current being evaporated, absorbed by the sands, or diverted for irrigation. It bursts out again with an increased temperature, which it does not wholly lose afterward, for it rarely if ever freezes, while the Arno at Florence, a degree and a quarter farther S., and more than 1000 feet lower, is often covered with ice. At Valenza, about one-third of the whole distance from its source to its outlet, it reaches the level of some 600 feet above the sea, and from this point it flows chiefly through its own alluvion to the Adriatic. The width of the Po is about 525 feet at Turin; 870 at the great bridge of Mezzana Corti, not far from Pavia; and 750 at Ponte Lagoscuro, near Ferrara, where it is crossed by its last bridge. At other points its width, the level of its surface, and of course its depth, are extremely variable, partly because, from its erosion of its banks on the one hand and the deposit of sediment brought down by torrents into its channel on the other, its bed is constantly widening or narrowing, as well as shifting, and partly because, except in extreme droughts or excessive cold, more or fewer of its many affluents are almost always at flood. These tributaries differ greatly in volume as well as in the solid matter they transport, and their partial inundations so variously affect the main trunk that the river-guards on the lower course of the Po profess to be able to distinguish, by the color and consistence of the balls of foam, the appearance of discolored threads of water in the current, and the character of the rubbish floated down, to what particular affluent any sudden rise of the river is to be ascribed. From Valenza to its mouth the Po is navigable for vessels of 130 tons, but steamers are not used on its waters; and as most of the transport which would otherwise be carried on by means of its channel is now effected by railway, the river has lost much of its relative importance as a route for personal travel and commercial communication.

The Po is diked continuously from near Cremona to the marshes at its outlet. The levees do not follow the smaller windings of the river, but, for the sake of saving distance and for other reasons of convenience, often diverge from it so widely as to leave a space of even miles between them. An embankment running along the margin of the channel is called *argine a froldo*, or simply *froldo*. When it recedes sensibly from the river it is called *argine a golena*. The *golene*, or spaces between the levee and the channel, are frequently protected by low dikes and cultivated, but in every considerable rise of the river the *piarde*, or natural banks, are overflowed, and a greater or less extent of the *golene* submerged. The levees are not often burst by erosion or by simple pressure, because the vigilance of the people and the official guardians of the river usually applies proper defences at threatened points in time. Crevasses are more frequently occasioned by the holes of burrowing animals, by the digging of wells near the dikes, and other purely accidental circumstances, and terribly destructive inundations are often caused by them. The prevention of the lateral spread of the water in floods by levees occasions the deposit of sediment in the channel, and consequently an elevation of the bed, which requires the embankments to be raised proportionally; but this effect in the case of the Po is by no means so considerable as has been often represented. Lombardini has shown that in the *middle* lower course of the Po the bed of the proper low-water channel of the river is subject to so little permanent change of level that it may be regarded as having now become substantially constant. But this conclusion, though, as we believe, sound, is not universally accepted by engineers; and besides, admitting that there is no elevation of this narrow bed by deposit, yet the surface of the *golene* is constantly rising from the sediment let fall whenever they are flooded. Hence, the effective capacity of the whole channel is diminishing, and in inundations the water conveyed by it must rise higher in proportion. It must further be observed that from the continued prolongation of the delta of the river by deposits at its mouth the inclination of its last reaches is gradually diminishing, and hence the velocity of the current is checked for a considerable distance up stream, and of course the level of its surface raised in proportion.

There is still another circumstance which has an important bearing on this point. Although there is probably little *permanent* elevation of the bed for a considerable part of the lower course of the Po, yet in floods the first waters it receives are from tributaries of a torrential character, very heavily charged with sediment. This is almost immediately let fall in large proportion near and below the confluence of these torrents with the main stream, and they must inevitably *temporarily* raise the bed of the river, and of course the level of its surface. These deposits, however, are very soon swept out and the bed restored to its normal level by the vast influx of *clear* water delivered into the channel of the Po by the emissaries of the Alpine lakes, which arrive at a later stage of the flood, and after the torrential affluents have mainly done their work. We must allude to another element in the physical geography of the lower Po hitherto little noticed. It has long been known that the coast of the Adriatic at and near the outlets of the Po is slowly sinking. If the depression is confined to the coast-line and its vicinity, it must increase the inclination of the bed of the lower Po, and of course tend to counteract many of the influences we have noticed. But we are ignorant whether it may not extend a greater or less distance into the interior, and thus compensate effects it would otherwise produce.

The Po drains the S. slope of the great chain of the Alps lying W. of the valley of the Adige, the E. slope of the Italo-French Alps, and the N. scarp of the Apennines W. of the valley of the Reno. The boundary of its basin crosses the summits of Monte Rosa, Monte Cervino or the Matterhorn, and Mont Blanc on the N.; of Monte Viso on the W.; and its S. limit, the watershed of the Apennines, at some points near the Gulf of Genoa, approaches within 5 miles of the Mediterranean. The basin of the Po lies wholly within the kingdom of Italy, with the exception of a portion of its N. and N. E. territory, belonging to Switzerland and to Austria, and comprising the valleys of the Maggia, the upper Ticino, Maira, and Chiese, the Sarca, and some other less important streams. Its drainage-area, down to the mouth of the lowest tributary, which empties into its channel near Ferrara, is computed at about 27,000 sq. m., of which Italian geographers class 16,000 as mountain, 11,000 as plain lands.

A striking and important feature of the hydrography of this basin is the existence of a chain of lakes lying at the foot of the Alps, between lat. 44° 30′ and 45° 30′, extending E. and W. about 150 miles, and with a total area of more than 300 sq. m. These lakes serve as basins of reception for the water and the sediment brought down by many torrents, greatly retarding the flow of the water into the Po, and retaining the whole of the vast quantity of sedimentary matter with which these torrents are charged. The Po receives not less than four-tenths of its volume from the lakes, and of course that proportion of its waters is thus detained and purified. The Lago di Garda, the longest of this chain, which drains only a narrow valley, is indeed subject to little change of level, but Lago Maggiore and the Lake of Como sometimes rise more than 25 feet in twenty-four hours. In the inundation of Sept., 1829, the single Lake of Como received, during a period of five days, an influx of 2600 cubic yards to the second, which is about equal to the mean discharge of the Po; and as the efflux was but about 1000 cubic yards to the second, it accumulated in those five days a surplus of 670,000,000 cubic yards of water, which was gradually drawn off by its natural channel. Still more signal services were rendered by these lakes in the great floods of 1839, 1868, and 1872. Had such stupendous volumes of water, sand, and gravel been precipitated into the channel of the Po, as but for the lakes they must have been, the entire plain of Lombardy would have been deluged and laid waste several times in the course of a single century.

The delivery of the Po is vaguely calculated to be equal to from two-thirds to three-fourths of the total precipitation upon the basin; but as, from the want of sufficient pluviometrical observations in the mountain-lands, we

know next to nothing of the actual rainfall in those regions, this estimate is entitled to very little confidence. The mean discharge into the Adriatic, as deduced from daily measurements for fourteen years, is 1720 cubic mètres, or 60,745 cubic feet, to the second, which appears to differ little from the delivery of the Rhone and of the Rhine, and equals six-tenths of the mean volume of the Nile, and about one-eleventh of that of the Mississippi. The smallest measured discharge of the Po is 7558 cubic feet, the largest, 181,580; but in the inundation of Oct., 1872, the amount must have been greater by at least 40,000 cubic feet to the second. Its waters are usually at their lowest stage twice in the year, about the summer and winter solstices, at their highest in May and October, but there are occasional exceptions. There has been a constant increase in the height of the floods of the Po for the last three centuries. This is partly explained by the permanent elevation of some portions of the channel of the river, and the temporary rise of other portions from sedimentary deposit, and by the general strengthening of the levees in modern times, whence crevasses allowing the escape of great volumes of water are less frequent, but chiefly by the more rapid drainage of the uplands in consequence of the felling of the woods and other "improvements." From original formation, and from a general rise of the bed of the Po at a remote period, the *piarde*, or natural banks, are relatively low. Hence, the adjacent plains, not being gradually raised by flood deposits like the borders of undiked streams, are not much higher than the river-bed. Consequently, the *golene*—and, in case of a breach in the levee, the adjacent plains also—are overflowed upon every considerable rise of the river, and its waters thus acquire space for a great lateral expansion, which serves as a basin of reception, and they do not rise so high as they would in a more confined channel. The difference of level between *ordinary* low water and the highest known, that of the inundation of Oct., 1872, did not exceed 28 feet at Ostiglia, the *ventre* of the floods, or point where they are highest, though it is believed that the water would have risen another foot but for a great crevasse on the right bank of the river, which served as a safety-valve and drew it off. On the whole, the scale of variation of level from the lowest to the highest known stage may be taken at not far from 35 feet.

Besides its vast discharge proportionally to the extent of its basin, the enormous amount of mineral matter ground down to fine silt deposited by its waters at and near its outlet—a consequence of the fact that most of its tributaries are mountain-torrents—is a very extraordinary feature in the physical character of the Po. In floods this is calculated to equal $\frac{1}{300}$th part of the total delivery in *volume*, or almost ten times the mean proportion of solid matter borne down by the Mississippi. It is computed to amount to 55,000,000 cubic yards per annum on the average, and in the single flood of 1839–40, which lasted three months, the Po is asserted to have let fall at its mouth nearly three times that quantity. The deposit extends the delta of the Po into the Adriatic at a rate of advance not greatly inferior to that of the Mississippi, or more than 200 feet per year, though the lateral spread of the sediment is less than at the mouth of the great American river. The total alluvion of the Po and its tributaries, from the earliest to the present age, appears to be little inferior to that of the Nile below the N. boundary of Nubia.

It is perhaps superfluous to add that very many of our numerical data respecting the Po, though derived from the best-known sources, are subject to uncertainty, and that our quantitative estimates in general require verification.

The hydrography of the lower course of the Po, as well as of many of its more important affluents, has been studied with extreme care for many centuries, and the highest theoretical science and practical engineering skill has been brought to bear upon it; but, for reasons which cannot here be stated, the existing knowledge respecting this river is far from complete, and it has not yet been collected and co-ordinated. Of the Po, therefore, as a whole, there exists no monograph at all approaching the remarkable studies of Gens. Humphreys and Abbot on the Mississippi. In that volume the reader will find much additional information upon the Po, and we refer further to the articles ITALY, by PROF. BOCCARDO, and LEVEE, by G. W. R. BAILEY, in this CYCLOPÆDIA; to the article "Po" in the great chorographical dictionary *Italia*, and especially to the numerous essays of the eminent Milanese engineer Lombardini on fluviatile hydrography, among which we particularize his *Guida allo Studio dell' Idrologia* (1 vol. 8vo). A board of engineers have just submitted to the government of Italy a plan for improving, regulating, and partially reconstructing the entire chain of dikes on both banks of the Po, as a national work. GEORGE P. MARSH.

Poaching and Poachers. See GAME LAWS, by PROF. GEORGE CHASE, LL.B.

Pocahon'tas, county in Central Iowa. Area, 576 sq. m. It is a very fertile, rolling prairie-region, finely adapted to wheat and corn culture. It is traversed by Iowa Falls and Sioux City R. R. Cap. Rolfe. P. 1446.

Pocahontas, county of West Virginia. Area, 830 sq. m. It is mountainous, with fertile plateaus and valleys. Wool is an important product. Coal, saltpetre, and superior iron ore are found. Mineral springs are numerous. Cap. Huntersville. P. 4069.

Pocahontas, p.-v., cap. of Randolph co., Ark., at the head of navigation on Black River, 100 miles W. of Memphis, has 2 weekly newspapers and is a shipping-centre for cotton, grain, and live-stock.

Pocahontas, p.-v. and tp., Bond co., Ill., on St. Louis Vandalia and Terre Haute R. R. P. 1535.

Pocahontas, p.-v., Hardeman co., Tenn. P. 225.

Pocahontas, daughter of Powhatan, a powerful Indian chief of Virginia, was b. about 1595. According to the *True Relation* of Capt. John Smith, she in 1607 rescued the latter from death by throwing herself beneath the uplifted war-club and successfully entreating her father to spare the prisoner's life. The truth of this narrative is doubted. The rescue, according to Smith's narrative, took place at Werowocomoco (now Shelly), Gloucester co., Va., near the junction of Carter's Creek and York River. In 1609 she visited Smith with news of an intended Indian attack, and she several times supplied the hungry colonists with corn. In 1612 the chief Japazaws sold her to Argall for a copper pot, and her father offered a ransom of 500 bushels of corn; but in 1613 she married Thomas Rolfe, afterward secretary and recorder-general of Virginia. She was baptized as Rebecca, went to London, and was presented at court. King James, it is said, blamed Rolfe severely for marrying an emperor's daughter without his consent. D. at Gravesend, England, Mar., 1617, leaving a son, Thomas Rolfe, from whom the Randolphs, Eldredges, Murrays, Bollings, Guys, Hemmings, and other leading families of Virginia trace their descent.

Pocatal'ico, p.-v. and tp., Kanawha co., West Va., on Pocatalico River. P. 1597.

Pock'et, tp., Moore co., N. C. P. 1362.

Po'cock (EDWARD), D. D., the foremost of English Orientalists, b. Nov. 8, 1604, at Oxford, where he graduated in 1622; was fellow in 1628; Laud professor of Arabic from 1636; regius professor of Hebrew and canon of Christ Church from 1648; received the degree of D. D. in 1660. D. Sept. 10, 1691. His life was one of many vicissitudes. From 1630 to 1636 he was chaplain to the English factory at Aleppo, Syria, where it was said of him, "This young man speaks and understands Arabic as well as the mufti of Aleppo." He returned to Oxford in 1636 to take the professorship of Arabic, then just founded by Archbishop Laud. After giving one course of lectures he went back to the Orient, and was in Constantinople from 1637 to 1640, collecting manuscripts and coins and ardently pursuing his favorite studies. When he returned to England in 1640 his patron was a prisoner of state in the Tower, and was afterward executed, Jan. 10, 1645. In 1643 his college gave him the living of Childrey in Berkshire, about 12 miles from Oxford. A staunch though not intemperate loyalist, he would have lost his professorships in the time of Cromwell but for the remonstrances of John Owen and John Selden. The restoration of Charles II. in 1660 multiplied and secured his honors. He published, besides other works, *Version from the Syriac and Notes on the Epistles of 2 Peter, 2 and 3 John, and Jude*, omitted in the Peshito (1630), *Specimen Historiæ Arabum* (1648), *Porta Mosis* (1655), *Annals of Eutychius* (1658), *Arabic Version of Grotius de Veritate* (1660), *Abulfaragius Historia Dynastiarum* (1663), and English *Commentaries* on Micah (1677), Malachi (1677), Hosea (1685), and Joel (1691). He also rendered important assistance in the editing of *Walton's Polyglott* (1657). (See his *Works* and *Life*, in 2 vols., by Leonard Twells, London, 1740.)—Of his nine children, two sons, EDWARD and THOMAS, were authors in the same line. R. D. HITCHCOCK.

Po'cocke (RICHARD), LL.D., the Oriental traveller, distantly related to the preceding, was b. at Southampton, Eng., in 1704; graduated at Oxford in 1731; took the degree of LL.D. in 1733; travelled in the East 1737–42; published his *Description of the East and some other Countries* (2 vols. fol., with 178 plates) in 1743–45; was made archdeacon of Dublin in 1745, bishop of Ossory in 1756, and in 1765 bishop of Meath, where he d. suddenly of apoplexy in September of that year. He was the author of some papers in the *Philosophical Transactions* and in the *Archæologia*, but his fame rests upon his work on Palestine, which Robinson pronounces "one of the most important,"

although he knew but little Arabic and his scholarship was more classical than biblical. R. D. HITCHCOCK.

Po'comoke River rises in the Cypress Swamp of Sussex co., Del., flows 60 miles S. and S. W., mostly in Maryland, to Chesapeake Bay. The tide ascends 22 miles, and it is navigable 20 miles, to Snow Hill, Md.

Pocono, p.-v. and tp., Monroe co., Pa. P. 1119.

Pocopson, tp., Chester co., Pa., on Brandywine Creek. P. 573.

Poc'oson, tp., York co., Va. P. 1710.

Pocotal'go, tp., Beaufort co., S. C. P. 605.

Podes'tà [Lat. *potestas*, "power"], an inferior police justice in Italian cities. The name was formerly applied to the chief magistrate of Italian towns, appointed in troubled times with full dictatorial powers. He was usually a stranger to all the local factions, appointed for a term of years, but he sometimes became a permanent despotic ruler. The name was probably first given to the German magistrates whom Frederick Barbarossa appointed over the Lombard cities.

Podgorit'za, town of European Turkey, eyalet of Room-Elee, near Montenegro, is fortified. P. 6000.

Podicip'idæ [from *Podiceps*, *podex*, the "rump," and *pes*, "a foot"], a family of swimming birds including the grebes. The body is somewhat duck-like; the neck moderate; the bill rather short, straight, compressed, and with the culmen decurved toward the tip, which is acute and entire; the nostrils oblong and in a groove near the base of the bill; the wings short, but pointed; the tail very small and inconspicuous; the legs appearing far behind (hence the name); the tarsi stout, rather short, and compressed, covered with small scales; the anterior toes with broad lobate margins, the posterior short and high up; claws short and depressed. The family is closely related to the loons (Colymbidæ), with which it has been confounded by some authors. It includes two well-marked genera—(1) *Podiceps* and (2) *Podilymbus*, the former with about thirty species, the latter with three. These are found distributed over almost the entire globe: *Podilymbus*, however, is peculiar to America. The species usually congregate in small flocks near the sea-coast, as well as on the border of inland waters, but are rarely found on land, their form being ill adapted for walking. They are great divers, and feed chiefly on fishes. THEODORE GILL.

Podie'brad (GEORGE), b. Apr. 23, 1420, of a noble and wealthy Bohemian family belonging to the moderate section of the Hussite party; joined the Utraquists after the election of Albert of Austria to the Bohemian throne in 1438, and distinguished himself greatly by compelling Albert to raise the siege of Tabor. As leader of the whole Hussite party, he became governor of Bohemia in 1444, during the minority of Albert's son, Ladislaus the Posthumous, and on the death of Ladislaus he was elected king himself, and crowned at Prague Mar. 2, 1458. It was his great aim to reconcile the Hussites and the Roman Catholics among his subjects, and he acted with wisdom, and not without success. But the pope excommunicated him as a heretic, preached a crusade against him in Germany, incited his son-in-law, Mathias Corvinus, king of Hungary, to attack him, and even instigated his own Roman Catholic subjects to revolt against him. But Podiebrad suppressed the insurrection, routed the German crusaders, defeated the Hungarians several times, and, in order to strengthen the anti-papal and anti-Hungarian party in Bohemia, he induced his countrymen to elect Ladislaus, heir of the Polish crown, as his successor, while his two sons retired into the ranks of the nobility. D. Mar. 22, 1471.

Podo'lia, government of European Russia, bounded W. by Galicia and S. by the Dniester, comprises an area of 16,558 sq. m., with 1,946,761 inhabitants. The surface is mostly level, the soil fertile, and the climate mild. Corn, hemp, flax, hops, and tobacco are grown, and the vine and the mulberry are extensively cultivated. On the excellent pastures large herds of cattle and sheep are reared.

Podophthal'ma [Gr. πούς, ποδός, "foot," ὀφθαλμός, "eye"], a sub-order of the order Rhipidoglossa (class Gasteropoda), characterized by the gills being developed solely on the left side of the branchial cavity, the eyes situated on peduncles, and the body and shell being spiral; it thus contrasts with the Dicranobranchia, and includes the aquatic Trochidæ, Neritidæ, and Haliotidæ, as well as the terrestrial Helicinidæ and related types. THEODORE GILL.

Podophthalmata, an order of crustaceans with the eyes borne generally at the end of more or less elongated movable peduncles, and with a dorsal carapace which extends over the head as well as covers the body, or at least the greatest number of thoracic segments; the feet are, in the typical forms, developed to the number of five pairs, the previous segmental appendages being converted to a greater or less extent into foot-jaws. The order embraces a very large number of species, including all the true crabs, lobsters, crawfishes, shrimps, etc. By recent systematic authors they have been grouped into three orders: Decapoda (including all the forms above mentioned), Schizopoda, and the Stomapoda. THEODORE GILL.

Podophyllum and **Podophylline.** See MAY-APPLE.

Podu'ra [Gr. πούς, ποδός, "foot," and οὐρά, "tail"], a genus of degraded wingless neuropterous insects, found on the surface of stagnant water, on dung-heaps, in hot-beds, and often seen on the snow in winter. They are called "spring-tails" and "snow-fleas," for they can leap a prodigious distance, considering their small size. The short anal bristles are bent under the body, and assist the creature in its leaps. The *Poduræ* are interesting from the fact that their scales are excellent test-objects under the microscope. They belong to a family called Poduridæ.

Poe, tp., Hancock co., West Va. P. 872.

Poe (EDGAR ALLAN), b. at Boston, Mass., Feb. 19, 1809, son of David Poe and Elizabeth Arnold, an English actress, said to have been a natural daughter of Benedict Arnold. His parents, who pursued the vocation of actors, having died in his early childhood, Edgar was adopted by a wealthy citizen of Richmond, Va., Mr. John Allan, by whom he was sent to school at Stoke Newington, near London, England, where he remained until 1822; was prepared for college by private tutors at Richmond; entered the University of Virginia at Charlottesville in 1826; was there distinguished for scholarship, but was expelled within a year, probably on account of addiction to the gaming-table; resided with his benefactor at Richmond two years; went to Baltimore, where he published a pamphlet of 71 pages, *Al Aaraaf, Tamerlane, and Minor Poems* (1829), which contained nothing remarkable and attracted no attention; was admitted a cadet at West Point 1830 through the influence of Chief-Justice Marshall and Gen. Scott, procured by Mr. Allan, but was expelled by sentence of a court-martial for irregular conduct Mar. 6, 1831; published by subscription (his patrons being chiefly cadets) a new edition of his poems, with some additional pieces; again resided some months with Mr. Allan at Richmond, with whom he ultimately quarrelled, when he enlisted as a private soldier in the U. S. army, but did not long remain in that position. In 1833, Poe competed for two prizes of $100 each offered by the publisher of a literary journal at Baltimore, won them both, and in consequence obtained, through Mr. John P. Kennedy, one of the committee of award, the post of editor of the *Southern Literary Messenger* at Richmond, Va. While occupying that position Poe married his cousin, Virginia Clemm, and led for two or three years a life of considerable regularity, devoting himself to study and writing many tales, reviews, essays, and brief poems. Having at length quarrelled with his publisher, Poe removed to New York Jan., 1837; earned a precarious living for a year by writing occasional articles in several papers; published in 1838 his first prose volume, *The Narrative of Arthur Gordon Pym;* went to Philadelphia; was editor of Burton's *Gentleman's Magazine* from May, 1839, to June, 1840, and of *Graham's Magazine* from Nov., 1840, to about Apr., 1842; published *Tales of the Grotesque and Arabesque* (2 vols., Philadelphia, 1840); gained a prize of $100 offered by the *Dollar Newspaper* in 1843, with his tale, *The Gold Bug;* removed to New York in the autumn of 1844, where the appearance of his best-known production, *The Raven*, in Colton's *Whig Review* for Feb., 1845, gained him a wide reputation, and procured him the post of sub-editor on Willis and Morris's *Home Journal*, where, according to the testimony of Mr. Willis, he conducted himself with strict propriety; was associated with Mr. C. F. Briggs in the management of the *Broadway Journal* 1845–46; contributed to Godey's *Lady's Book*, May to July, 1846, the biographical and critical sketches entitled *The Literati of New York City;* resided about this time in a cottage at Fordham, Westchester co., and fell into such poverty that an appeal to public charity in his behalf was made by N. P. Willis in the *Home Journal;* lost his wife, who had clung to him with fond devotion, in Jan., 1848; delivered at the Society Library, Feb., 1848, a lecture, published soon after under the title *Eureka, a Prose Poem*, which comprised a novel and ingenious system of cosmogony; was engaged about this time to an accomplished New England lady, but the engagement was soon terminated; went to Richmond, Va., in the summer of 1849; was there engaged to a lady of fortune, one of his early friends, and having appointed the day for the wedding, started for New York Oct. 2, to make preparations for that event; became in-

toxicated; was attacked with delirium in the streets of Baltimore; was conveyed to the Baltimore Hospital, and there d. Oct. 7, 1849. A monument to his memory was erected in the Westminster churchyard, Baltimore, Oct., 1875, by a subscription raised by the school-teachers of that city. The works of Poe have been repeatedly republished since his death, both in the U. S. and in England, where they are perhaps better known than in America, and have attained an immense popularity in a French translation. They were first edited in New York (4 vols., 1850) by Poe's "literary executor," Rufus Wilmot Griswold, who prefixed a defamatory *Memoir*, many of the allegations of which have been successfully refuted by later biographers, such as Mrs. Sarah Helen Whitman in her *Edgar A. Poe and his Critics* (1860), John H. Ingram in a *Memoir* prefixed to Poe's *Works* (Edinburgh, 1874), and Richard Henry Stoddard in a memoir accompanying a new edition of the *Poems* (New York and London, 1875). A more elaborate biography will probably soon appear, and is fully warranted by the untiring popular interest in the mysterious character and career of one of the most remarkable of American authors. PORTER C. BLISS.

Poe (ORLANDO M.), b. in Ohio Mar., 1832; graduated at the U. S. Military Academy, and entered the topographical engineers July, 1856; major 1867; engaged upon lake survey duty until the outbreak of civil war in 1861, when, after serving as chief engineer department of the Ohio and on the staff of Gen. McClellan, he was (Sept., 1861) appointed colonel of the 2d Michigan Vols., and served with the Army of the Potomac until Dec., 1862, having been appointed brigadier-general Nov. 29, 1862; subsequently served in his engineering capacity as chief engineer 23d corps, Army of the Ohio; as chief engineer of Gen. Sherman's army in the invasion of Georgia, the march to the sea, and through the Carolinas, terminating in the surrender of Johnston's army at Durham Station, gaining the successive brevets from major to brigadier-general for "gallant" and "meritorious" services. Returning to duty with the corps of engineers at the close of the war, he was (1865–70) engineer secretary of the U. S. lighthouse board; in 1870–73 constructed the lighthouse on Spectacle Reef, Lake Huron. (See LIGHTHOUSE CONSTRUCTION.) In 1873 appointed aide-de-camp on the staff of the general of the army, and 1874 a member of the lighthouse board.

Poé'rio (ALESSANDRO), b. at Naples in 1802; was banished when scarcely thirteen years old, and on his return the sentence was renewed in 1821. He passed the time of his exile in Germany, France, and England, and in 1835 returned to his own country and commenced the practice of law; in 1843 published at Paris some anonymous verses full of patriotic fire; in 1848 hastened to the defence of Venice, was mortally wounded at Mestre, and d. invoking blessings on his country. A second and enlarged edition of his poems was published in Florence in 1852, with a *Life* of the author written by Mariano d'Ayala.

Poerio (CARLO), b. at Naples in Apr., 1803; took a most active part in the Neapolitan movements in 1848; was director of the police, and afterward minister of public instruction. On the re-establishment of the Bourbon tyranny, having refused to fly, he was arrested and imprisoned with many liberals, and finally condemned to hard labor. The sufferings of Poerio and his companions in the prisons of Naples were proclaimed to all Europe by Gladstone in his famous letter to Lord Aberdeen. Being liberated in 1858, Poerio retired to Turin, where he contributed by his influence to bring about the annexation of Naples to Piedmont. He was afterward elected deputy to the Italian Parliament, and became one of its vice-presidents in 1861. D. in Florence Apr. 28, 1867.

Poes'tenkill, p.-v. and tp., Rensselaer co., N. Y. P. 1769.

Po'et-Lau'reate, a title once bestowed at universities and by sovereigns at various courts, and so named, it would appear, from the tradition that Horace and Virgil were crowned with laurel in the Roman Capitol. In 1341, Petrarch was crowned poet-laureate, and this has been called the first instance of the title. Tasso died the day before his proposed coronation. Bernardino Perfetti in 1775, and a lady, Signora Morelli (Corilla), in 1776, both improvisators, received the title. Court-poets had long been employed in England, but it is believed that John Kay or Caius, appointed by Edward IV., was the first to receive the title. Skelton, who had been made poet-laureate by both universities, was probably court-poet also. In 1512, Robert Whittington was made poet-laureate by Oxford. This is the last instance of the degree at an English university. The name of Andrew Bernard seems to be the second on the list of court poets-laureate, for there is no proof that Bracton or Scogan, much less that Chaucer, ever bore the title. Spenser, Daniel, and Drayton are sometimes called poets-laureate, but they probably never were officially so called. The regular succession of English court poets-laureate is as follows: Ben Jonson (1630–37), Davenant (1638–68), Dryden (1670–89), Shadwell (1689–92), N. Tate (1693–1714), N. Rowe (1714–18), Eusden (1719–30), Cibber (1730–57), W. Whitehead (1758–85), T. Warton (1785–90), H. J. Pye (1790–1813), Southey (1813–43), Wordsworth (1843–50), and Tennyson (since 1850). The yearly fee of the poet-laureate was formerly £100 and a tierce of canary wine, but since 1813 the wine has been commuted for money.

Po'etry [from the Gr. ποιεῖν, to "make," to "create"] is used in a double sense—the one, especially English, nearly synonymous with "verse," and forming the opposite to "prose;" the other, descending from the Greek literature, denoting all creations of the imagination irrespective of their form, verse or prose, literature or art, and forming a correlative to "science." The former sense has fallen almost entirely out of use in the literature of continental Europe; the latter was not introduced into English literature until very recently, but is gaining ground rapidly. (For more detailed information see DRAMA, EPIC POETRY, LYRIC POETRY, FINE ARTS, etc.)

Poey (FELIPE), b. in Havana, Cuba, in 1802, is of French descent; studied in Madrid, devoting himself especially to natural history; fled to Paris in consequence of having been involved in a political conspiracy; took part in the foundation of the French Entomological Society; published *La Centurie des Lepidoptères* (1828); went to Havana 1830; organized the Museum of Natural History in that city 1837; became professor of natural history in the University of Havana; published a school geography of Cuba (1840), *Geografia Universal* (1842), *Memorias sobre la Historia natural de la Isla de Cuba* (Havana, 2 vols. 4to, 1864), the text being in Spanish, French, and Latin; and commenced in 1865 the publication of a scientific monthly periodical entitled *Repertorio fisico-natural de la Isla de Cuba*, in which he has described 230 new species of fishes. He is a member of the Smithsonian Institution and of the French Academy of Sciences, and author of poems which have been highly commended.—His son, ANDRÉS POEY, b. at Havana in 1837, has taken high rank as a meteorologist, was for several years director of the physico-meteorological observatory at Havana; author of many French publications on meteorology; published a new classification of clouds in the *Report* of the Smithsonian Institution for 1870; is, like his father, a member of the French Academy of Sciences, and commenced in 1875 the publication of *La Bibliothèque positiviste*, as an exponent of the positive philosophy of Auguste Comte.

Pog'gendorff (JOHANN CHRISTIAN), b. at Hamburg, Germany, Dec. 29, 1796; was educated at the University of Berlin, where he became professor of physics in 1834; attained great distinction as an observer of magnetic and electrical phenomena; published a *Treatise on Voltaic Electricity* (1821), and in 1824 became editor of the renowned *Annalen der Physik und Chemie*, and with Liebig edited the *Wörterbuch der Chemie;* has written important works on biography and on the literature of the physical and mathematical sciences.

Poggibon'si, town of Italy, province of Siena, about 25 miles S. of Florence, to whose territory it generally belonged during the Middle Ages. It is now a place of little industry or energy. P. 7760.

Pog'gio Renati'co, town of Italy, province of Ferrara, formerly belonging to Bologna, and fortified as a frontier town. P. in 1874, 5500.

Pogodin (MIKHAIL PETROVITCH), b. at Moscow Nov. 22, 1800; was professor in history at the university of his native city from 1828 to 1844; undertook for archæological purposes extensive travels in Russia; published his *Lectures on the History of Russia* (7 vols., St. Petersburg, 1846–54), besides several other works, and developed great activity as editor and translator. His *Political Letters*, in which he advocated panslavism, made a great sensation and were translated into German in 1860.

Poin'dexter (GEORGE), b. in 1779 in Louisa co., Va.; became a lawyer; removed in 1802 to Mississippi; was chosen attorney-general of Mississippi 1803; delegate in Congress 1807–13; a U. S. judge 1813–17: in Congress 1817–19, where his brilliant and effectual defence of Jackson attracted much attention, but Jackson and he afterward became bitter enemies. Poindexter's duel with Abijah Hunt, who was killed, led to sharp controversies. He was governor of Mississippi 1819–21; U. S. Senator 1831–35, after which he practised law at Louisville; prepared the *Revised Code* of Mississippi laws 1824. D. at Jackson, Miss., Sept. 5, 1853.

Poin'sett, county in the N. E. of Arkansas. Area, 425 sq. m. It is rolling, fertile, well timbered, and adapted to cotton and grain culture. Cap. Harrisburg. P. 1720.

Poinsett (Joel Roberts), LL.D., b. at Charleston, S. C., Mar. 2, 1779, of a Huguenot family; spent his early childhood in England; educated at Greenfield, Conn., under Pres. Dwight 1793–94; went again to England 1796; studied medicine at Edinburgh, and entered the military academy at Woolwich; returned to Charleston and studied law 1800; went again to Europe 1801; travelled in Asia Minor and in Russia; returned home in 1809; was sent to Chili by Pres. Madison to report on the revolution in that country, and there achieved great popularity; was in Congress from South Carolina 1821–25; U. S. minister to Mexico 1822 and 1825–29, filling a position then very difficult and important; U. S. secretary of war 1837–41; founded the Academy of Fine Arts, Charleston, S. C., and liberally endowed the National Institution; author of *Notes on Mexico* (1824) and of various published essays and discourses, and was a strong opponent of the extreme States Rights view. While in the U. S. Poinsett's name is nearly forgotten, he fills a large space in the histories of Chili and of Mexico. D. at Statesburg, S. C., Dec. 12, 1851.

Point, tp., Woodruff co., Ark. P. 788.

Point, tp., Calhoun co., Ill. P. 1551.

Point, tp., Posey co., Ind. P. 980.

Point, tp., Northumberland co., Pa. P. 938.

Point à la Hache, p.-v., cap. of Plaquemines parish, La., on E. bank of Mississippi River, 40 miles S. of New Orleans, has 1 weekly newspaper and an export-trade in sugar and rice.

Point Comfort, Old. See Old Point Comfort.

Point Coupée, parish of Central Louisiana. Area, 500 sq. m. It has Mississippi River on the E. and Atchafalaya on the W. Cotton, corn, sugar, and molasses are among the leading products. Cap. Point Coupée. P. 12,981.

Point Coupée, p.-v., cap. of Point Coupée parish, La.

Point du Chêne, p.-v. of Westmoreland co., N. B., on the island of Shediac, and on Gulf of St. Lawrence, is the N. terminus of European and North American Railway, and has lines of steamers plying to Quebec and Charlottetown. P. about 150.

Pointe-à-Pitre, town of the French island of Guadeloupe, in the West Indies, is well built, has a good harbor on the Petit Cul-du-Sac, and carries on a lively trade. P. about 19,000.

Pointe Claire, p.-v., cap. of Jacques Cartier co., Quebec, Canada, on St. Lawrence and on Grand Trunk Railway, 15 miles W. of Montreal, and 67 miles from Lachine, has extensive stone-quarries. P. 461.

Point Edward. See Sarnia.

Pointer (*Canis avicularis*), a species of dog of the hound type, employed for hunting game. The best-known breed is the Spanish pointer, probably of Eastern origin. The faculty of pointing at game, though much developed by training, seems to be chiefly due to inheritance, so that dogs of the purest stock acquire the habit almost without instruction.

Point Isabel, p.-v. and tp., Clermont co., O. P. 160.

Point Levi. See Levis.

Point Pleasant, tp., Warren co., Ill., has 1 weekly newspaper. P. 1004.

Point Pleasant, p.-v., Monroe tp., Clermont co., O., on Ohio River. Native place of Gen. U. S. Grant. P. 137.

Point Pleasant, v., Valley tp., Guernsey co., O. P. 138.

Point Pleasant, p.-v., cap. of Mason co., West Va., near the junction of the Kanawha with Ohio River, and opposite Gallipolis, O., has 2 weekly newspapers, an extensive trade in coal and salt, and was the scene of one of the most important battles fought with the Indians during the colonial history of America, Oct. 10, 1774. (See Lewis, Gen. Andrew.) P. 773.

Point Reyes, tp., Marin co., Cal. P. 271.

Poiri'no, town of Italy, province of Turin, 15 miles S. E. of the city of Turin. The inhabitants are industrious, and there are 700 private looms in operation. P. 6770.

Poison. See Toxicology. See also Jurisprudence, Medical, by Prof. John Ordronaux, M. D., LL.D.; and Lead-Poisoning.

Poison Ivy. See Rhus.

Poison of Serpents. The venom of serpents is formed in a gland which lies back of and below the eye on each side, and the gland of either side discharges its poison through a duct which leads to the base of the hollow fang. The poison is in all serpents a thin yellow fluid, which is made up chiefly of albuminoid matters in solution, and resembles white of egg. One of these albumen compounds is the poison, the others are inert. The poison is active—half a drop of rattlesnake venom will kill a pigeon—and when dried it preserves its virulence for years; neither is it altered by contact with weak acids, strong alkalies, alcohol, iodine, bromine, or any disinfectant like chlorine or carbolic acid. The recent researches of Indian surgeons corroborate the prediction made years ago by Dr. Weir Mitchell in America, that the action of all the various snake-venoms would be found in time to be alike. In fact, they differ only in that some produce more local effects, and some destroy sooner than others the coagulability of the blood.

The effects are divisible into local and general, immediate and remote. The venom having been injected under the skin by the fang, the first effect is a general feebleness, in which the heart shares, and which is or is not accompanied by nausea and vomiting. If the dose be large, the animal or man dies within a time which varies from twenty minutes to hours; but if, in man, he survives several days, the tendency is to recovery. The first effects are upon the nerve-centres of breathing, and of the heart and muscles in general. If the early depression passes over, recovery is often sudden, or else the creature poisoned enters the second stage of the poisoning. This is characterized by blood-changes, and by a general degradation in the nutrition of every tissue, so that all suffer more or less. The series of changes begins with lessened or lost power of the blood to clot; at the same time the texture of the smaller vessels is so altered as to allow of the escape of the incoagulable blood, which, if the animal survive long, finds its way into the tissue of nearly every organ, causing thus symptoms which vary as the organ most affected is the brain, spinal cord, liver, lungs, or kidneys. These changes result, therefore, in bleeding from the mucous surfaces of the breathing or digestive organs, and in oppressed respiration, bloody stools or bloody urine, and finally in coma or convulsions, which close the scene. These facts account for the variety of descriptions given by authors of the causes of death in snake-bite. The local symptoms vary with the snake, but vary in degree only. First, there is thrown out about the fang-track a vast amount of blood, which, as it cannot clot, soaks through the tissues, and even stains the bones. The muscles near by soften, and at last inflammation comes on, with great swelling and pain, and with, at last, more or less local death of the part.

Snake-venom does not affect plants. Seeds will germinate in it, and it does not check the growth of the yeast-plant or inhibit the development of bacteria or vibriones; but to all life above these it is fatal when inoculated in sufficient amount, while it does not seem to have any power to injure when swallowed; so that the author has even fed pigeons on it, giving 20 or 30 drops a day for a week without harming them. Mixture with gastric juice alone does not destroy its power, but it is altered below the stomach, and seems unable to enter the blood in a virulent form by this channel. Birds die easily from venom—cold-blooded creatures slowly, unless kept very warm.

There is no antidote yet known. The proper treatment is to tie a ligature around the part bitten, and at once to lay open the wound in the line of the fang-mark. It is useless to apply any local dressing, save to put the part in hot water to provoke copious bleeding. If within reach of full help, an elastic bandage should be put around the whole limb, after Esmarch's plan for bloodless operations, until time is given to deal with the part bitten. This would be better than a mere ligature alone, which causes swelling beyond it. After ligation every effort should be made to squeeze out the venom from the wound. Next, alcohol should be given until the heart is excited, when the ligatures may be loosened a little, so as to admit to the general circulation some of the poison, which soon or late must reach it. When the heart begins to fail the ligature should be tightened again and more stimulus given, and so the poison which remains may be fought in detail. The alcohol is not an antidote. Men bitten when dead drunk die; it is a stimulus to carry the suddenly-enfeebled system over this time of weakness. For the second stage there is little to do but to ease pain and wait.

Rattlesnake-bite is rarely fatal; cobra-bite is more so, not on account of being a much stronger poison, but because of the generally larger size of the snakes and of the speed with which in a hot climate they accumulate venom, the severity of symptoms being directly as the dose of poison. The authorities on serpent-venom are Fontana, *Poisons;* Weir Mitchell, *Venom of Rattlesnake;* and Fayrer, *The Poisonous Serpents of India.* Weir Mitchell.

Poisson' (Siméon Denis), b. at Pithiviers, department of Loiret, France, June 21, 1781; was educated at the École Polytechnique, and became professor in that school

in 1802; member of the bureau of longitudes in 1808; counsellor of the university in 1820; peer of France in 1837. D. Apr. 25, 1840. His principal works are *Traité de Mécanique* (2 vols., 1811), *Mathematical Theory of Heat* (2 vols., 1835), besides about 300 memoirs in scientific journals, mostly on mathematical physics.

Poitiers′, town of France, capital of the department of Vienne, on the Clain, is an old, ill-built, and gloomy place, but it has a celebrated lyceum, a theological seminary, a good public library, and other educational institutions. Large breweries, distilleries, spinning-mills, glass-works, and tanneries are in operation, and an active trade is carried on in corn, wine, hemp, wool, wax, honey, and leather. Here Edward the Black Prince defeated and captured King John of France and brought him as a prisoner to England in 1356. P. 30,036.

Poitiers, Diana of. See DIANE DE POITIERS.

Poitou′, an old province of Western France, now divided into the departments of Deux Sèvres, Vendée, and Vienne. It became an English possession in 1151, on the marriage of Eleanor, the countess of Poitou, and Henry of Anjou, afterwards Henry I. of England. In 1204, Philip Augustus conquered it from England, and although it once more reverted to that country in 1360 by the Peace of Bretigny, it was soon after reconquered, and finally incorporated with the French crown.

Pokag′on, p.-v. and tp., Cass co., Mich., on Michigan Central R. R. P. 228; of tp. 1386.

Pokanokets. See MASSACHUSETTS INDIANS.

Poke, a name given in parts of the U. S. to *Phytolacca decandra* (see GARGET-ROOT), and in other parts to *Veratrum viride* (see VERATRUM). These plants are both poisonous, and both useful in medicine, but differ widely in properties and appearance. The young shoots of the former are eaten like asparagus.

Poker, a game of cards for two or more players, originating in the S. W. of the U. S. about 1835, formerly played with 20 cards, excluding all below the tens, but now, under the name "draw-poker," employing a full pack. The original "twenty-deck poker" was a variety of "brag," a game much in use in America early in the present century, but now become obsolete by the superior interest of modern games. The most authoritative statement of the rules of draw-poker may be found in a pamphlet by Hon. R. C. Schenck (London, 1874).

Pokhurn, town of Hindostan, dominion of Jodhpoor, which is tributary to Great Britain, is a desolate-looking place, surrounded with heavy walls, and containing a very conspicuous temple. It carries on an important transit-trade. P. 15,000.

Po′la, town of Austria, in Istria, on an inlet of the Adriatic, 54 miles S. of Trieste, occupies the site of the ancient *Pietas Julia*, of which it contains several interesting ruins—an amphitheatre, a beautiful triumphal arch, etc.; was made a naval station in 1850, and has an excellent and fortified harbor, an arsenal, a dry dock, etc. P. 16,324.

Po′lacre [It. *polacca*], a three-masted vessel of the Mediterranean, sometimes rigged in a peculiar style called the polacca-rig, and oftener square rigged; but the main and fore masts are of only one piece, and have neither cross-trees, caps, tops, nor horses for the upper yards.

Po′land [from *polska*, "a plain"] comprised at the time of its first division an area of 282,000 sq. m., with about 12,200,000 inhabitants, and extended from the Baltic Sea to the Carpathian Mountains; bounded E. by the Russian provinces of Smolensk, Tchernigov, Poltava, and Kherson, and W. by the Prussian provinces of Silesia, Brandenburg, and Pomerania. The surface of this territory presents one vast plain, swelling just enough in the centre to form the watershed between the rivers flowing to the Baltic and those flowing to the Black Sea. Large tracts of the land consist of sand, heath, and swamp, others are covered with forests of pine, beech, and oak, but generally the soil is a light loam, well suited for agriculture and affording excellent pastures. From ancient times large herds of cattle, horses, and swine were reared here, and much rye, barley, wheat, and fruit was raised; honey, wax, and salt were also largely produced.

The inhabitants of this country form one of the principal branches of the Slavic family. They appeared first in history in the fifth century under the name of the Polani, occupying the plain between the Oder and the Vistula, and living among other Slavic tribes, as, for instance, the Masovii, Kujavii, Obotrites, Wends, etc., which they partly absorbed, partly subdued. For several centuries, however, their history is fabulous, and it did not assume a clear and distinct shape until the time of Mieczyslaw I. (962–992). By his marriage with the Bohemian princess Dombrowka he was induced to embrace Christianity and to allow it to be preached among his subjects, and thereby the country came in close contact with Western and Southern Europe. His son, Boleslas I. Chrobry the Great (992–1025), extended the frontiers to the Saale in the W., the Dnieper in the E., and the Danube in the S., and contributed at the same time very much to the consolidation of the empire; he established the archbishopric of Gnesen and received the royal crown from the pope. Both these kings belonged to the Piast dynasty, which ruled over Poland to 1370, when it became extinct with Casimir III. It was followed by the dynasty of the Jagellons, who were grand dukes of Lithuania, and united that country to Poland. When the Jagellonian family became extinct in 1572 with Sigismund II., Poland became an elective monarchy; and this circumstance is apparently the principal cause of all the great misfortunes which befell the Polish nation. Parties were formed, which fought not for victory, but for life, and means were employed in the party contests which made defeat not ruin, but crime. It was natural that the party which opposed the election of a king should often assume the aspect of traitors in the eyes of the king elected, and thus it became less unnatural when parties often employed treason in order to avoid defeat. Such is the principle of the elective monarchy, and this principle had in Poland the freest scope for its evil consequences, because it corresponded to a defect in the national character. There is, or was, in the Polish character a wild pride, an undisciplined feeling of independence (independence without obedience), a wrong idea of freedom (freedom without duty); and their history is the Nemesis of this fault. They saw in the elective monarchy a guaranty of their liberty as a people, and they overlooked the fact that it might be the annihilation of their existence as a nation—a mistake which reappears in many other points of their political organization, most strikingly in their *liberum veto*. In the Polish diet, the foundation of which was laid by Casimir II. (1177–94), any one member had it in his power to bring the action of the whole diet to a dead standstill by his veto. As it was impossible for a Pole to submit to anything which was not of his own choosing, every decision of the diet had to be unanimous in order to be valid; and when, after months of debate and fight, of intriguing and bribery, of violence and manslaughter, the assembly approached to unanimity, one disagreeing member, concealed in the chimney and in the last moment crying out into the hall his veto, was enough to prostrate the most enormous exertions and renew the most intolerable agonies; and just as if there had been an evil purpose in the play, the social organization of the Polish people showed a defect similar to that of their political constitution. There was no third estate. Commerce and industry were almost exclusively in the hands of the Jews. They were degraded into mere means of gain, and they never ranked, or pretended to rank, as an important branch of the business of the people. Literature and art were occupations of the nobility, and nothing but occupations. Splendid gifts were wasted in finding out new ornamentations for other people's ideas and other people's artistic types. The nation consisted of two classes only—the nobles, who owned the soil and strove after an illusory freedom; and the serfs, who cultivated the soil and were tied to it in miserable thraldom. The connecting link, the vital channel between these two classes, was lacking, and in several cases the Polish peasants sided with the oppressors of the Polish nation, and fell with fire and sword on their own countrymen who had risen in rebellion to fight for the freedom of their fatherland. The consequences of this situation soon became evident. In 1572 the dynasty of the Jagellons became extinct with Sigismund II. In 1573 more than 25,000 Polish noblemen in brilliant attire, armed *cap-à-pie*, and with their horses gorgeously caparisoned, assembled on the field of Wola to choose their new king. Several candidates presented themselves, and the most worthless of them was chosen—Henry of Valois. Shortly after, however, he ran away to become king of France, and then followed the voivode of Transylvania, Stephen Bathori (1575–86); three princes of the Swedish Vasa dynasty, Sigismund III., Ladislaus VI., and John Casimir (1586–1672); a native Pole, John Sobieski (1674–96); and at last the two electors of Saxony, Augustus II. to 1733, and Augustus III. to 1763. Every new prince brought a new set of vices, which the Poles imitated with too much success, and produced wars with new enemies, in which the Poles won the battles with their blood and paid the expenses with their best provinces. Internal jealousy, rivalry, and dissensions split the nation into as many parties as there were noble families, and bribery, violence, intrigue, and treachery blossomed like thistles in August. Poland was ripe, and with the death of Augustus III. in 1763 the end began. There was one party, called monarchists or

reformers, and headed by the family of Czartoryski, which saw where the root of the evil lay, and tried to hit it. The abolition of *liberum veto* and the establishment of an hereditary constitutional monarchy were their ideas; and in order to realize them they sought and found the support of Catharine II. of Russia. At the death of Augustus they succeeded, by the aid of Russian bayonets, in placing Stanislas Poniatowski, a member of the Czartoryski family and a great favorite of the empress, on the Polish throne, and the work of reform began immediately. Catharine saw very soon, however, that Poland, reformed in this direction, would very rapidly fall out of her grasp, and accordingly she changed position. There was another party, headed by the family of Potocki, and called republicans because they defended the old oligarchical institutions. They had adopted the old Polish maxim of religious toleration, while the Czartoryskis were fanatical Roman Catholics and tried to exclude all dissenters from office. The empress chose to defend religious toleration and "republican" institutions, and having entirely forgotten her former favorite, the present king, she had a number of his adherents kidnapped in the night and sent to Siberia. This occasioned the Confederation of Bar, headed by the family of Pulaski, and formed in 1768 against foreign aggression (which meant Russia), regal usurpation (which meant the king and the Czartoryski party), and the influence of the dissenters (which meant the republican or Potocki party). The confusion could not be greater. The confederates entered into an alliance with the Turks, and the war began. Catharine had a large army in the country, and in 1772 a Prussian and an Austrian army also entered Poland. A diet was convoked in 1773, but only to sanction the dismemberment of the country—its first division. Russia took the palatinates of Polotzk, Vitebsk, and Mstislavl, comprising an area of 42,000 sq. m., with 1,800,000 inhabitants; Prussia took the province of Posen, area 13,000 sq. m., population 416,000; and Austria took Galicia and Lodomeria, area 27,000 sq. m., population 2,700,000. The second and third divisions followed in rapid succession. The people had now become thoroughly roused to the appreciation of the dangers which their old constitution involved, and reform became the work of the day. *Liberum veto* was abolished, the crown was made hereditary, the cities received political rights, etc. But, unfortunately, there were found a few persons who, at the instigation of Catharine II., formed the Confederation of Torgovitza in 1792, in defence of the old "republican" institutions, and under the pretext of aiding them and their cause the Russian army invaded Poland once more. Frederick William II. of Prussia, who had encouraged the reformers, found it more profitable now to side with the czarina, and when, at last, the poor king himself went over to the confederates, Joseph Poniatowski and Kosciusko's victories were in vain; the second division took place. Russia seized a territory of 96,000 sq. m., with 3,000,000 inhabitants, and Prussia one of 22,000 sq. m., with 1,100,000 inhabitants. A general and violent rising in all the Polish provinces was the consequence, and the Russians and Prussians had to retreat; but in the right moment Austria entered the stage and turned the balance. Kosciusko was taken prisoner at Macieowice, Praga was stormed by Suwaroff, Warsaw capitulated, the king resigned his crown, and the third division (in 1795) annihilated the existence of Poland. Russia took all the provinces E. of the Niemen and Bug (area 43,000 sq. m., population 1,200,000); Austria, those between the Bug and the Vistula (area 18,000 sq. m., population 1,000,000); and Prussia the remainder, together with the capital (area 21,000 sq. m., population 1,000,000). Thus the end had come. In 1814 a rearrangement of the Polish territories took place. Napoleon had in 1807 established the duchy of Warsaw, consisting of the Polish provinces which Prussia ceded by the Treaty of Tilsit. But after his disastrous campaign in Russia any hope of the re-establishment of the old kingdom of Poland vanished, and at the Congress of Vienna the largest part of the former Polish territory was given to or taken by Russia. Alexander erected a kingdom of Poland, gave it a free constitution, and, at least in the beginning, the country seemed to have not only a tolerable, but even a hopeful future. But no one ever knew what Alexander meant. The good and sensible which he attempted remained floating in the air like a dream; that on which he succeeded in bestowing form and shape was atrocious and disgusting. At the end of his reign that line of policy began to show itself which since has been followed by his successors—denationalizing and Russianizing Poland. The consequence of this policy has been a number of bloody rebellions—in 1830, 1846, 1849, and 1863—which have been put down and stamped out by the Russians with unexampled and revolting severity, while the behavior of the Poles has excited at once the highest admiration for their valor and perseverance and the deepest pity for their lack of unity and discipline.

Language and Literature.—See POLISH LANGUAGE AND LITERATURE, by JOSEPH KZARGÉ. CLEMENS PETERSEN.

Poland, p.-v., Cass tp., Clay co., Ind. P. 126.

Poland, tp., Buena Vista co., Ia. P. 60.

Poland, p.-v. and tp., Androscoggin co., Me. P. 2436.

Poland, tp., Chautauqua co., N. Y. Pop. 1418.

Poland, p.-v. and tp., Mahoning co., O., on Ashtabula Youngstown and Pittsburg R. R. P. 453; of tp. 2481.

Poland (LUKE P.), LL.D., b. at Westford, Vt., Nov. 1, 1815; received an academic education: was admitted to the bar 1836; was register of probate 1839–40, prosecuting attorney 1843–44; judge of the supreme court, annually re-elected, 1848–65, becoming chief-justice 1860; served as U. S. Senator, filling the vacancy caused by the death of Jacob Collamer, 1865–67, and was a member of Congress 1867–75; was a regent of the Smithsonian Institution, and took an active part in legislation.

Polar, in geometry. See POLE.

Polar Bear. See BEAR.

Polar Circles. See ANTARCTIC and ARCTIC.

Polar Clock. See OPTICS (conclusion), by PRES. F. A. P. BARNARD.

Po'lar Co-or'dinates, a system of co-ordinates by means of which points are referred to a fixed line, called the *initial line*, and to a fixed point of that line, called the *pole*. There may be two cases: (1) all the points considered may lie in the same plane; and (2) the points considered may be situated in any manner in space. In the former case, only two co-ordinates are required; in the latter case, three are necessary. (1) Let A X be a fixed line, and let P be any point lying in a plane through A X; then will the point P be known, or given, when we know the angle X A P and the distance A P. The angle X A P, denoted by v, is called the *direction angle* of P, and the distance A P, denoted by r, is called the *radius vector* of P. By giving proper values to v and r, the point P may be made to coincide with any point of the plane X A P. If P is any point of a plane curve lying in the plane X A P, the equation which expresses the relation between r and v is called the *polar equation* of the curve; r and v are the *polar co-ordinates* of the point P. (2) Let A X be a fixed line, let X A P′ be a plane through A X, and let P be any point in space. Draw P P′ perpendicular to the plane X A P′, and let P′ be the point in which this perpendicular meets the plane; then will the position of P be known with respect to A X when we know the angle X A P′, denoted by u, the angle P′ A P, denoted by v, and the distance A P, denoted by r. The quantities u, v, and r are the *polar co-ordinates* of P; by giving suitable values to these co-ordinates, the point P may be made to coincide with any point in space. If P is any point of a curve in space, the two equations which express the relations between r, v, and u are called the *polar equations* of the curve. If P is any point of a curved surface, the single equation which expresses the relation between r, v, and u is called the *polar equation* of the surface. The method of polar co-ordinates is used in analytical investigations, and on account of its simplicity it is peculiarly adapted to the subjects of astronomy and analytical mechanics. W. G. PECK.

FIG. 1.

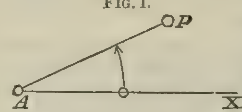
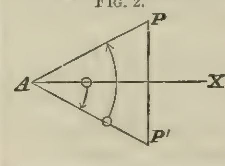


FIG. 2.



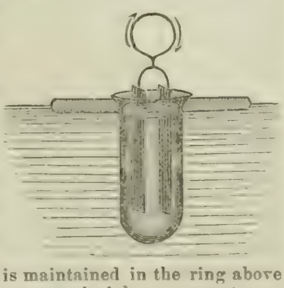
Po'lar Equa'tions, of a curve or surface, are those in which, instead of rectangular co-ordinates, the *distance* of the point from the origin, and the angle or angles which its direction makes with the axes of reference, are used. They are much used in astronomy for the expression of the orbits and varying positions of the heavenly bodies; indeed, the terms *latitude, longitude, right ascension, declination*, etc. refer to angular co-ordinates, which alone can be directly derived from observation.

Polar'iscope [Gr. πολεῖν, to "turn," and σκοπεῖν, to "view"], properly, an instrument for testing the condition of radiant light as to polarization. The term is, however, very commonly employed to denote any of the various forms of apparatus designed for the examination of transparent media with a view to ascertain how far they may possess the polarizing power. Among the simpler forms of polariscope may be mentioned that of Savart, in which two plates of quartz four or five millimètres thick, cut

from the crystal parallel to a face of one of the terminal pyramids, are crossed upon each other and secured in a setting along with a tourmaline plate having its axis 45° from the principal planes of the quartz. The tourmaline acts as an analyzer (see POLARIZATION), and when the light coming to the eye through this eye-piece is polarized, the field of view is striped with colored bands or fringes. In Babinet's polariscope a thick plate of unannealed glass occupies one end of a short tube, and a Nicol's prism the other. This in polarized light gives colored figures in the field, which in common light are not seen. Arago's polariscope consists of a plate of quartz cut across the axis placed in one end of a tube which carries in the other end a doubly-refracting prism. Two images are seen, both colorless in common light, but exhibiting complementary colors in light which is polarized. Soleil's polariscope, employed in his ingenious saccharimeter, is a disk of quartz formed of two semicircular plates severally cut from right-handed and left-handed crystals across the axis, and joined along their common diameter. Light transmitted through this disk and received through an analyzer is colorless if unpolarized; but if originally polarized, will exhibit complementary colors in the two semicircles, except in a single position of the analyzer, in which the tint is the same on both sides. This tint, called the "tint of passage," changes with a very slight movement in rotation of the analyzer or of the plane of original polarization, and the tints become again contrasted. Senarmont's polariscope is a compound plate, or flat rectangular prism made up of four triangular prisms, two of them cut from right-handed, and the other two from left-handed quartz crystals. In polarized light it presents colored stripes parallel to the edges of the plate, the middle stripe being well defined and dark. These stripes, in a certain position of the analyzer and of the plane of polarization, are continuous from end to end; but on the slightest rotatory displacement of either they become dislocated, the halves being displaced laterally in opposite directions. Any instrument capable of being used as a polarizer, or as an analyzer of polarized light, may serve to a certain extent as a polariscope, since, when common light is observed through such an instrument, the intensity is independent of the azimuth; while polarized light exhibits a variable intensity when the azimuth of the instrument is varied by rotation. F. A. P. BARNARD.

Polar'ity [Gr. πολεῖν, "to turn"], in language, is the name of a phenomenon, which some words present, of having opposite meanings, as *dike*, which is applied to a ditch and an embankment, as the clay taken from one forms the other.

Polarity, a physical character possessed in certain conditions by some bodies or their molecules, in virtue of which they manifest, in a determinate direction, properties which are analogous and at the same time contrasted on opposite sides. The original idea attached to this term was much simpler, embracing merely a geometrical relation. A pole of any circle of the sphere is a point in the spherical surface around which as a centre an arc of a great circle revolving in the same surface will describe with its remoter extremity the circumference of the circle of which it is the pole. As there are always two points on the sphere which fulfil this condition, and as these are diametrically opposite, the term *pole* was, in consequence of the obvious analogy, early transferred to the opposite points in a magnet which are the apparent centres of its dissimilar attractive and repulsive forces. The notion seems, indeed, to have long prevailed that these forces are actually inherent in these points; but as every fragment of a magnet, however small, has still its two poles, it is evident that such polar points are merely the points of common intersection of the resultants in different directions of all the forces exerted by the individual molecules. Magnetic polarity is happily illustrated and rationally explained by the theory of Ampère, which attributes the phenomena of magnetic attraction and repulsion to the reaction upon each other of closed electric circuits surrounding the molecules. The condition of a molecule, as supposed in this theory, is illustrated on a palpable scale in the little apparatus represented in the cut known as "De la Rive's ring." A current generated by a miniature battery floated on a cork is maintained in the ring above the float; and this, when approached by a magnet, exhibits polarity in a direction at right angles to its plane, the axis being reduced to a minimum, and the two poles sensibly coincident.



The term "polarity" is not, however, limited in physics to cases in which manifestations of active energy are observed to take place. It is applied to any case in which similar but contrasted properties are oppositely and symmetrically disposed. The most important examples of this are the polarity possessed under certain circumstances by the rays of light and heat, for which see POLARIZATION OF LIGHT. F. A. P. BARNARD.

Polariza'tion of Light, a physical condition produced in rays of light by reflection or refraction, in which they exhibit unequal intensities when subsequently reflected in different planes at a constant incidence. This is the characteristic most easily detected, though polarized light possesses other properties, to be presently mentioned. Polarization of light by reflection was first, as stated in the article OPTICS, observed by Malus in 1808. It is also produced by refraction—partially by ordinary refraction, and completely by double refraction. Polarization by reflection is also partial, except for a limited number of reflecting substances, and for them at particular determinate incidences. Water and glass are such substances, and the polarizing incidences for these are—for the first, 52° 45′, and for the second, 54° 35′. The variations of relative intensity of the two images of a luminous point produced by a doubly-refracting crystal, when observed through a second similar crystal which is rotated in azimuth, are described in the article on REFRACTION, DOUBLE (which see). Malus discovered that the two images of a radiant observed through a single crystal undergo similar variations when the crystal is rotated, provided the radiant is seen by reflection at the incidences just specified from water or glass; and thus he reached the conclusion that light so reflected possesses all the properties which belong to the two pencils into which a ray of common light is divided by a doubly-refracting crystal. Accordingly, if such a crystal be placed in the path of a ray reflected at the polarizing angle, with the principal plane of the crystal or a conjugate plane in the plane of reflection, the ray will not be doubly refracted. (For definition of these terms see REFRACTION, DOUBLE.) But if the crystal be turned in azimuth, two rays will make their appearance, unequal at first in intensity, but becoming equal at the azimuth of 45°. Beyond this azimuth the ray which was previously most intense fades gradually away, while the other gains in strength, until at 90° the former disappears entirely, and the latter remains alone. These phenomena are repeated in every quadrant.

If the ray which has been reflected as above described be incident upon a second surface of glass at the same angle (54° 35′) as at first, the plane of second reflection corresponding with that of the first, it is in part reflected and in part transmitted, as is the case with common light; but if the second plane of reflection be at an azimuth of 90° with that of the first, no reflection at all will occur, but the whole ray will be transmitted.

An interesting experiment of Brewster illustrating the identity of the phenomena of polarization by reflection, and polarization by double refraction, is the following: Let the light of a candle or other luminous object be polarized by reflection, and afterward received, at the polarizing angle, upon a plate of plane glass which has its plane of reflection in azimuth 90° from the plane of polarization. It will be wholly transmitted, so that, to an eye placed anywhere in the direction in which reflection would ordinarily occur, the radiant will be invisible. The eye remaining in this position, let another person breathe upon the glass plate, and instantly the luminous object will appear, and will continue to be seen until the film of moisture left by the breath has evaporated. This is because the polarizing angle for water is not the same as that for glass. The experiment may be varied and made still more striking by placing a second plate by the side of the first, and adjusting this one to the polarizing angle for water. The radiant will then be visible in the second plate, but not in the first. In this state of things, if both plates be breathed on simultaneously, the light in the second plate will be extinguished, and that in the first revived by the same breath.

It is only at the angles which have been mentioned that polarization by reflection is complete. But partial polarization takes place in reflection at any angle, being zero at the incidences 0° and 90°, and increasing from those incidences up to the polarizing angle. Light is polarized by reflection from all polished surfaces, but it is only in the case of bodies whose indexes of refraction are in the neighborhood of 1.4 that the modification which it undergoes has the simplicity which belongs to the examples we are considering. The index of water is 1.336, and that of crown-glass 1.48 to 1.53.

Malus believed the angle of polarization of a given

body to be independent both of its refractive and of its dispersive power. Dr. Brewster, however, demonstrated that this angle depends on the refractive power, and is connected with it by the law that "the index of refraction of any body is the tangent of the angle of polarization." From this last law we derive one or two interesting consequences—first, at the angle of polarization the reflected ray is perpendicular to the refracted ray; for, putting i for the angle of incidence, r for the angle of refraction, and n for the index, the law of Snellius gives us $n \sin r = \sin i$; and the law of Brewster, just mentioned, gives $n = \tan i$. Hence,

$$\tan i \sin r = \frac{\sin i}{\cos i} \sin r = \sin i; \text{ or, } \sin r = \cos$$
$$\text{and } i + r = 90°.$$

Secondly, when light falls upon a transparent plate having parallel surfaces, if the angle of incidence at the first surface is the polarizing angle, the angle of incidence at the second surface will also be the polarizing angle for that surface. In this case r is the angle of incidence and i the angle of refraction for the second surface, the index of refraction being $\frac{1}{n}$, and we have

$$\tan r \sin i - \frac{\sin r}{\cos r} \sin i = \sin r; \text{ or, } \sin i = \cos r,$$
$$\text{and } i + r = 90°.$$

We have seen that when the two polarized rays into which a single ray of common light is divided by double refraction in passing through a rhomb of Iceland spar fall upon a second similar rhomb, they are both of them subdivided in most of the positions of the second rhomb, but that the intensities of the rays of each pair are unequal, except when the principal planes of the rhombs differ in azimuth 45°, and that one member of each pair disappears entirely when the principal planes are coincident or normal to each other. The inequality of intensity is variable, and is dependent on the angle between the principal planes. If one ray of either pair be observed through all its variations, it will be found to begin from zero of intensity to increase regularly in brightness for 90°, and then to diminish through the second 90° to zero again. The other member of the same pair passes through a similar series of changes, but its maxima correspond in azimuth to the minima of the first, and its minima to the maxima of the first.

A ray which has been polarized by reflection possesses the same character as those which have been produced by double refraction in Iceland spar; and, accordingly, if such a ray be transmitted through a doubly-refracting rhomb which is turned in azimuth in the manner just described, it will be divided into two rays, which will alternately increase and diminish in intensity, and of which one will become zero in the azimuth 0° or 90° between its plane of polarization and the principal section of the rhomb. Assuming the united intensities of the two rays into which a single one is thus divided by double refraction to be equal to the total intensity of the original ray, Malus inferred that their several intensities should vary as the squares of the sines and the cosines of the azimuth. Thus, if I be put for the total original intensity, and a for the azimuth, reckoned from the position of coincidence of the plane of polarization with the principal section of the rhomb, then the ordinary ray would have the intensity $I \cos^2 a$, and the extraordinary $I \sin^2 a$. These values fulfil the condition of constancy of sum, since

$$I \cos^2 a + I \sin^2 = I.$$

If a ray which has been polarized by reflection fall, at the polarizing angle, upon a second mirror of transparent glass with parallel faces, it will be divided into two rays, one of which will be reflected and the other transmitted. When the second mirror is turned in azimuth around the incident ray, these two derivative rays will undergo changes of intensity somewhat resembling those which have just been described as produced by double refraction. When the two planes of reflection are coincident, the intensity of the reflected ray will be maximum, and that of the transmitted ray minimum. This minimum will not, however, be zero. When the two planes differ in azimuth 90°, the intensity of the transmitted ray will be maximum, and that of the reflected ray minimum. This minimum *will* be zero, and the simultaneous maximum of the transmitted ray will be equal to the total intensity of the incident light. The alternations in this case resemble, therefore, to a certain extent, those previously described as produced by double refraction; but they are not represented by the law of Malus. By *plane of polarization*—a term used above without definition—is always to be understood the plane in which a polarized ray is most susceptible of reflection at the polarizing angle.

In the arrangement of two mirrors, as above described, when the second mirror is rotated in azimuth, its plane of incidence and reflection is constantly changing its inclination to the plane of polarization of the ray incident upon it. Suppose the incidence upon the second mirror *not* to be at the polarizing angle. It is found that after reflection in an oblique azimuth the plane of polarization is nearer to the plane of reflection than it was at incidence. If the azimuth at incidence be represented by a, and that after reflection by a', there will be found to be a constant ratio between $\tan a$ and $\tan a'$, $\tan a'$ being always less than $\tan a$. By many reflections, with the same azimuth between the mirrors, the plane of polarization may be brought indefinitely near to the plane of reflection, but it can never be made in this way absolutely coincident with it.

When common light is reflected from any surface at an angle greater or less than the polarizing angle, it is found to be partially polarized; that is to say, it is made up of a mixture of polarized light with common light. By repeated reflections at the same incidence the polarization may be made sensibly complete. The number of reflections necessary for this purpose will be greater as the angle of incidence is farther from the polarizing angle. It must not be overlooked that, though at the angle which we have called the polarizing angle all the light that is reflected is polarized, yet that this is, after all, but a small portion of the incident light. From a single surface of glass it amounts to less than 8 per cent. When, for purposes of experiment, it is desired to obtain a large and intense beam of polarized light, it has accordingly been found useful to employ many reflecting plates placed one upon another, forming a *bundle* or *pile*. It is obvious that the thinner these plates are made (so that they are not so thin as to produce color) the more convenient they will be in use, and, from the diminution of absorption, the more economical of light. Not fewer than sixteen are usually employed.

The amount of light reflected at different angles of incidence goes on increasing from 0° to 90°. The amount which is polarized in the reflected beam also goes on increasing, but not throughout the quadrant. For glass having the index 1.5 the incidence of maximum polarization is 79°. At this incidence the total intensity of the reflected light is expressed by the decimal 0.355, the intensity of the incident light being 1. The amount which is polarized in the reflected beam is, however, only 0.1518, which is still about double that which is reflected at the polarizing angle. But, comparing this value with the foregoing 0.355, we shall see that it is less than half the total light reflected (44 per cent.), and accordingly it is not suited to exact experiments in polarization.

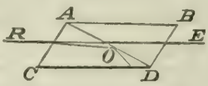
When a transparent reflector is employed as a polarizer, the transmitted beam will be found to contain light which is polarized in a plane perpendicular to the plane of refraction. The amount of light so polarized is exactly equal to the amount polarized at the same time by reflection, and in the plane of reflection; and as the maximum amount polarized by reflection from one surface of glass having the index 1.5 is 0.1518, this also is the maximum amount which can be polarized at one surface by refraction. But since, at this angle of maximum polarization, the total reflection is only 0.355, the total transmission will be 0.645, and of this amount the polarized portion will be but 23½ per cent. But if this light, already partially polarized, be transmitted through other refracting surfaces, though it will continually lose in total intensity by reflection, it will gain in the *proportion* of the polarized light which it contains; and if the incidence is that of the polarizing angle for reflected light, the quantity transmitted *which is polarized* will continue to increase *in absolute amount,* notwithstanding the decrease of *total intensity,* until polarized light only is transmitted. Moreover, if the number of refracting plates employed should happen to be greater than is necessary to produce complete polarization, the supernumerary plates will not reduce the amount of polarized light transmitted, since, at the incidence supposed, they are incapable of reflecting light polarized transversely to the plane of reflection. This statement presumes, of course, that the refracting surfaces are perfect, and that no light is lost by absorption in the media.

It is a curious fact, resulting from the polarizing power of a pile of glass plates, that the pile is more transparent when held at an obliquity greater than the angle of polarization than it is at that angle, and that the transparency increases with the obliquity. This is owing to the fact that the light which has been polarized by the first few laminæ undergoes very little loss by reflection on increasing the obliquity; but the amount *polarized* in these first refractions increases as the obliquity increases, more rapidly than the loss by reflection of the natural light falling on the same surface is increased. The intensity of the transmitted beam, therefore, becomes actually greater as

the obliquity is greater—a fact which is the reverse of what happens with a single plate.

In observations upon polarized light there are some inconveniences attending the use of a mirror, which when turned in azimuth obliges the observer to change his own position, or of a doubly-refracting prism or crystal, which presents two images often not sufficiently separated. Both these disadvantages are obviated by means of a prism invented by Mr. Nicol, which is now in almost universal use. This contrivance is represented in Fig. 1. It is an elongated rhomb formed of Iceland spar, its length being about three times its breadth. Having been brought into this shape from the natural crystal, it is carefully sawn asunder in the plane which divides it symmetrically through its shortest diagonal A D, and then reunited by means of Canada balsam.

FIG. 1.



This substance is perfectly transparent, and has a refracting power whose index is 1.532, intermediate between those of the ordinary and extraordinary rays—viz. 1.654 and 1.488. The relative index between the crystal and the balsam for the ordinary ray is 1.0796, and the limiting angle of emergence from the former to the latter is 68°. The ordinary ray from R meets the surface A D at a greater angle than this, and is totally reflected at O. The extraordinary ray passes through. The sides of the prism are blackened to prevent a second reflection. This ingenious contrivance is invaluable to the observer in this interesting branch of optical investigation. Its advantages are, however, in some respects limited. The necessary length of the prism, as compared with its lateral dimensions, renders it difficult to employ light of any considerable convergency or divergency. The cost of the construction of such prisms increases also very rapidly with their magnitude, and few have been made which measure more than an inch on the side. Those commonly found with opticians are much smaller than this.

Another convenient eye-piece, which may also serve, like Nicol's prism, as a polarizer for small beams, is formed of a lamina of tourmaline cut parallel to the axis. This mineral possesses the very remarkable property, when not in exceedingly thin laminæ, of suppressing one of the rays into which incident common light is divided by it, and transmitting the other. The ray transmitted, as in Nicol's prism, is the extraordinary ray. Cut perpendicularly to the axis, a plate of tourmaline is opaque. Two equal plates, cut parallel to the axis, are opaque when crossed upon each other. The disadvantages of the tourmaline eye-piece are—first, the color of the crystal, which mars the beauty of the tints exhibited by polarized light, and to some extent neutralizes them. It is rather unfortunate that the crystals which are least colored are usually bad polarizers. In this respect different crystals very much differ. Some, which are light green, transmit a notable amount of the ordinary ray even when quite thick. Those which polarize best are usually brown or yellowish-brown. Occasionally one of this kind will be found which polarizes well without being very disagreeably dark. But an equal if not greater disadvantage of the tourmaline is the great brittleness of the crystal, and the rarity of specimens in which fissures do not naturally exist. It is difficult, therefore, to obtain clear plates of any considerable size. Finally, the supply seems, of late years, not to have kept pace with the demand, and opticians intimate that it is almost impossible to obtain large specimens fit for optical purposes at all.

A few years since Dr. Herapath of London announced the discovery of a property like that of tourmaline in artificially prepared crystals of the iododisulphate of quinine. These crystals are but slightly colored, and could they easily be prepared and made permanent would probably come into general use. Dr. Herapath succeeded in obtaining specimens half an inch across. The peculiar property of the tourmaline was also early observed by Sir David Brewster in agate, but that substance is not sufficiently transparent for the purposes of optical experiment. For large polarizers, mirrors may be employed made of black glass or bundles of thin plates, as above described. Instruments in compact form for observations on polarization are called polariscopes. (See POLARISCOPE.)

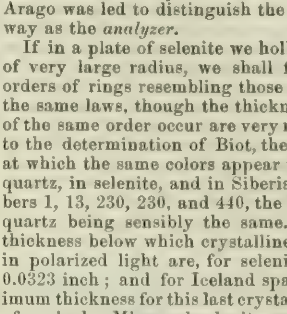
Upon examining thin plates of certain transparent crystals, such as mica, selenite, or quartz, by means of transmitted polarized light, M. Arago found that when the light was received upon the eye through a prism formed of Iceland spar, the richest conceivable colors made their appearance, which were complementary to each other in the two images, and which varied in intensity with the azimuth of the lamina or of the prism. When the principal plane of the prism coincides with the plane of polarization of the light, and the azimuth of the lamina is varied, the maximum brilliancy of coloring is found in the azimuth of 45° between the principal section of the lamina and the plane of polarization. When the azimuth is 0° or 90° the color entirely vanishes, and the light appears entirely unchanged. At intermediate azimuths the color has an intermediate intensity, regularly increasing and diminishing between the positions of minimum and maximum. These variations, as well as the thickness of the laminæ themselves in which the phenomena appear, satisfied M. Arago that the colors could not be owing to the same causes which produce the colors of Newton's rings. Still, they had evidently some relation to the thickness, for it was not difficult to remove them entirely, either by considerably increasing the thickness or by excessively diminishing it. In the rotation of the lamina as just described, the colors which appear between the successive positions of minimum are always the same in the same image. But when the lamina itself remains fixed while the prism at the eye is rotated in azimuth, the two images interchange their colors in passing each successive position of minimum.

If instead of a doubly-refracting prism as an eye-piece, a mirror, presented to the ray at the polarizing angle, be employed, only one of the images is reflected, but the other, if the mirror be transparent, will be seen in the light transmitted. In consequence of this separation of effects, M. Arago was led to distinguish the mirror when used in this way as the *analyzer*.

If in a plate of selenite we hollow out a spherical cavity of very large radius, we shall find it to exhibit several orders of rings resembling those of Newton, and following the same laws, though the thicknesses at which the colors of the same order occur are very much greater. According to the determination of Biot, the comparative thicknesses at which the same colors appear in air, in Iceland spar, in quartz, in selenite, and in Siberian mica are as the numbers 1, 13, 230, 230, and 440, the thickness for selenite and quartz being sensibly the same. The limits of absolute thickness below which crystalline plates fail to give colors in polarized light are, for selenite, 0.017 inch; for mica, 0.0323 inch; and for Iceland spar, 0.001 inch. The maximum thickness for this last crystal is but $\frac{6}{1000}$ths or $\frac{7}{1000}$ths of an inch. Mica and selenite are therefore prepared with facility for this class of chromatic experiments, but this is not equally true of Iceland spar. If a lamina of selenite —a mineral which is very easily wrought—be secured by transparent cement of any kind to a plate of glass, very fanciful effects may be produced by grinding it away unequally in different parts according to any definite pattern. Figures of various kinds, images of insects, flowers, Gothic windows, etc. may thus be prepared, which will come out in polarized light in very brilliant colors.

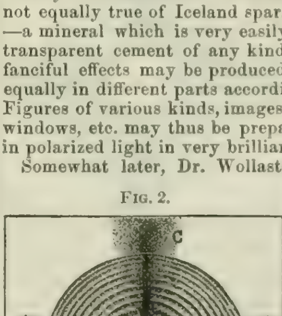
Somewhat later, Dr. Wollaston discovered a class of chromatic effects of a novel and highly interesting character observable in crystals cut across the axis. The arrangements for observation are the same as in the experiments already described. If a mirror be employed as an analyzer, and be turned to azimuth 90° before the introduction of the crystalline plate, no light will, of course, be reflected to the eye; but the moment the crystal is introduced a system of concentric rings will make its appearance, colored with the richest conceivable tints, and marked by a black cross, whose arms are in the plane of reflection, and at right angles to it, passing through the centre.

FIG. 2.



The ends of these arms are enlarged, and have the appearance of brushes. If the analyzer is transparent, another set of rings may be seen by the transmitted light, in which the colors will be complementary to the former, and the cross will be white. As the analyzing mirror is revolved in azimuth the colors fade, and a new set of rings gradually appears, with colors complementary to the first, and distinguished by a white cross. In short, in this case the colors before trans-

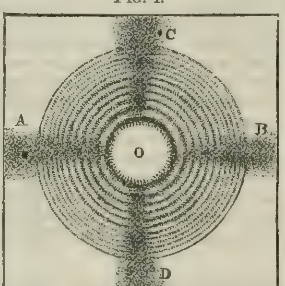
FIG. 3.



mitted are reflected, and those before reflected are transmitted. Figs. 2 and 3 exhibit the two aspects of the rings which have been just described. These rings make their appearance at thicknesses much greater than those which produce color in laminæ parallel to the axis.

Crystals of quartz cut across the axis and examined in polarized light present a curious and exceptional peculiarity. The centre of the field is always illuminated with light of uniform tint, whatever be the position of the analyzer; but the tint varies as the analyzer is turned, ascending regularly through the scale from red to violet. To this fact, first noticed by M. Arago, M. Biot contributed the additional discovery that the ascent of the tints is produced in some crystals by a right-handed rotation (in the direction of the hands of a watch), and in others by a left-handed rotation. Hence, the distinction since made between right-handed and left-handed crystals, called also, more appropriately, *dextrogyre* and *lævogyre*. It was subsequently noticed by Sir John Herschel that the gyratory power of crystals is so apparently dependent on the causes which produce modifications of the crystalline form, that its direction may be inferred without optical examination, by means of the external characteristics. The crystal is usually a hexagonal prism, with terminal hexagonal pyramids; but the tetrahedral angles where the lateral and terminal faces meet, and the lateral edges also, are sometimes replaced by planes, called *plagihedral*, which encroach on the neighboring faces more on one side than on the other. If, in the crystal as held by the observer with the pyramidal vertex toward him, the plagihedral encroachment is largest on the faces toward the right, the crystal is optically dextrogyre, and *vice versâ*. Sir David Brewster's observations on these crystals led to the discovery that when the crystal is not very thick the uniformly-tinted field is confined to the centre, and is surrounded by a system of rings resembling those seen in Iceland spar, but in which the cross is imperfect. (Fig. 4 exhibits the appearance.) He also found in that remarkable species of colored quartz called amethyst, veins of right-handed and left-handed crystallization alternating with each other in many parallel layers, and producing at their surfaces of contact lines of neutral character. In some specimens the layers were found to be so extremely thin as to neutralize the rotatory power of the whole crystal, and in these instances the ordinary system of rings with a perfect cross makes its appearance. In all these observations upon crystals in the direction of their optic axes, the number of rings is greatly increased by the use of monochromatic light. The intervals between the rings are also, in such light, intensely dark. In the case of quartz crystals, monochromatic light presents appearances in the centre very little different from those seen when the crystal is not present; that is to say, it exhibits, as the analyzer is turned, a succession of maxima and minima, separated from each other in azimuth 90°. But the absolute azimuths of these maxima and minima are no longer what they were before the introduction of the crystal; in other words, the plane of polarization has been turned to the right or to the left, according to the nature of the crystal, through an angular distance proportioned to the thickness of the crystal. The peculiar kind of polarization produced by quartz has on this account been called *rotatory* polarization.

Fig. 4.



It will be easily conceived that a right-handed and a left-handed crystal of equal thickness, superposed upon each other, will produce a resultant rotation equal to zero. But two such plates so superposed, examined in polarized light, exhibit a remarkable spiral cross, such as is seen in Fig. 5. These spirals were first observed by Mr. Airy, and are commonly known as Airy's spirals. Two contrary plates of *unequal* thickness, superposed as above, produce an amount of rotation proportional to their difference of thickness.

Fig. 5.

The power of rotation of the same crystal is different for the different colors, being, in the undulatory theory of light, an inverse function of the length of the undulations. By employing the successive colors of the spectrum for each separately, M. Biot determined the absolute rotatory power of a crystalline plate of quartz $\frac{1}{25}$th of an inch in thickness, as follows:

Extreme red	17.4964	Limit, green and blue	30.0460
Limit, red and orange	20.4978	Limit, blue and indigo	34.5717
Limit, orange and yellow	22.3138	Limit, indigo and violet	37.6829
Limit, yellow and green	25.6752	Extreme violet	44.0827

This property of rotatory polarization does not exist in plates of quartz cut parallel to the axis. In such plates ordinary double refraction exists, but it is the extraordinary instead of the ordinary ray whose velocity is least, or the crystal is a positive one.

The double refraction of quartz along its axis was experimentally analyzed by Fresnel by means of a very ingenious arrangement. The difference of velocity of the two rays being so slight as to render their separation by ordinary expedients difficult, he devised and constructed a compound prism by which to double their divergency. In Fig. 6, A B F and C D F represent similar triangular prisms of right-handed quartz with the faces A B, C D cut perpendicularly to the axis. The obtuse-angled prism B F D, having the angle B F D equal to the supplement of 2A F B, has its base B D parallel to the axis of a crystal of left-handed quartz. The incident ray I I′, falling perpendicularly upon A B, is separated into two, whose velocities differ, but which pursue the same path, which is the axis. At the surface B F their paths become different, the velocity of one of them passing from − to +, and that of the other from + to −. At the surface F D this divergency is increased, the velocities again interchanging their relations. At final emergency from the face C D the divergency will be further slightly increased in consequence of the inclination of the emergent rays to the surface. By this arrangement a sufficient separation of the two rays is obtained to make it possible to examine them singly; and it is obvious that a duplication of the system of prisms here shown, or an increase in the number of elements employed, would, if necessary, make the separation still wider. If quartz were like other uniaxial crystals in the law governing refraction along its axis—that is, if the velocities of the two rays were in that direction equal in this crystal, as they are in others—the system of prisms just described would produce no separation of the rays. The fact of the separation proves quartz to be in this respect an exceptional case. When the separated rays are examined, however, the extent to which quartz is exceptional is discovered to be much greater than is implied in the difference just indicated. The peculiarities are the following, and are true of either of the separated rays. Examined with a doubly-refracting prism, two perfectly equal images appear in all azimuths of the prism. Received upon a mirror at the polarizing angle, equal reflection takes place in all azimuths of the mirror. In these respects the rays resemble ordinary unpolarized light. But in the following particulars they differ. Transmitted through thin crystalline plates, they display, on being analyzed, tints like those produced by polarized light, only they are such tints as ordinary polarized light produces in thicknesses of crystal greater or less, by a determinate amount, than those used in the experiment. Transmitted through a rhomb of glass, like that represented in Fig. 7, of which the acute dihedral angles are $54\frac{1}{2}$, they emerge, after two internal total reflections, at P and Q, polarized in planes—one in azimuth 45° on the right, and the other in azimuth 45° on the left of the plane of reflection. If both are transmitted through the rhomb simultaneously, so as to emerge together, they will form a single ray polarized in the plane of reflection. Rays in this condition are said to be *circularly* polarized. And as it appears that a circularly polarized ray becomes *plane* polarized by two internal reflections in glass at an angle of incidence of 54° 30′, the resultant plane of polarization being in azimuth 45° from the plane of reflection, it follows that a plane polarized ray may be circularly polarized by causing it to make two similar reflections, the plane of its original polarization being 45° in

Fig. 6.

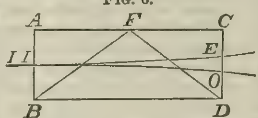
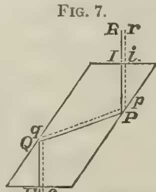


Fig. 7.



azimuth from that of the first reflection. This is effected by the use of a rhomb such as has just been described, and which, from its originator, has been called Fresnel's rhomb. It is obvious that if a plane polarized ray be thus passed through *two* of Fresnel's rhombs successively, it will emerge plane polarized.

M. Fresnel was led to the discovery of the remarkable property of the rhomb which bears his name by theoretic considerations. When light is passing from a denser to a rarer medium, the angle of refraction is greater than the angle of incidence, and the law of Snellius,

$$\frac{\sin i}{\sin r} = n,$$

gives a value for n, the index of refraction, less than unity. Now, as 1 is the greatest possible sine, if we put $\sin r = 1$, we shall have $\sin i = n$, and therefore i itself less than 90°. For an incidence greater than this value of i there can be no emergent ray; and hence this is called the *limiting angle*. For all such incidences the whole of the light is reflected; and this is what is meant by *total reflection* at second surfaces. M. Fresnel found that the mathematical formulæ which he had deduced from his theory of light, to express the intensity of reflection at different incidences, became *imaginary* in the case of total reflection; and in reasoning on the probable causes of their failure he was led to predict that a rhomb of glass having the angles above stated would produce precisely the effect which has just been described. Experiment proved the truth of this anticipation.

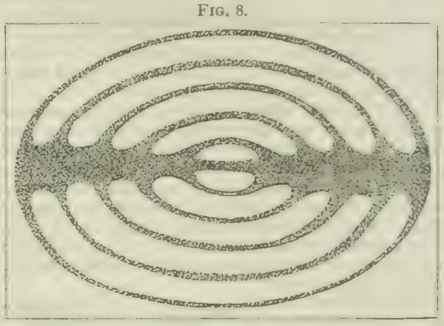
Reflection from metals presents characters which resemble those of reflection from the second surface of transparent media. There is this difference, that common light totally reflected exhibits no traces of polarization, but common light reflected from metallic surfaces *is* partially polarized. When the incident light at second surfaces is polarized in an azimuth between 0° and 90°, the modifications which it undergoes resemble those produced by metals. This subject was first systematically investigated by Sir David Brewster. He first discovered that polarized light, after having undergone one total reflection in an azimuth between 0° and 90°, produced colors, when examined with an analyzer, analogous to those produced by thin crystalline laminæ. He afterward ascertained that a polarized ray which has undergone successive reflections from plane metallic mirrors placed parallel to each other, when the original azimuth of reflection is 45° from the plane of polarization, will exhibit similar tints. The angle of incidence at which the effect is best produced varies with different metals, but is in all or nearly all cases above 70° and below 80°. The brightness of the tints increases with the number of reflections. Sir David Brewster also found this analogy between the effects of such a pair of parallel metallic mirrors and a pair of Fresnel's rhombs—that at a certain angle of incidence, different for different metals, the effect of the reflection on the first mirror would be exactly compensated by that on the second, and the ray would emerge plane polarized. But he found also this difference between the cases—that while (the azimuth of incidence being $+45°$) the ultimate plane of polarization with the rhombs was $-45°$, that with the metallic mirrors was always less than this, being for silver, in which it was greatest, $-39° 48'$, and for galena, in which it was least, no more than $-2°$. There is also this additional and very remarkable difference: in the case of the rhombs, after the light had undergone reflection in the first, it will be restored to its original condition by the second, no matter what be the azimuth between the planes of reflection in the two rhombs; but in the case of the two mirrors, if the second be turned in azimuth, it will no longer restore the ray unless the *angle of incidence* be changed also. If it be turned quite round, the angle of incidence required to effect restoration will pass through a series of regular variations between determinate limits, which variations may be represented by the varying radii of an ellipse. It was on this account that the term *elliptical* polarization was originally applied to light in this physical condition. Common light reflected from metallic surfaces is more or less elliptically polarized. In fact, the recent investigations of M. Jamin and others have proved that there are very few substances which furnish by reflection from their surfaces absolutely pure plane polarized light. None are capable of doing so whose indexes of refraction exceed or fall short of 1.414. Water and glass do so sensibly, but in this respect they are nearly exceptional.

The rings seen in crystals cut across the axis, when examined in circularly polarized light, exhibit some singular peculiarities. They are divided into quadrants by a cross which is neither very dark nor very bright, and which does not change in intensity with the revolution of the analyzer, but turns with it. The rings in the alternate quadrants are *unconformable*, those in one opposite pair being nearer to the centre, and those in the other more distant from the centre by a quarter of an interval than the corresponding rings in plane polarized light.

Mr. Airy found that light may be circularly polarized by *refraction* in passing through laminæ of crystals which doubly refract, provided the thickness of the laminæ used is such as, on the undulatory theory of light, is just sufficient to effect a retardation of one of the rays produced by the double refraction one quarter of an undulation behind the other, or to advance it one quarter of an undulation before the other. The mineral employed by him for this purpose, and which is more conveniently prepared of suitable thickness than most others, is mica, of which the laminæ are easily separable and cleave in large sheets without breaking. A lamina reduced to a thickness proper to produce circular polarization is commonly called a "quarter-wave lamina."

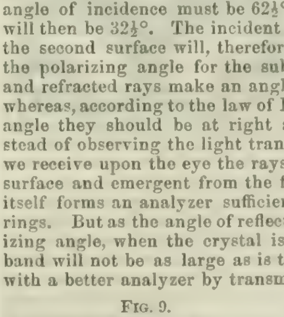
For some time after the discoveries had been made of which a brief account has here been given, it was supposed that all doubly-refracting crystals have but a single optic axis. In the year 1817, however, Sir David Brewster announced the remarkable fact that most crystals have two optic axes instead of one. The rings seen in crystals of two axes are elliptical when the axes are so far apart that only one can be observed at a time; and they form *lemniscate* curves, or curves resembling the figure 8, when they are near together. In topaz the axes form an angle with each other of 65°, and the rings present the appearance shown in Fig. 8 when the analyzer is crossed upon the polarizer, the plane of the axes of the crystal being in azimuth 0° or 90°.

FIG. 8.



This crystal possesses the peculiarity of showing its own rings without the help of an analyzer when the plate subjected to experiment is cut across the line intermediate between the axes, the opposite surfaces being parallel. In such a plate, in order that the ray may follow the line of one of the axes within the crystal, its angle of incidence must be $62\frac{1}{2}°$; the angle of refraction will then be $32\frac{1}{2}°$. The incident angle at either the first or the second surface will, therefore, be very nearly equal to the polarizing angle for the substance, since the reflected and refracted rays make an angle of 85° with each other; whereas, according to the law of Brewster, at the polarizing angle they should be at right angles. If, therefore, instead of observing the light transmitted through the plate, we receive upon the eye the rays reflected from the second surface and emergent from the first, the reflecting surface itself forms an analyzer sufficiently perfect to exhibit the rings. But as the angle of reflection is not truly the polarizing angle, when the crystal is in azimuth 90° the dark band will not be as large as is the case in the rings seen with a better analyzer by transmitted light.

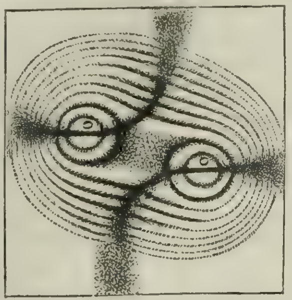
FIG. 9.



In Figs. 9 and 10 are seen the appearances presented when the subject of examination is saltpetre (nitrate of potash), in which the axes are inclined to each other 6°. The plane of the axes of the crystal being brought into coincidence with the plane of polarization of the incident light, and the analyzer being crossed upon the polarizer, a system of lemniscate curves is seen, like that shown in Fig. 9 intersected by a dark cross, of which the bar coinciding in direction with the plane of the axis is longest. If the analyzer be turned 90°, the colors become complementary and the cross becomes white; but if, the analyzer and

polarizer remaining fixed, the crystal itself is turned in azimuth, the cross will break at the centre, forming two curves, which, when the rotation becomes 45°, assume the form of two opposite hyperbolas. This appearance is exhibited in Fig. 10.

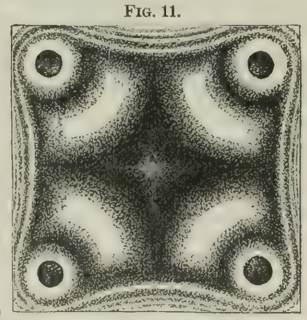
Fig. 10.



A very curious property of crystals of two optic axes, first announced on theoretical grounds as probably existent, and afterward experimentally demonstrated by Dr. Lloyd, consists in this—that, supposing, in a crystal properly prepared for the purpose, the straight line representing either axis to be produced externally in both directions, this line will be also the axis of a hollow cone at either extremity, the vertices being at the intersections with the surface of the crystal and the bases outward, such that any incident ray coinciding with an element of either conical surface will coincide within the crystal with the optic axis itself, and will coincide on emergence with the other conical surface. Thus, an incident hollow cone of rays becomes an emergent hollow cone; but what is more remarkable, an incident solid cone or pencil gives an emergent hollow cone, since the interior rays of the incident pencil are scattered by refraction within the crystal. Moreover, an incident ray coinciding externally with the true direction of the optic axis is spread out by refraction into a hollow cone within the crystal, and becomes on emergence a hollow cylinder. These singular phenomena are usually referred to by the terms *conical refraction* and *polarization*.

When cylinders, tubes, rhombs, or other geometrical forms of well-annealed glass are subjected to a sudden increase of temperature acting upon all their surface, as by immersing them in hot water or hot oil, there will be seen within them, by polarized light, systems of symmetrical figures circular and concentric in cylinders, and dependent on the form of the solid for their shape in other cases, bearing a striking resemblance to the rings seen in crystals. An illustration of these appearances is presented in Fig. 11. Like those rings, these figures are marked by a cross, which changes from black to white with the rotation of the analyzer. But these figures will alter their forms if the glass be broken, which is not true of the rings formed in crystals. When the heat has fully penetrated the glass, and the interior temperature is uniform, the figures cease to be seen. At this time, if the heated glass be removed from the bath and allowed to cool rapidly, a new system of figures will spring up within it. This is related to the former one, as the rings of a positive crystal are to those of a negative one; and therefore, if two similar solids, in one of which the former set of figures is seen, and in the other the latter, be superposed when the intensities are equal, they will neutralize each other's effects, and the colors will disappear. This structure may be made permanent in the glass solids we have been considering, by heating them nearly to the point of fusion and then suddenly cooling them. Many common articles of glass are so imperfectly annealed as to display the doubly-refracting structure in a striking manner. The stoppers of bottles, if cut across the axis and polished, will invariably show it; so will the stems of wine-glasses, the stirring-rods of the chemist's laboratory, and many if not all glass tubes.

Fig. 11.



The effects of heat are also remarkable in altering the doubly-refracting character of crystals. M. Mitscherlich discovered that heat expands crystals unequally in different directions. Iceland spar is expanded in the direction of its axis, and slightly contracted at right angles to the axis. Its doubly-refracting power is thus diminished. In sulphate of lime, which is a crystal of two axes inclined to each other 60°, he found that the inclination diminishes with elevation of temperature until the two axes unite in one; after which, with further increase of heat, they open out in a plane at right angles to the first. Dr. Brewster discovered an example even more remarkable in *glauberite*. At the freezing-point this crystal has two optic axes for every color of the spectrum, the inclination of the axes of the red being greatest, and that of the violet being least. At ordinary temperatures it has two axes for red and one for violet. When heat is applied, the other axes approach, as in the case just described, and, after successively uniting, successively open out in the transverse plane.

In comparing the crystals which possess the power of double refraction (being by far the greater number of the whole), there is found to be a certain relation between the optical character of the crystal and the crystallographic structure. All crystals whose primitive form is the cube, the regular octahedron, or the rhomboidal dodecahedron—figures whose geometrical axes are all equal—are destitute of the property. All crystals which have one axis greater or less than the others are crystals of one optic axis. All crystals whose geometric axes are all three unequal have two axes of double refraction.

The power of rotatory polarization belongs to many liquids. Their relative rotatory forces are estimated by a comparison of the amount of angular change in azimuth produced upon a polarized ray in passing through a column of given length; but as yet there has been no universal agreement upon a standard length. The statements of experimenters, therefore, usually embrace both the angular rotation and the length of the column by which it has been produced, rendering a reduction to a common length necessary before a correct comparison can be instituted. It would perhaps be most convenient to adopt as a standard length the length of the tube introduced by M. Soleil into his *saccharimeter*, or instrument for measuring the rotation in solutions of sugar, which is twenty centimètres. With this length the dextro-gyration of the oil of bitter orange is, for red light, 157°.89, which is the maximum observed in this class of liquids. The lævo-gyration of narcotine in alcohol and ether is 151°.4; that of sulphate of quinine in water acidulated with sulphuric acid is 192°.95 in the same direction. Solution of crystallizable cane-sugar is dextrogyre; that of uncrystallizable cane-sugar, or molasses, is lævogyre. Solution of sugar of grapes is also dextrogyre when prepared from the juice and before solidification, but if evaporated to dryness and redissolved it is lævogyre. Crystallizable cane-sugar is made uncrystallizable by heat, and its rotatory power is accordingly reversed by the same cause. In many solutions the introduction of an acid modifies the rotatory power. Narcotine, from being $-151°.4$, becomes, after the addition of hydrochloric acid, $+83°$. Cane-sugar has its rotatory power inverted in the same way. On this principle is constructed the saccharimeter of Soleil, just mentioned. A solution of the sugar to be examined is made of a definite density, and its rotatory power is observed in a tube twenty centimètres in length. One-tenth of its volume of strong hydrochloric acid is then added, and the mixture is kept for ten minutes at a temperature of 150° F., after which it is cooled and observed in a tube one-tenth longer than before. Its rotation is now wholly negative. The two observations are proportional to the difference and the sum of the crystallizable and uncrystallizable sugar present. (See SACCHARIMETER.)

M. Pasteur has made a very elaborate examination of the salts of tartaric and paratartaric acid in their relations to polarized light. All the tartrates are dextrogyre; the paratartrates have no rotatory power at all. M. Pasteur made the interesting discovery that paratartaric acid, which is the same as racemic, and which differs from tartaric acid only in having an additional atom of water, is composed of two acids, one of which has a positive and the other a negative rotatory power. The dextro-racemic acid is simply tartaric acid, and the dextro-racemates are tartrates. Paratartaric acid and its salts owe their neutral character to the balance of opposite forces belonging to their components. In considering the crystalline forms of these different salts, M. Pasteur detected a relation between them and their polarizing properties, such as has already been described to exist in quartz; that is to say, the salts which possess rotatory power have plagihedral faces leaning in the direction of rotation. The crystals are all of the kind called by M. Weiss *hemihedral;* that is to say, not in all respects symmetrical. M. Pasteur observed that there are two kinds of hemihedral crystals, which he has distinguished as the *superposable* and the *non-superposable*. When a crystal or any solid or surface is such that another may be conceived or constructed like it in every particular as to form and dimensions, yet incapable of being made to occupy the same matrix or mould, such a crystal or solid or surface belongs to the class of the *non-superposable*. The image of the face in a mirror as compared with the face itself, the left hand or the left foot as compared with the right, and many analogous objects, natural and artificial, may serve to illustrate this conception. M. Pasteur

found that all the crystals whose salts possess the rotatory power are hemihedral and *non-superposable*, and, conversely, that all salts whose crystals are non-superposably hemihedral have the power of circular polarization, with two exceptions only thus far known, which are formiate of strontian and sulphate of magnesia. In the latter case the crystal is so very nearly superposable that it is hardly surprising that it should not sensibly conform to the law. In the instance of the formiate of strontian, M. Pasteur thinks that the hemihedrism does not depend on the arrangement of atoms in the chemical molecule, but on that of the physical molecules in the entire crystal; so that, on solution, the structure on which the rotatory power depends disappears in the same manner as it is known to do in quartz on fusion.

The polarization of the light of day by atmospheric reflection has been sufficiently noticed under OPTICS. The object of the present article has been to give an account of the most important phenomena belonging to this interesting branch of science, without discussing the causes to which they are owing. These are considered under the title UNDULATORY THEORY (which see).

F. A. P. BARNARD.

Po'lar Research', a term indicating explorations and researches in the Arctic and Antarctic circles. The Arctic or its vicinity was visited as early as the ninth century. Iceland, which touches the Arctic circle at the N., and corresponds with the accounts of the ancient Thule, was discovered by Naddodr, a Norwegian viking, A. D. 860, and settled in 874 by a colony of Norsemen, the ancestors of the present Icelanders. In 890, Octher, a Norwegian, sailed into the Arctic, along the north-eastern coast of Norway, passing the Loffoden Islands, North Cape, and probably as far as Varanger Fiord, or the mouth of the river Kola, finding the country along the coast occupied by Finns, who lived by fishing in the summer and by hunting in the winter; which is the first voyage around the North Cape and across any part of the Arctic circle that is on record. In 982 or 983, Erik the Red, a Northman, discovered the E. coast of Greenland. He sailed around Cape Farewell, passed three years in exploring the W. coast of Greenland, and in about 986 returned with a colony of Icelanders and established a settlement on the S. E. coast of Greenland, in about lat. 60°, which existed for some time, but ultimately perished, all connection with the parent country having been cut off. In 1869, Dr. I. I. Hayes found the stone ruins of this settlement, including the church edifice, which was still in good preservation, excepting the roof. Two Italians, the brothers Zeni, made a voyage in 1380 in this direction, far to the N.; but as the truth of the published account, particularly as to the extent of the voyage and the details of it, is in dispute, the facts are not deemed sufficiently certain to be accepted and enumerated. In 1477, Columbus, from his own account, "sailed 100 leagues beyond the island of Thule," from which it is inferred that he visited Iceland, and probably Greenland. This is all, up to this period, that can be reliably stated respecting the Arctic, except that it was at this time, and probably before, resorted to for its fisheries, being then, as it is still, a favorable region for the capture of whales and the fur-bearing animals.

Toward the close of the fifteenth and throughout the sixteenth century the northern nations of Europe, and particularly the English and the Dutch, became deeply interested in promoting explorations and discovery in this quarter of the globe. The account given by Marco Polo of the wonderful countries he had visited in the East drew the attention of the maritime nations of Europe to the importance of a more intimate connection with China and India. A comparison of Marco Polo's account with that of others led Prince Henry of Portugal, surnamed "the Navigator," to devote the residue of his life to the study of navigation, the fitting out of vessels, and the promotion of that brilliant era of maritime discovery which began in the latter part of the fifteenth century, the inauguration and successful prosecution of which in the beginning were wholly due to his efforts. The discovery of the continent of America by Columbus in 1492, and of a way to the Indies by the Cape of Good Hope by Vasco de Gama in 1498, diverted maritime commerce from its ancient seat in the Mediterranean, and gave to the Portuguese and the Spaniards, as the discoverers of the newly-acquired territories in Africa and America, a control over the commerce of the world. These nations not only claimed the new countries by the right of discovery, but also a right to the exclusive navigation of the ocean between them, and each claimed over the other the exclusive right. As the enforcement of such a claim by either would have involved both in an interminable war, they mutually agreed to refer the settlement of their respective claims to the pope as arbitrator, and he drew a line through the centre of the South Atlantic, and decided that the Portuguese had the right to the eastern part and the Spaniards to the western; which has been erroneously supposed by some writers to have been a gift of this part of the world by the pope, whereas it was simply a settlement, in the interests of peace, of a matter in controversy between two great nations, in which he merely acted as umpire. Neither the English, the Dutch, nor the French, however, recognized this claim on the part of the Portuguese and the Spaniards, nor did the pope, in fact, assume any right to dispose of the newly-discovered countries or the ocean between them as against the rights or the claims of other nations. But as the Portuguese and the Spaniards after this settlement united in the exclusion of all other nations, and as any attempt on the part of any other to encroach upon their mutually-assumed rights involved a war with each of them, the attention of the northern maritime nations of Europe was awakened to the importance of the discovery at the N. of a passage around the continent of Europe or of America to the Indies, which, if found, would not only be shorter than the route by the Cape of Good Hope, but would give to these nations, from their nearer proximity, the commercial superiority.

To the statesmen and geographers of that day it appeared highly probable, as a passage by water had been found around the continent of Africa, that one would be found also around the continent of Europe or through some portion of the northern part of America—a probability which was greatly strengthened afterward by the discovery of a passage to the Pacific through the Straits of Magellan in 1519. It was with this object that the voyages of the Cabots were made in 1495, 1497, and 1502; of Cortoreale in 1500 and 1501; the disputed voyage of Verazzano in 1524; the voyage of Gomez in 1525, of Rut in 1527; the voyages of Cartier in 1534, and of Frobisher in 1576, 1577, and 1578, by which voyages Newfoundland and the North American continent up to the Arctic circle were discovered. The design of Sebastian Cabot was the discovery of a north-*west* passage to India, but having sailed as far as 67° N. lat. without finding it, the English, after the lapse of some years, directed their attention to the discovery of a north-*east* passage, and an expedition under Sir Hugh Willoughby and Richard Chancellor, consisting of three ships, sailed in 1553, and entering the Arctic, reached as far as the southern part of Nova Zembla, in about 72° N. lat., but were compelled to return. Sir Hugh Willoughby, with the officers and crews of two of the vessels, was frozen to death in the mouth of the Dwina; but Chancellor in the other vessel succeeded in entering the White Sea, then only known to the Russians, and reached Archangel in safety. The search for a N. E. passage was renewed by the English in 1556, and Stephen Burroughs was sent out by the Muscovy Company. In a small pinnace he sailed along the coast of Norway, and passing the eastern promontory of the Gulf of Archangel, and beyond the mouth of the Petchora, discovered the straits that bear his name and the entrance to the Sea of Kara. Another expedition was sent out under Pet and Jackson in 1580, but got no farther than the Bay of Petchora. The efforts and failure of the English to discover a passage to the N. E. stimulated the Dutch, and in 1594 the merchants of Amsterdam, uniting with those of Middleburg and the syndic of West Friesland, fitted out three vessels, which proceeded to the Arctic, and, separating into two divisions, two of the vessels sailed through the Tugorsky Schar (Pet's Strait) and along the coast of Nova Zembla until their further progress in that direction was obstructed by ice, when they sailed through the Sea of Kara to about the vicinity of the Gulf of Obi, and then returned; whilst Barentz, in the other vessel, sailed along the western coast to the northern extremity of Nova Zembla, in lat. 77°, but was compelled to return. A Dutch mercantile expedition in 1595, and another for discovery in 1597, made further attempts in this direction. The last of these expeditions, which was commanded by Barentz and John Cornelius Ryp, discovered Bear Island and Spitzbergen, both vessels reaching as far N. as 80° N. lat. when they entered the Straits of Hinlopen from the E., and, passing around New Friesland and West Spitzbergen, returned to Bear Island, from whence Barentz, in one of the vessels, sailed around the N. E. point of Nova Zembla, until his further progress was impeded and he was hemmed in by ice. His vessel being crushed and disabled by the ice, he and his companions passed the winter, under terrible sufferings, in a hut erected by them in a little bay on the N. E. shore of Nova Zembla, from whence they emerged in the spring, and after a journey of great peril and hardship, in the course of which Barentz died, they reached Kola in Lapland in safety. All further attempts to pass around Nova Zembla to the N. E. were unsuccessful until 1871, when Capt. Karlsen rounded it in a small Swedish

sloop, and found the hut of Barentz with everything in it as Barentz had left it 276 years before.

The ill-success of these attempts to find a N. E. passage drew the attention of the English to the possibility of crossing in the direction of the Pole, as the vessels engaged in the fisheries penetrated farther into the Arctic in that direction than in any other. Henry Hudson was accordingly sent out in 1607 by the Muscovy Company to find his way, if possible, across the Pole. He made a vigorous attempt to do so, and got as far as about 81° N. lat., E. of Spitzbergen, when he was obliged to put back to Nova Zembla. The same company in 1610 sent out Poole with the like object, but he reached only to 77° 25′ N. lat., W. of Spitzbergen, although about the same time Thomas Marmaduke is said to have penetrated N. of Spitzbergen to 82° N. lat. In 1614 and 1615, Fotherby made a similar attempt, but reached no farther than the northern part of Spitzbergen; after which all attempts to reach the Pole, except an abortive one by Capt. Wood in 1676, were abandoned by the English for more than a century and a half.

The failure to discover a passage either to the N. E. or in the direction of the Pole revived the interest for the discovery of a N. W. passage. From an early period a belief existed that the continent of North America terminated in a cape, and was separated from Asia by the imaginary Straits of Anian, which were supposed to open into the Pacific and afford a short passage to China and India. It was with this view that the voyages of the Cabots, Cortoreale, Gomez, and Frobisher, before referred to, were undertaken respectively by the English, the Portuguese, and the Spaniards. This investigation, as has been said, was renewed in 1585, when some merchants of London sent out John Davis, who, following up the W. coast of Greenland, discovered Davis Straits and a part of Cumberland Island, and in two subsequent expeditions in the same direction he reached as far as 72° N. lat. Expeditions were again sent out by the Muscovy Company, under Weymouth in 1602, and under Knight in 1606, but they did not get as far north-westward as Davis. In 1608, Hudson, in the employment of the Dutch, explored, in the search for a western passage, the coast of North America, and discovered the Hudson River and the Bay of New York. In 1610 he was sent out again by the English, and discovered Hudson Strait and Hudson Bay, where his crew mutinied and set him adrift with his carpenter, who agreed to share his fate, in an open boat in the middle of the great bay that bears his name. The English, continuing their efforts, despatched Sir Thomas Button in 1612, Gibbons in 1614, and Bylot and Baffin in 1615—expeditions which resulted in very important discoveries, such as Baffin's Bay, the strait between Cumberland Island and the continent, and Horn, Lancaster, and Smith sounds; and having penetrated thus far N. in the western part of the Arctic without finding the expected western passage, the English desisted for some years from any further efforts in that direction. They were renewed, however, by Denmark in the expedition of Jens Munk in 1619; and in 1631 the English sent out Fox, James, and Middleton; in 1641, Moor and Smith; and in 1646, Capt. Wood; by which expeditions the island of Southampton, Fox Channel, James Bay, Wager River, and Repulse Bay became known.

The whole of the northern coast of Asia, with the Liakhov Islands or New Siberia and Wrangel's Land, was discovered by the Russians. The Arctic was traversed in the middle of the sixteenth century by Russian navigators in small vessels from the White Sea and the Petchora to the entrances of the rivers Obi and Yenisei. The subsequent Russian expeditions were so numerous and involve so many details that within the limits of our space they can be referred to only by name: Expeditions to the Yenisei in 1610; to the Lena in 1630; to the Kolyma in 1644; to the Gulf of Anadyr in 1648; Bhering and Tchirikow to East Cape in 1728; Krupischew, completing the discovery of both sides of Bhering's Straits, in 1730; Bhering and Tchirikow to the peninsula of Alaska and the Aleutian Islands in 1740; Liakhov's discovery of, and expeditions by him to, the archipelago of New Siberia in 1770, 1773, and 1775, and by Anjous in 1823; the various expeditions and attempts to double Capes Taimur and Tchscheljuskin in 1735, 1736, 1738, 1739, 1740, 1741, and 1843; Kotzebue's voyage to the N. E. coast of Alaska, and the discovery of Kotzebue Sound in 1815 and 1817; Wrangel's exploration and survey from the mouth of the Kolyma eastward to Cape Schelagskoi in 1820 and 1824; Middendorf to Cape Taimur and discovery of the Open Sea in 1843; Lutke's exploration of the Siberian coast and discovery of Wrangel's Land.

The search for a N. W. passage was resumed by the English in 1818 under Sir John Ross, and continued until the discovery of the passage by Sir Robert McClure in 1850. The explorations and expeditions despatched for this purpose, and those sent out for the relief of Sir John Franklin or other absent explorers, resulted in the discovery of that great region lying within the Arctic circle between 60° and 130° W. lon., up to Cape Parry, 71° 23′ W. lon. and 77° 6′ N. lat., or from Davis Strait to Cape Bathurst, embracing Banks, Prince Albert, and Prince Patrick's Lands, Melville Island and Sound, McClintock's Channel, Bathurst Island, Victoria, Prince of Wales, and King William Lands, Boothia and Gulf of Boothia, North Somerset, North Devon, Melville Peninsula, Cockburn Island, Grinnell, Ellesmere, and Washington Lands, Lancaster, Eclipse, and Jones sounds, Wellington Channel, Kellett, Barrow, Franklin, Peel, Sir James Ross, and the Fury and Hecla straits, Regent's Inlet, and the discovery in 1833 by Sir James Ross of the N. magnetic pole. These expeditions were so numerous, and the discoveries, explorations, and researches made by them so extensive, that we can only state the expeditions in the order of their occurrence: Sir John Ross, 1818, 1829, and 1833; Sir Edward Parry, 1819, 1824, 1832, 1833, 1847, and 1850; Admiral Beechey, 1826–29; Capt. Back, 1836; Dease and Simpson, 1837, 1838, and 1839; Dr. Rae, 1846, 1850, 1853, and 1854; Sir John Franklin, 1836, 1845, and 1849; Sir John Richardson, 1848; Capt. Kellett, 1847; Sir James Ross, 1848; Capt. Penny, 1849–50; Sir Robert McClure, 1850–54; Admiral Ommancy, 1850; Lieut. De Haven (Grinnell expedition), 1850; Capt. Austin, 1850 and 1855; Capt. Kennedy, 1850–53; Sir L. McClintock, 1850, 1857, and 1859; Sir Edward Belcher, 1852 and 1853; Lieut. Bellot, 1852; Admiral Inglefield, 1852 and 1854; Dr. Kane, 1853; Dr. Hayes, 1853 and 1860; Capt. Hall, 1860.

Parry, after attempting in three voyages to find a N. W. passage, determined in 1827 to renew the attempt to reach the Pole. His vessel being impeded by ice at the N. end of Spitzbergen, he made the attempt to reach the Pole in boats, getting as far as 82° 50′, the highest position attained by any previous explorer, and would probably have reached much farther but that the ice on which he was travelling drifted southward, rendering any further advance by him impossible.

The N. W. passage found by McClure is between Banks and Prince Albert Lands, through Prince of Wales Strait, Melville Sound, Barrow Strait, and Lancaster Sound, to Baffin's Bay, and may be entered from other points. It is, from the obstruction of ice, of no practical utility for the purpose of commerce and navigation, and since its discovery polar research has been limited to attempts to reach the Pole or to explore the seas that lie between Vaigat's Island and Bhering Straits, and the countries within the Arctic circle that are in the northern part of Siberia and the north-eastern portion of Europe.

The explorations of Dr. Kane and Dr. Hayes in 1853 and 1860 through Smith Sound and Kennedy Channel revived the belief in the existence of an open polar sea—a belief which has existed for more than two centuries, and which sea was even represented upon maps as early as 1608. The probability of the existence of such a sea was advocated by the Russian explorers, Wrangel and Middendorf; and Dr. Kane, after the discoveries of Admiral Inglefield in Smith Sound, and of Sir Edward Belcher in Wellington Channel, became convinced that there was such a sea somewhere between 80° N. lat. and the Pole, with a milder climate than in the region S. of it. His expedition to Smith Sound in 1853 was for the purpose of discovering it, during which Morton and a companion discovered Kennedy Channel, and reached as far as Cape Constitution in 82° 27′ N. lat.; and Morton saw at the N. E. what he supposed to be the open sea, but which was found, upon Capt. Hall's expedition in 1871–73, to be what is now known as Robeson's Channel. Dr. Hayes followed up this exploration in Smith Sound by an expedition in a single vessel in 1860, and by a sledge-journey, after great hardships, reached as far as 81° 35′, returning with the conviction that the most practicable route to the Pole was through Smith Sound—an opinion which subsequent events have strongly tended to confirm.

Attention, however, was directed from this route by Dr. Petermann, the German geographer, who maintained that the experience of the past warranted the belief that the best course was either between Greenland and Spitzbergen, or through Barentz Sea between Spitzbergen and Nova Zembla; and his opinion being generally adopted, the attempts to reach the Pole were in this direction for the following ten years in expeditions despatched by the Swedes, Germans, and Austrians. Expeditions were sent out by the Swedes in 1857, 1861, 1864, and 1868; by the Germans in 1868, 1869, and 1871; by the Austrians in 1871, 1872; to which should be added explorations by Norwegian vessels in 1869 and 1871, and several voyages made by Mr. Lamont in his yacht. All attempts, however, to reach the Pole in this direction proved abortive, and the knowledge

acquired impressed the navigators that any further attempt between Spitzbergen and Greenland was hopeless. The second Austrian expedition, however, under Lieuts. Weyprecht and Payer, penetrated the sea between Spitzbergen and Nova Zembla, discovering a large region (Franz Joseph Land) extending from below the 80th to beyond the 82d parallel of N. lat.; and from the farthest point reached, 81° 57′ N. lat., they saw land extending beyond the 83d parallel, the farthest northern point upon the globe yet seen by man. Lieut. Payer's opinion was, that ships could not penetrate N. of Franz Joseph Land, and he has no belief in an open polar sea. It has been said that this voyage confirms Capt. Bent's theory that the Pole can best be reached by following the course of the Gulf Stream northward between Nova Zembla and Spitzbergen; which is, however, in direct conflict with Lieut. Payer's statement that the drift northward was in no ways owing to the Gulf Stream. The Norwegians were also very successful. They penetrated through Pet's Strait and the Karian Sea to the Gulf of Obi, and Capt. Karlsen sailed around Nova Zembla in 1871—a feat achieved for the first time. In 1872, Capt. Hall sailed through Smith Sound and Kennedy Channel, and through what he named Robeson Channel, unobstructed, to 82° 16′ N. lat., being farther than any sailing vessel had reached before. Although none of these expeditions succeeded in reaching the Pole, the amount of scientific information they gathered has given to polar explorations a new and important interest, in the fact, now generally recognized, that scientific observations in the region of the Arctic and Antarctic are of the highest value; that they materially assist in the solution of some of the most important scientific questions of the day; and that the large contributions made by these expeditions to human knowledge have not only fully repaid the fitting of them out, but have shown the importance of still more extended explorations in this interesting field for scientific research. It is mainly in this view that an expedition, consisting of two vessels under the command of Capt. Nares, the late commander of the Challenger and an experienced Arctic explorer, was despatched by the British government in 1875, which, when last heard from, was upon its way through Smith Sound in an attempt to reach the Pole. The feasibility of the route through Smith Sound and Kennedy Channel, which is called the American route, has been uniformly advocated by Kane, Hayes, and the American Geographical Society, and was followed successfully by Hall to the high latitude previously stated. It has, heretofore, had in England the support of the Arctic explorers Osborne, Collinson, McClintock, Back, and Hamilton, but with these exceptions English geographers and explorers, until very recently, have generally been in favor of the route E. or W. of Spitzbergen. The result of the abortive efforts in that direction, however, as contrasted with the easy passage of Hall's vessel to 82° 16′, has entirely changed opinion, and the Nares expedition has gone by that route with the common approbation and hearty approval alike of Dr. Petermann and of all who are entitled to be regarded as authority.

In 1875 the Swedish explorer Nordenskiöld sailed through and *dredged* successfully in the Sea of Kara, to the mouth of the Yenisei, which he ascended, and made his way by Tobolsk to St. Petersburg.

Explorations within the limits S. of 66° 30′ S. lat. of the Antarctic circle have been few as compared with those of the Arctic. After the discovery of the passages around the continents of Africa and America by the Cape of Good Hope, the Straits of Magellan, and Cape Horn, there was no practical object to stimulate further explorations, as in the Arctic; in addition to which, explorations toward the Pole in the Antarctic are impeded by greater difficulties and attended with greater perils than in the Arctic. When the ancients, from astronomical observations and mathematical deductions, came to the conclusion that the form of the earth was globular, and Parmenides had divided it into five zones or climates, separated by an equatorial belt or zone, which was originally thought to be uninhabitable from excessive heat, an impression arose that there was beyond this supposed highly-heated region of the equator a large continent extending to the Pole, which they called *Terra Australis incognita*, in a portion of which, between the equator and the Pole, it was assumed there was a temperate climate. When it was afterward known that the region upon the equator was inhabitable, this unknown continent was shifted farther S. The belief in its existence survived to the Middle Ages, and after the continents of Africa and South America were circumnavigated this Terra Australis incognita continued to be represented upon the maps as a huge continental mass encircling the Antarctic Pole, and presenting to the ocean a continuous circuit of shore extending around the globe. After Van Diemen's explorations of the coast of Australia, and Tasman's exploration of the western coast of New Zealand, the supposed continent was again shifted farther S.; and when Cook, in his voyage of 1722–55, made a circuit of the southern seas in high latitudes, and entered the Antarctic circle in three separate quarters, the illusions respecting this huge continent were dispelled, and it disappeared from the maps. To use his own words, he put an end to the searching for a southern continent, which had engrossed the attention of maritime nations for two centuries, and had been a favorite theory with the geographers of all ages. The most southerly point attained by Cook within the Antarctic circle was 71° 10′ S. lat., on the 107th meridian, and he settled the form of New Zealand, New Caledonia, and other Australian lands and islands. Bellinghausen in 1821 sailed several degrees within the circle, and discovered Petra and Alexander islands. In 1821, Palmer, an American, discovered the land bearing his name. Weddell, in 1823, advanced three degrees farther than Cook—that is, to 74° 15′ S. lat. Biscoe, in 1831–33, discovered Graham and Enderly Lands and Kemp Island—Ballenny, in 1833, Sabrina Land. Expeditions for discovery were sent in 1840 by the French government under D'Urville, and by the American government under Wilkes. D'Urville discovered Adelie and Clarie Lands, and Wilkes, in about the same parallel, coasted along an impenetrable barrier of ice, and as he saw land at different points, he inferred that this icy barrier marked the coast-line of a continuous continent; which does not necessarily follow, and geographers, from subsequent explorations, think, on the contrary, that it is probable that there is a chain of islands in this quarter of the Antarctic just without the circle, extending from the 95th to the 150th meridian. The most important exploration, however, in the Antarctic was made by Sir James Ross in the Erebus and Terror, from 1839 to 1843, who penetrated to 78° 11′ S. lat., the highest southern latitude ever attained, and made extensive discoveries within the Antarctic circle, amongst which was Victoria Land, which he supposed to be a continent, and the coast of which, with its icy barrier 150 feet high, he followed from 70° to 79° S. lat. In the northern extremity of this land, 77° 32′ S. lat., 168° 12′ E. lon., he discovered Mount Erebus, a volcanic mountain 12,360 feet high, and Mount Terror, 10,880 feet, and Mounts Ross, Crozier, Sabine, and Murchison, the whole coast being steep, rocky, and, like nearly all the land seen in the Antarctic, entirely bare. He ascertained the position of the S. magnetic pole to be 75° 5′ S. lat., 154° 8′ E. lon. The object of this voyage was scientific research. It was one of extraordinary perils and wonderful escapes, and the cool courage, perseverance, and ability displayed by both officers and men have never been surpassed in any voyage of exploration. The scientific information obtained in relation to the Antarctic, the course of currents, the distribution of heat, the temperature of the ocean depths, the tides, the mean temperature and pressure of the atmosphere, the extent of the distribution of plants, the fauna, and the geology, were of the highest value. In 1845, Capt. Moore, in the Pagoda, was despatched by the British admiralty for the observation of magnetic phenomena in a quarter of the Antarctic not visited by Ross. In E. lon. 39° 30′, S. lat. 68°, the vessel's course was stopped by an impenetrable ice-pack, when her direction was changed, and she afterward got beyond the 73d parallel.

The researches made show that the two polar regions differ greatly. The seas of the Arctic teem with animal life. Land animals, such as the bear, wolf, reindeer, musk-ox, and Arctic fox, are scattered over the frozen surface of the land, where they find the means of subsistence. The air is peopled with innumerable flocks of birds; a hardy vegetation extends close up to the Arctic circle, and beyond it, in mosses, lichens, scurvy-grass, sorrel, small stunted shrubs, dwarfed trees, and in summer beautiful flowers. In the Antarctic, on the contrary, vegetation ceases at a certain limit, trees terminating at about 56° S. lat. Animal life abounds in the seas, but no quadrupeds are found upon the land, though birds exist in great numbers and in varieties unknown in the Arctic. The severer climate of the Antarctic has been attributed to the great preponderance of water, the direction of its currents, and to the small extent of the land, the continents of America and Africa narrowing to a point, in marked contrast with the great breadth of land that encircles and covers the Arctic. The researches show that in both regions a luxuriant tropical or semi-tropical vegetation formerly existed. The fossil remains of trees three feet in circumference have been found in the Antarctic underlying basalt, and beds of coal in Kerguelen Island and throughout the Arctic, particularly in the eastern portion of the N. W. passage; and at Disco, New Siberia, and in Smith Sound fossil remains have been found of trees of enormous size, of plants, and of numerous animals that exist now only in tropical or semi-tropical regions. Many theories have been advanced

to account for this remarkable phenomenon, the last of which, and the most probable, is that of Mr. Croll, the meteorologist, that a tropical climate in the Arctic and Antarctic is brought about in long lapses of time through the change in the eccentricity of the earth's orbit, in combination with the precession of the equinoxes, by which the distribution of heat, through the action of ocean-currents, is increased N. and S. of the equator as the eccentricity approaches its maximum, causing a slow secular change of climate, of warmer and colder cycles, alternately in the northern and southern hemispheres.

CHARLES P. DALY.

Polar Seas. See ANTARCTIC OCEAN and ARCTIC OCEAN.

Pol'der [Dutch, probably allied to English "pool;" Ger. *pfuhl*, a "pool" or "marsh"], the technical term in Holland for a once-submerged area of land surrounded by dikes and reclaimed by artificial drainage, usually in the smaller polders by wheels driven by windmills—in the great polders powerful pumping-engines moved by steam. The polders vary in area from 100 acres and less to 12,000 or 15,000 acres; their surface is usually depressed from 1 to 15 or 20 feet below the surrounding country, and these lowest, as those of Schieland near Rotterdam, the Haarlemermeer polder, etc., are below the sea-level. South Holland alone contains more than 1000 polders. The most important are those which have been created by artificial drainage of what were permanently-submerged areas, such as that of the Haarlemermeer. (See HAARLEM LAKE.) In connection with the formation of the NORTH SEA CANAL (which see), all the areas once covered by the waters of the Y and Wijkermeer are converted into polders. J. G. BARNARD.

Pole and **Polar,** in geometry. If from any external point a pair of tangents be drawn to a circle, the line drawn through the two points of contact is called the *polar*, and the external point the *pole*. The polar of any point P is constructed geometrically by joining it to the centre C of the circle, and taking on the joining line a point M such that $C\,M.\;C\,P = R^2$. A line drawn at right angles with the joining line through this point is the polar. If the point P be *within* the circle, the above construction will give a line wholly external: no tangents can be drawn through such a point. Nevertheless, the analytical process of determining equations of tangents and of the chord of contact remains the same. The points of contact become *imaginary*, but the imaginary expressions for their co-ordinates will satisfy the equation of the line as constructed by the above rule, and the point and line are still regarded as pole and polar to each other with reference to the circle. Modern geometry rests in no small degree upon the relations of poles and polars. If any curve S and an *auxiliary* circle* be given, another curve s may be generated, the consecutive points of which shall be the *poles* of consecutive tangents to S. The curve s is called the *polar reciprocal* of S, since the latter can be generated from the former in the same manner that s was generated from S. Very important geometrical deductions are derived from these relations. Every theorem of *position* (*i. e.* not involving *magnitudes* of lines or angles) is twofold; from each another can be derived by suitably interchanging the words "point" and "line," "inscribed" and "circumscribed," "locus" and "envelope," etc. Thus, the reciprocal theorems:

If two $\left\{\begin{matrix}\text{vertices}\\ \text{sides}\end{matrix}\right\}$ of a triangle $\left\{\begin{matrix}\text{move along fixed right lines}\\ \text{pass through fixed points}\end{matrix}\right\}$, the $\left\{\begin{matrix}\text{locus}\\ \text{envelope}\end{matrix}\right\}$ of the third $\left\{\begin{matrix}\text{vertex}\\ \text{side}\end{matrix}\right\}$ is a conic section.

In these reciprocal relations consists the "PRINCIPLE OF DUALITY." The method of reciprocal polars (as of projection) is due to Poncelet, but the principle is established on a broader basis (by Möbius, 1827) by that important modification of geometrical interpretation of analytical equations by which a system of co-ordinates (tangential or line) is introduced, in which the position of a right line is indicated by co-ordinates, and that of a point by an equation. J. G. BARNARD.

Pole (REGINALD), b. at Stourton Castle, Staffordshire, England, in Mar., 1500, son of Sir Richard Pole, Lord Montacute, and of Margaret Plantagenet, countess of Salisbury, daughter of the duke of Clarence, the brother of Edward IV.; studied at the Carthusian monastery of Shene, near Richmond; graduated at Magdalen College, Oxford, 1515; was made prebendary of Salisbury 1517 and dean of Wimborne and Exeter 1519; completed his education at the University of Padua, Italy, 1520–23; returned to England 1525; was favorably received by his cousin, Henry VIII., by whom he was sent in 1529 to negotiate for the approval by the University of Paris of the projected divorce of Queen Catharine of Aragon, but soon came himself to an opinion adverse to that measure, and was consequently dismissed from the royal presence 1530; refused also to approve Henry's project of renouncing the allegiance of the English Church to the pope; resided successively at Avignon, Padua, and Venice; sent to Henry his book, *Pro Ecclesiasticæ Unitatis Defensione* (1536), for writing which he was summoned to return to England, and, refusing to obey, was deprived of his ecclesiastical preferments and attainted by Parliament, but in compensation was in the same year invited to Rome by Pope Paul III. and created cardinal Dec. 3; was commissioned as papal legate to France and Flanders 1537, but refused entrance into their territories both by Francis I. and Charles V., but was received by the latter as ambassador in Spain Jan., 1539; was legate at Viterbo 1539–42; presided as papal legate at the opening of the Council of Trent, Dec. 13, 1545; was excepted by name from the amnesty decreed by Edward VI. on his accession to the throne, 1547; was a prominent candidate for the papacy in the election of 1549; was appointed legate to England on the accession of Queen Mary, and received by her with great pomp Nov. 24, 1554; successfully invited Parliament to a reconciliation with the papacy, and freed the realm from spiritual censures; was appointed by the pope archbishop of Canterbury Dec. 11, 1555; was consecrated Mar. 22, 1556; elected chancellor of the universities of Oxford and Cambridge 1556; made a visitation of the universities Feb., 1557, and exercised a great influence upon the government of Mary, though not responsible for the cruelties of the persecution of Protestants, as has frequently been alleged. D. at Lambeth Palace Nov. 18, 1558, the day following the death of Mary. Author of *Liber de Concilio* (1562), the first work printed at Rome by Paulus Manutius; *De Summo Pontifice Christi in Terræ Vicario* (1569), and *A Treatise of Justification* (1569), besides his principal work, previously mentioned. PORTER C. BLISS.

Pole-Axe. See BATTLE-AXE.

Polecat. See WEASEL.

Polem'ics [Gr. πόλεμος, "war"], **Theological,** a branch of the science of theology which has now generally lost its position in the theological system as an independent discipline, and has been incorporated with other branches of the science, but which at certain periods of the history of the Christian Church, and in certain situations, has vindicated itself as of the greatest importance. Thus, in the earliest times of the Christian Church, when Christianity had to defend itself against the attacks of the Jews and the pagan philosophers, theological polemics often occupied the time and the genius of the first minds, such as Irenæus, Tertullian, Athanasius, and Augustine, and a science was developed of the method and principles on which Christianity was to be defended. Again, at the time of the Reformation a similar situation was formed. The Protestant and Roman Catholic theologians not only attacked each other, but the science of such theological polemics was reconstructed. By Schleiermacher, however, this discipline was reduced to an introduction to practical theology.

Polemonia'ceæ [from *Polemium*, one of the genera], a natural order of exogenous gamopetalous plants, mostly herbs, distinguished from allied families by having regular and symmetrical flowers with the parts five each, except the superior pistil, which is of three carpels, forming a three-celled capsule. The seed-coat when wet usually develops mucilage and spiral threads, especially in the genus *Collomia* (which takes its name therefrom), and in the large genus *Gilia*. *Polemonium* (the Greek valerian or Jacob's ladder) is the only European genus, but the single European species is also North American, as are the few others and nearly all the rest of the order, except a few peculiar to South America, and one or two extending into North-eastern Asia. The order is rich in plants for ornamental cultivation, but is otherwise of no economical importance, the plants and their watery juice being bland and inert. PHLOX (which see) furnishes the gardens with numerous handsome perennials and one or two annuals, running into many varieties; *Gilia* supplies many annuals, chiefly Californian, and one or two showy biennials, such as the "standing cypress." *Cobæa*, a common cultivated climber, with compound leaves and tendrils, is an anomalous member of the family from Mexico and South America. ASA GRAY.

Polianthus. See TUBEROSE.

Police' [Gr. πόλις]. This term is applied in common discourse to two very different although related subjects: it denotes the particular department of a national juris-

* Any conic section may be employed, but the circle, as the simplest, is used. The relation of pole and polar, of point and line joining pairs of tangents, is, however, developed by *all* curves of whatever degree.

prudence which is specially concerned with the quiet and good order of society, and it is also used to designate the organization of officials by which the rules composing that department of the law are enforced. In the former and primary sense, and in its most comprehensive meaning, police may be defined as the action of society in suppressing and removing the obstacles which are opposed to the attainment by the state or by individuals of the objects or ends for which they exist. In more definite language, it is the means instituted by the government to maintain public order, liberty, property, and individual security. In the accomplishment of this function it is sometimes the auxiliary of the administrative department, sometimes the auxiliary of the judicial department. In the former case, the measures which it employs are chiefly preventive, and are necessarily, to a certain extent, discretionary. This very discretionary power, which renders the police action more prompt and effective, also renders it more dangerous to civil liberty. The sphere within which it may act should therefore be carefully limited, and the general purpose of its measures should be accurately defined by the law. In respect to the nature of its functions and the subject-matter of its acts and rules, police is separated into two principal divisions—the administrative and the judicial. The former is confined to the work of supervision, and to the habitual maintenance of public order in every place and in each part of the general administration. The latter has for its object the discovery and investigation of offences which the administrative police has not been able to prevent, the collection of the proofs, and the bringing the offenders before the courts for trial and punishment. These divisions are essential, and are found in every country; the differences exist in the modes of organization.

Administrative Police.—According to the definition already given, this most important class should consist solely in the use by the public authorities of such measures of prevention in every place, and for each branch of the administration, as are deemed proper to suppress the infractions of existing laws. In some European countries, however, the police authorities exercise in addition a certain power of making regulations, delegated to them in different degrees, by virtue of which they themselves promulgate the rules necessary to maintain the permanent good order in society. Such methods are unknown in England and in the U. S., and are opposed to the principles of constitutional government and to the spirit of civil liberty, which require an absolute separation of the legislative and the administrative functions. In respect to the extent of the powers which may be exercised in maintaining public order, there are two systems which stand in marked opposition. One entirely subordinates the citizen to the administration, assumes charge of all his acts, authorizes or forbids the exercise of private rights, and only allows to the individual the liberty of choosing certain pursuits, of opening certain establishments, of devoting himself to certain professions, when he has obtained permission of the proper authority. The other, on the contrary, trusting the citizens, traces out in advance their duties, and subjects them equally to conditions which are expressed in general terms, and not for each special case and each individual; whoever infringes them incurs the penalties prescribed beforehand by the law. The former of these systems prevails to a greater or less degree in several continental states of Europe—among others, in France, Germany, Austria, and Russia; it is opposed to the genius of American and British institutions, and to all the tendencies of legislation based upon free constitutions. A special branch of administrative police forms a part of many European national systems, to which the name "political police" has been appropriately given. It has for its object the maintenance of the public peace considered as identified with the stability of the government. Its proceedings are therefore directed solely to the detection and prevention of offences against the state, and both its measures and its officials are generally secret. In respect to the modes of organizing the officials who are charged with the administrative police duty, and the distribution of functions among them, the division is commonly made between the general or rural police, which operates throughout the country districts, and the metropolitan police, which is constituted for large cities. While both of these classes have the same general objects and are clothed with the same general powers, the duties of the latter are, from the nature of the case, much more minute, extensive, detailed, affecting a greater variety of subjects, and enforcing a greater number of rules. The most important objects which the administrative police, whether rural or municipal, has in view are the safety of the state, the security of persons, the public health, and the orderly pursuit of the various industries in which society is engaged. In many of the continental states of Europe the functions of the police organizations, properly so called, embrace all of these subjects. In the U. S. and in Great Britain their functions are limited to the security of persons and property, and to the measures which fall within the division of judicial police; other departments of the government, State or municipal, are charged with the duty of maintaining the safety of the state, preserving the public health, and regulating the operations of trade and commerce so far as they are subjected to governmental control.

John Norton Pomeroy.

Polignac′, the name of a French family which has played a conspicuous and fatal part in the later history of the Bourbons.—Jules, Count de Polignac, and his wife, Yolande Martine Gabrielle de Polastron, were the most intimate friends of Marie Antoinette and the most prominent members of that faction of the court which, under the leadership of the count of Artois, gathered around her and intrigued, more or less openly, against the reforms of Louis XVI. and his ministers. The count was made a duke in 1780, and the family received immense dotations of land and money. As the prodigality of the queen and the political mistakes she made were generally ascribed to the influence of the duchess of Polignac, she and her husband were the special objects of the French people's hatred and contempt. But they were very prudent people; they left the country, together with the count of Artois, July 16, 1789, as the first *emigrés.* The duchess d. at Vienna Dec. 3, 1793. The duke went afterward to Russia, where he was well received by Catharine II.; she gave him an estate in Ukraine, where he d. Sept. 21, 1817. His three sons tried first to form an intrigue for the re-establishment of the Bourbons by the First Consul, through his wife, Josephine; afterward they participated in the conspiracy of Cadoudal, and were imprisoned at Paris when the allied army approached the city. They were very active for the return of the Bourbons, and soon made a brilliant career. The second of them, Jules Augustus Armand Marie, b. May 14, 1780, was made a Roman prince by the pope in 1820, and became president of the cabinet Aug. 8, 1829. As such he signed the famous ordonnances of July 25, 1830, which caused the immediate downfall of the Bourbon dynasty. He fled, but was caught at Granville Aug. 15, 1830, brought first to St. Lô, then to Vincennes, and sentenced by the Chamber of Peers to imprisonment for life and forfeiture of his titles and rights as a citizen. Restored to liberty by the amnesty of Nov. 29, 1836, he went to England. D. Mar. 2, 1847, at Paris.

Poligna′no a Ma′re, town of Italy, province of Bari, on the summit of a broad, steep rock which rises, island-like, almost perpendicularly from the Adriatic, with a partially secure anchorage for shipping. The trade is mostly in lemons and oranges. A little N. W. of the town stands the monastery of Sanvito, remarkable for its size, its architecture, and the fine finish of the interior. P. in 1874, 8564.

Poligny′, town of France, department of Jura, has large dye-houses, tanneries, ironworks, and a trade in wine and grain. Good marble-quarries are found in the vicinity. P. 5401.

Pol′ishing Slate, a very light scaly material brought from France and Germany, and used for finishing glass-ware, marble, etc. It is composed of the fossil frustules of diatoms, and is essentially the same as tripoli.

Po′lish Language and Literature. The great Slavic family, with its numerous idiomatic variations, offers four distinct literary languages—the Polish, the Bohemian (Czech), the Serbo-Illyrian, and the Russian. The Polish, developing under the parliamentary debates of a comparatively free government, and refined through the genius of eminent writers, is superior to all her sisters, and the nation which speaks it occupies the first place in the civilization of the Slavic peoples. The Poles, who were masters of all the countries between the Elbe and the Dnieper, have spoken it ever since their settlement in these regions. It became a written language simultaneously with the introduction of Christianity into Poland. Its oldest relic is the war-song *Bogarodzica* ("St. Mary's Hymn"), ascribed to Bishop Adalbert (d. 997), a Bohemian, Poland's first apostle and martyr. But the Latin language, introduced and fostered by the Church, gained a powerful ascendency even among the people; Polish writers used it exclusively for several centuries. Extant among these are the chronicles of Martin Gallus (d. 1150), Vincent Kadlubek (d. 1223), and the more extensive works of Jan Dlugosz (d. 1480). The golden era of Poland's classical literature embraces the interval between 1506 and 1622. The popular idiom had at that time asserted its right as a written language, without, however, entirely superseding the Latin, as the poems of the renowned lyrists Sarbiewski (d. 1640) and Szymanowicz (d. 1629) attest. Upon this newly-acquired domain

Polish classical poetry throve both in style and form with wonderful vigor, demonstrating how thoroughly ancient and modern models had been studied, and how well they were appreciated. Nicolas Rêj (d. 1569), heralding the classical period of Polish literature, stands hardly above mediocrity as a poet, but as a prose-writer he has earned the name of the Polish Montaigne in his didactico-historical memoirs entitled *The Books of the Life of an Honest Man*. A younger contemporary of Rêj, Jan Kochanowski (d. 1584), the most brilliant representative of this literary period, is deservedly considered as the coryphæus of the Polish language. The Frenchman Ronsard was his teacher; Virgil and Ovid his models. Highly valued both by Roman Catholics and Protestants was his translation of the Psalms, which in sublimity of style equals the original. A charming production, replete with noble sentiment, is his lyrical poem, *Treny* (tear-drops shed over the grave of his little daughter). His rivals and imitators were numerous, but all the writers of this period were distinguished not only for simplicity and elegance of style, but for entire absence of levity; what they wrote was for a serious and manly purpose, in keeping with the nation's character; and it is indeed to the credit of Poland that her intellect never has been prostituted to the service of vice. The sacred literature of this period is represented by Andrew Trzyciecki (d. 1584), chaplain at the court of Albrecht of Brandenburg, the first sovereign duke of Prussia. Trzyciecki contributed extensively to the Protestant Polish hymnal compiled by Jan Seklucyan (d. 1578), whose Protestant Polish Bible, now very rare, was printed at Königsberg in 1551. Seklucyan also took prominent part in the translation of the Calvinistic Bible, printed at Brzesc-Litewski in 1563. Jacob Wujek (d. 1597), a renowned Latin, Greek, and Hebrew scholar, called the Hieronymus of Poland, translated the Bible into Polish for Roman Catholics. The third decade of the seventeenth century found Poland's literature in complete lethargy, which continued for over a century and a half. The precious germs so successfully nurtured during the golden era became mildewed and blighted under the baneful influence of the order of Jesuits, whose importation into Poland was effected by Cardinal Hosius in 1562. They managed to secure the exclusive guardianship of national education and the printing-press. Henceforth, the Polish language was looked on as heathenish, and therefore to be reprobated, and in its place the dead language of Rome was instituted. They fomented internal discord and destroyed the welfare of the realm for ever, paralyzing the intellectual life of the nation. All valuable relics of Poland's ancient literature, as well as a large number of Protestant works, were doomed to the flames, and books of mediæval scholasticism put in their place. The nation had become degenerate and frivolous. Religious tolerance, the boast of an earlier Poland, was abrogated and the horrors of persecution initiated. Toward the close of the eighteenth century began among the priestly order of the Piarists a national reaction against the Jesuits. A member of the former order, Konarski (d. 1773), undertook by means of educational, religious, and rhetorical works, as well as through the republication of ancient Polish authors, to revive the national literature, wherein he was supported by O. Kopczynski, the foremost Polish grammarian, Piramowicz, and Naruszewicz. Literature revived, indeed, but only in the form of imitation, and the French classicism of the period of Louis XIV. became its absolute model. The leaders of this movement were the archbishop Krasicki (d. 1801), whose fables and satirical epics, *Myszeis* ("War of Mice") and *Monomachia* ("War of Monks"), are famous; the declamatory satirist Trembecki (d. 1812), the erotic Kniaznin, and the satirist Wegierski (d. 1787).

Poland's deplorable downfall caused also the death of this artificial literature, as it had developed under the effeminate Stanislas Augustus, preparing, however, for the regeneration of Polish poetry. The Poles began to appreciate the sacred word *ojczyzna* ("fatherland"). The national chord was touched by Karpinski (d. 1825), and the epic poem of Woronicz (d. 1829), *Sibylla*, delineates the principal epochs of Poland's history. Still more decisively is this the case in the works of Kosciusko's war-companion, Julian Niemcewicz (d. 1841). Although not entirely emancipated from the formal traditions of "classicism," his *Songs of the Poles*, his drama, *Kasimir the Great*, his novel, *Jan of Tenczyn*, and his history of the reign of Sigismund III. are nevertheless replete with national pathos. Upon these three-mentioned harbingers follows the reformer of Polish literature, Adam Mickiewicz (d. 1855), undoubtedly the greatest poet that not only Poland but the entire Slavic race has as yet produced. He belongs to the romantic school of poets. Besides the traditional poetry of the various Slavic peoples, Shakspeare, Schiller, and Byron have influenced him. Not without reason, and apparently referring to himself, Mickiewicz once said that Byron was the mystic ligature which united the great literature of the Slaves with that of the Western nations; the types created by Byron are multiplied and refined in even more sublime forms by the Slavic genius. *Ojczyzna*, however, is the chord which incessantly vibrates in Mickiewicz's poems; it affords him neither rest, nor time to plunge, like Byron, who cared little for England, into a sea of doubts. The dominant thought which resistlessly agitates the Polish bard is the moral and political restitution of his country. A fierce strife ensued subsequently to 1815 between the classical and romantic leaders in Poland, which resulted in the general acknowledgment of Mickiewicz as leader of the modern literature, seconded by the excellent popular lyric poet and influential critic, Brodzinski (d. 1835). A. C. Odyniec and I. Korsak have both been meritorious in furthering the new movement by the translations of congenial foreign authors. The most perfect expression of Mickiewicz's genius is given in his ballads and romances, including the bold and fantastic rhapsody *Faris* and the delightful sonnets *From the Krim* (Crimea), all translated into German by K. von Blankensee. Among his great creations in dramatic form is *Dziady* ("Obsequies"), wherein the author portrays not only his personal grief, but also the woes of his people and humanity at large; it is a shriek of rage and revenge in behalf of a downtrodden people, a cry of despair in behalf of an enslaved and tortured humanity. More artistic in form than *Dziady* is *Konrad Wallenrod* (German translation by Kannegiesser), which the Poles consider their national epic. It treats of the period when the order of the German knighthood preached to the Lithuanians "the religion of love" by means of fire and sword. The pearl of Slavic literature, and at the same time one of the best modern European epic poems, is Mickiewicz's *Pan Tadeusz* ("Thaddeus"), German translation by Spazier. In it the author treats the social and political events of his country of a more recent date. His subsequent productions are historical studies of the Slavic race, delivered in the form of lectures at Paris in the Collége de France (1840–44), published in 4 vols. in French, and translated into German by Siegfried. A contrast to Mickiewicz was J. Slowacki (d. 1849). Both were patriots; the former romantic, with a tendency toward religious mysticism—the latter modern and liberal. As a dramatist (in *Maria Stuart*, *Balladina*, *Mazeppa*, etc.) and as a writer of epics (in *Zmija*, *Jan Bielecki*, *Mnich*, *Lambro*, *Waclaw*, *Beniowski*, etc.) he has evinced high power; and as a lyrist, in his last poem, *Krol Duch* ("king-genius"), he delineates in beautiful and lofty stanzas the Slavic genius, approaching in design and execution Shelley's *Revolt of Islam*.

With the Lithuanian school of poets—called so in honor of Mickiewicz's home—was associated that of the Ukraine. Inspired likewise by the same national aspiration, it principally bases its creations on the nature and history of the poetical home of the Cossacks. Among the first of the Ukraine's poets is Bogdan Zalewski, whose *Dumy* ("Musings") have become the common property of the people. His next great poem, *Duch od Stepu* ("The Genius of the Steppe"), is a thrilling reflection of the historical destiny of the Slaves. Still more energetic than Zalewski are Malczewski (d. 1826) and Goszczynski, in their poetical portraiture of Ukraini's life. The former in his poetical narrative *Maria* (German translation by Vogel) has transplanted a Volhynian legend upon the soil of the Ukraine, describing with masterly skill the tumult of battle which so frequently swept over these steppes. His poetry became the most popular on account of its heroine being the true ideal of a Polish woman. Goszczynski's renown rests chiefly on his famous *Zamek Kaniowski* ("Castle of Kaniov"), in which he portrays with great fidelity the last war between the Cossacks and the Poles. An original and fiery prose-writer of this school, Michal Czajkowski, gives graphic pictures of the life and habits of the Cossacks and Don Slaves in his *Cossack Legends*, *Wernyhora, the Prophet of the Ukraine*, *Kirdzali*, *the Hetman of the Cossacks*, *Czarniecki*. Active participator in the great rising of the Poles in 1830, he became a voluntary exile, and, buffeting with an adverse fate in foreign lands, he finally embraced Islamism, as a reward for which the Turkish government created him pasha and commandant of Turkish Cossacks. Pardoned 1873 by the Russian government, he now lives within her domain as her pensioner, devoting as loyal subject his talent to the reconciliation of his countrymen with Russia. Most of the followers of the Ukraine school were, like Mickiewicz, exiles, who produced in foreign lands an extensive literature. As lyrists and novelists active at home Bielawski, Siemienski, Skarbek, Massalski, and Kraszewski—the latter a highly-gifted author, and unquestionably the greatest, most fertile, and national among Polish novelists—deserve mention. In the historical novel Rzewuski is

noticeable. In his poetical narratives, *Stepy, Kirgiz* (German translation by Bahn), Zielinski is the successful rival of Mickiewicz and Malczewski. Prominent among the most recent writers are the ardent and pathetic poet of *Lirenka*, T. Lenartowicz; the national songster, *par excellence*, Vincent Pol (d. 1873); the valiant, but early deceased, Romanowski (d. 1863); Roman Zmorski, Ch. Brzozowski, the affectionate lyrist, F. Morawski; Maria Ilnicka; Gabriela Zmichowska; the highly-gifted improvisatrice, Deotima (Hedwig Luszczewska); and the epic as well as dramatic poet, Wladimir Wolski. In religious legends and popular traditions Archbishop Holowinski excels (d. 1855). Adam Asnyk published in 1869, under the pseudonym "El . . . y," his excellent poems, remarkable for artistic finish, copiousness, and nobility of thought. Wladyslaw Belza may also be counted among the most gifted modern poets. Before concluding the list of remarkable Polish poets, particular mention must be made of two of the highest rank. Stephen Garczynski since his participation in the revolutionary war against Russia (1830) has uttered many a wrath-flaming war-song in exile. His philosophical epic, *Waclaw's Deeds*, is his principal work. Sigismond Krasinski (d. 1859) is the author of *Nieboska Komedia* ("Undivine Comedy"), (German trans. by Batornicki), a fantastic drama, inasmuch as not only the scene and persons, but also the time which it portrays, had never existed, but, ardently hoped for by millions of sorrowing hearts, were created by the poet. The future therein is anticipated with such solemn and prophetic grandeur that one reading it cannot help exclaiming, "Thus will it be." Krasinski's second work, *Iridion* (German translation by Germano-Polonus), likewise in prose and dramatic form, is, æsthetically viewed, a still loftier composition than the former. It also delineates the exasperated strife between an ancient and modern society —the strife from an enlarged Christian view of the world with that of an arrogant Roman state-idea. The scene is laid in the most depraved period of Rome's decay. The main thought of this glowing poem is the principle of revenge, which exhibits itself in the history of the world as the world's doom. *Iridion* contains the embodiment of a principle which ever again reappears in stirring centuries.

In the department of metaphysics noteworthy is J. Goluchowski (d. 1858), *Philosophy in its Relation to the Life of Nations and Single Individuals*. August Cieszkowski accepts in his *Prolegomena Historiosophiæ*, as a philosophical basis, a personal self-conscious God and the immortality of the soul. The original, but in his theories frequently misty supernaturalist, F. B. Trentowski (d. 1869), wrote, besides numerous works in Polish, in German *Vorstudien zur Wissenschaft der Natur; Grundlage der universellen Philosophie*, and a posthumous work, *Die Freimaurerei*. Honorable mention should be made of J. Supinski, who has written a valuable work on general physiology, and belongs to the greatest of national economists. Carl Libelt, rewarded with the title of doctor by the University of Berlin for an essay, *De Pantheismo in Philosophia*, wrote a new system of philosophy, holding that the discovery of truth is only feasible through intuition, "which either as a vague, uncertain presentiment or as a sudden flash reveals in its totality a clear recognition of truth." An edition of all his works is about to be issued by J. K. Zupanski in Posen.

Among Poland's modern historians, Joachim Lelewel pre-eminently occupies the first place. Bestowing with unsurpassed industry his activity not only on the history of his own country, to which even in exile he clung devotedly, he embraced in his investigations all nations, as his numerous works on the philosophy of history, geography, numismatics, history of jurisprudence, and bibliography attest. Lelewel wrote in Polish as well as in French, and himself engraved the explanatory charts for his works. This highly meritorious man, minister of public instruction in Poland during the revolution of 1830, lived during the last twenty-nine years of his life at Brussels in indigent circumstances, yet known and honored by high and low. Abstemious as Diogenes, he rejected with indignation every offer of open or secret aid. D. at Brussels in 1861. C. Szajnocha, J. Szujski, L. Lozynski, A. Moraczewski, T. Morawski, J. Lepkowski, and J. Lukaszewicz are all accurate historians. In the department of linguistic research are noted Kopczynski, Linde, Mrozinski; in lexicography, Bandtke, Trojanski, Mrongovius, Leslaw, Lukaszewicz, A. Czajkowski, and Rykaszewski. JOSEPH KARGÉ.

Poliste'na, town of Southern Italy, province of Reggio di Calabria, on the Gerapotamo, at the western foot of the Apennines. The modern town is of little interest except as commanding a wonderfully fine sea-view. The old town, of ancient but uncertain origin, was nearly destroyed by an earthquake in 1783. P. in 1874, 8530.

Poli'tical Econ'omy. The Greek word *οἰκονομία* means "the law of the house," with special reference to a thrifty provision for the physical well-being of the members of the household. As individuals make up families, so families make up cities or states; and *political* economy is to the community or body politic what domestic economy is to the household. The principles of sound economy as respects both the acquisition and the expenditure of means for physical comfort, are essentially the same in the two relations. Hence, there is fitness in the term thus extended, and, despite the manifold objections that have been urged, its fitness and convenience are likely to perpetuate its use, as the term, on the whole, best suited for its purpose.

Definitions.—Political economy is that department of social science which treats of the development and application of material wealth for the physical well-being of men in society. The science is based on four fundamental laws: (1) God has made man a creature of *desires*, and constituted the material world in which he lives with qualities and powers available for the *gratification* of those desires. There is no assignable limit to the development of either men's desires or nature's resources. (2) For those desires which rise above the very simplest wants of the animal, man must by *labor* force Nature to yield her hidden resources. All the conveniences and comforts of civilized life come only through labor. (3) The exertion of labor establishes a *right of property* in the fruits of labor, and the idea of exclusive appropriation and possession is a necessary consequence. (4) With this right of property comes also the possibility and right of *exchange*, or the mutual transfer of possessions between man and man and between different communities and countries. The material of this department of science thus lies fixed in the nature of man and of the physical world which he controls, and in the structure of human society. It is drawn out by the study of men's wants, the investigation of nature's resources, the study of the statistics of human invention and industry, and the defining of principles for common and reciprocal agencies in social relations. This science combines elements of both physical and metaphysical philosophy. It differs from the purely physical sciences in that the phenomena of *human volition* are continually involved in the system. It differs from the branches of intellectual and moral science in that it contemplates those phenomena with reference mainly to certain physical results.

Political economy regards *self-interest* as a universal motive of human action. Assuming this without considering directly the moral aspects, its ever-recurring problem is to find a common interest which, as the resultant of the antagonism of individual self-interest, may properly combine and regulate the separate forces. Three desires inherent in every man contend for the mastery: (1) desire of ease; (2) desire of present gratification; (3) desire of means to ensure future gratifications. The resultant of these conflicting desires measures for any man his interest in the accumulation of wealth. The degree in which the others are subordinate to the third determines the productive activity of a community.

The main subject of political economy is *wealth*. This term may be concisely defined to embrace *the sum-total of useful things which can be appropriated and exchanged*. The original source of all wealth is the bounty of God in nature. The secondary source of wealth is man's labor exerted to bring forth the bounty of nature in form and time and place adapted to meet the wants of men. (See WEALTH.) Another important term of this science is *value*. In its strict signification value is simply *purchasing power*; that is, that quality of anything which gives it power to command other things in exchange. Both services and commodities have value. (See VALUE.) The ultimate end contemplated in political economy is the production of wealth in the largest measure and of the highest value, and its application to the fullest and most general satisfaction of men's desires.

Divisions.—First to be studied are the laws and processes which relate to the *production* of wealth. But the object for which wealth is produced is to provide the means of gratifying men's desires, and such gratification involves always the destruction or consumption of values. Next to be studied, therefore, are the laws and processes which relate to the *consumption* of wealth. Production and consumption thus constitute the two leading divisions of this science. But, again, in civilized society many persons are concerned in producing the things of value which are counted as wealth, and the principles which pertain to the equitable *distribution* of the value embodied in these joint products must be distinctly studied. Furthermore, every man wants many things which he cannot directly produce for himself—many things which his own country cannot yield. Hence the necessity for the mutual transfer of values

in *exchange* under defined processes and just laws. So we recognize distribution and exchange as two subordinate divisions of political economy. The processes and laws of production and consumption are simple and easily apprehended. The most difficult problems of the science are concerned with adjusting matters of distribution and exchange. Those which are logically the subordinate divisions do therefore demand the largest place in the actual treatment of the subject. (The limits of this article permit a notice only in meagre outline of the main points of these four divisions.)

Production.—Wealth is produced by the application of human labor to things existing in nature. But the laborer must have fit instruments, and must be supported by provisions already laid up. These are the fruits of previous labor embraced under the comprehensive term capital. Under production must be considered, therefore, (*a*) labor, (*b*) *capital*, (*c*) the co-operative union of labor and capital. Under labor are included both physical and mental labor. In the last analysis, physical labor only gives motion to matter and directs it. Mental labor, as directly concerned in production, is employed in the processes of discovery and invention. Indirectly, it contributes to the main end by improving the condition of the laborer and perfecting the organization of society. (See LABOR.) The effectiveness of labor is increased by the employment of nature's forces and by a systematic division of labor. (See DIVISION OF LABOR and MACHINERY.) To secure these helps capital is all-essential. Capital is the result of saving—that is, simply laying up a surplus of wealth produced above wealth consumed. It represents former labor, and in the process of production it is embodied in three forms—viz. the materials to which labor is applied, the instruments of labor, and the means for the support of the laborers. (See CAPITAL.) The union of labor and capital is natural and necessary. In it, past labor, the fruit of saving, simply joins hands with present labor, vital and active. They meet to best advantage in the same person—that is, when the laborer is owner of capital enough to employ his labor. Sound political economy favors the making of every laborer to some extent a capitalist, and every capitalist in some way a laborer. But the capacities, tastes, and habits of men so differ that this adjustment cannot be made universal. Yet, as the principles of political economy are better understood and more fairly applied, society will approximate this ideal state, and the greatest good of the greatest number will be realized. Government best fulfils its function when it secures the utmost freedom to both parties and guards most faithfully the rights of each.

Consumption may be regarded as either *private* or *public*. Private consumption embraces the following legitimate gratifications: (*a*) those which pertain directly to the preservation of life and health; (*b*) those which delight the senses and tastes, refining without corrupting the life; (*c*) intellectual gratifications, which come through the expansion of the mind's powers and the acquisition of knowledge; (*d*) social gratifications, found in the exercise of genial hospitality and all acts of friendliness; (*e*) moral gratifications, which proceed from the culture of a good conscience toward God and toward man. It will be seen that the noblest and richest of these gratifications are the least costly. Public consumption includes that destruction of values which is directed by public authority for the general good, specified as follows: (*a*) expenditures for the support and administration of government; (*b*) expenditures for the defence of the state; (*c*) expenditures to favor commercial intercourse at home and abroad; (*d*) expenditures to secure the general education of the people; (*e*) expenditures for advancing science and diffusing intelligence; (*f*) expenditures for the relief of poverty and special calamities. The style and scale of public expenditure should be such as to command the respect and honorable pride of the people, without useless display. Its method should be such as to hold all the agents of the government to a direct responsibility and to the utmost fidelity in the discharge of all trusts. Wisdom dictates that the government should undertake no work which private enterprise can as well or better achieve. There are two simple rules of economy for both private and public consumption: (1) let the destruction of value in any case be as small as possible to secure a given result; (2) from a given expenditure get the largest and most satisfactory result possible.

Distribution.—In any branch of industry, and in the general productive industry of a nation, three parties are to be recognized—viz. the government, which gives security to property, the owners of the capital employed, and the laborers. The gross annual production must accordingly be distributed for four distinct purposes: (1) for the support of government through taxes paid (see TAXATION); (2) for replacing the capital actually destroyed, in materials used up, in provisions consumed, and in machinery worn and decayed; (3) to give capital its due reward in the form of rent, interest, or dividends (see INTEREST and RENT); (4) to give labor its due reward in wages, salaries, commissions, or fees (see WAGES). These four items are to be reckoned in the aggregate of expenses of production. But the result of productive industry should show a surplus beyond these in the form of profits. (See PROFITS.) The most difficult question of distribution respects the disposal of these. Strict justice would divide the profits in some fair proportion between the capitalists and the laborers, including the managers, with due regard to the difference of capacity, responsibility, and risk pertaining to the respective parties. The interposition of government is needed only to guard the rights of all. Where liberty and intelligence prevail, these matters will be best adjusted by free competition under the general law of supply and demand. The wide range and intricate complication of this part of the subject may be apprehended if one will take a single article—a shirt, for instance—and consider how many processes and how many persons have come in between the unploughed cotton-field and the finished garment on the wearer's back, to have some part in its production.

Exchange.—The diversity of nature's gifts, the wide reach of men's desires, and the principle of division of labor necessitate exchange. This part of the machinery of society gives rise to the most difficult problems of our common life; hence it fills the largest place in the discussions of political economy. Some have therefore proposed to resolve the whole science into a science of catallactics or exchanges. The simplest form of exchange is barter—that is, the giving of service for service, commodity for commodity, or service for commodity, and commodity for service. Value is the central term in this branch of the subject. The inconveniences of barter necessitate the introduction of some instrument which shall serve as a universal measure of values and as a medium of exchange. This instrument, whatever form it takes, is money. (See CURRENCY and MONEY.) Credit also, in the machinery of exchange, renders a service no less important than that of money. Credit in political economy is simply *trust in the promise of an equivalent to be rendered at a future day for values immediately transferred.* The true basis of all credit is real wealth, existing or prospective, which is, or is expected to be, at the command of the party trusted. Its essence is confidence in his ability and truthfulness. When either of these is weakened, credit wavers. Credit fulfils two important functions: (1) It brings capital and labor together for production. It cannot of itself create wealth, but it can turn existing wealth into capital by transferring it from those who cannot to those who can employ it, and is thus the indispensable means for bringing the whole capital of a country into the fullest productive activity. (2) Credit facilitates exchanges. As an intermediate agency it actually effects far the greater part of the exchanges of the world with great saving of money, time, labor, and risk, virtually resolving trade to a great extent into barter. The leading forms in which credit is thus employed are, book-accounts, loans, mercantile paper, bank-deposits, stocks, bonds, and bills of credit issued by banks or governments to be used as currency. (See BANK, BOND, BOOK-KEEPING, BILL OF EXCHANGE, and STOCKS. Credit unduly extended leads inevitably to financial panic. Under the head COMMERCE the intricate relations of exchange to both production and consumption, and to the growth of nations and the progress of civilization, are treated with sufficient fulness. For a discussion of the question of government interference with the freedom of exchange in order to foster home production, see the articles on FREE TRADE and PROTECTION.)

History.—This article cannot be fitly closed without a few words on the history and development of political economy as a science. Under the ancient civilizations of Egypt, India, Greece, and Rome we find evidence of careful observation of the facts of economic science and the occasional defining of sound principles. But no systematic arrangement of either facts or principles was attempted. Aristotle in one of his works first employs the term "political economy," though in a vague way, and propounds some good doctrines which have stood the test of time. But with Greeks and Romans alike agriculture was the only form of labor held in any honor. All mechanical and commercial occupations were esteemed servile and degrading, and consequently any development of public economy in its wide range was impossible. The convulsions of the Dark Ages checked industry and suspended commerce. Feudalism gave birth to the protective system and to manifold grievous monopolies. In the sixteenth century the industrial and commercial activity of

the Italian cities prompted a broader and more philosophical investigation of the sources of public prosperity, and with the Italian writers of that and the following centuries systematic political economy had its origin. Its development was aided by Spanish and French writers and by the financial reforms instituted by Sully and Colbert, the ministers of Henry IV. and Louis XIV. The restrictive policy of the so-called mercantile system, which forbade all exportation of gold and silver, and of the false idea of the balance of trade, both involving the principle of monopoly, prevailed in the first stages of the science. In England the operations of the East India Company first raised a question as to the soundness of the current notions, and along in the middle of the seventeenth century various tracts appeared affirming, as McCulloch says, "that the prosperity of states can never be promoted by restrictive regulations or by the depression of their neighbors; that the genuine spirit of commerce is inconsistent with the selfish and narrow policy of monopoly; and that the self-interest of mankind, not less than their duty, requires them to live in peace and to cultivate a fair and friendly intercourse with each other." In 1776, Adam Smith published his *Wealth of Nations*, which may be said to be the beginning and source of modern political economy. Since his day, amid much conflict of opinions, fundamental principles have been settled, and the tendency has been to recognize more and more the golden rule of Christ as applicable alike to states, communities, and individuals, in their economic relations as well as in all other social relations.

A. L. CHAPIN.

Polity, Ecclesiastical. See CHURCH GOVERNMENT.

Polizia'no, Angelo (ANGELUS POLITIANUS), b. at Monte Pulciano in Tuscany July 14, 1454; was tutor to the two sons of Lorenzo de' Medici, and afterward professor of Latin and Greek at the Lyceum of Florence; exercised a great literary influence by his elegant translations and critical treatment of the classical authors, and acquired wide celebrity both as a Latin and an Italian poet. D. Sept. 24, 1494, at Florence. He was the author of the first regular drama written in Italian, *Orfeo*, composed in 1472, first published in a critical text in 1770, and again, together with his *Rime*, in 1864 by Carducci. An edition of his collected works appeared in Bâle in 1653.

Poliz'zi Genero'so, town of Sicily, province of Palermo, situated in a very fertile but little cultivated district. There is a great lack of industry as of education among the inhabitants. P. in 1874, 6724.

Polk, county of Arkansas, bounded W. by the Indian Territory. Area, 1100 sq. m. It is rough and hilly, and abounds in coal, iron, lead, novaculite, limestone, and timber. The soil is adapted to corn and cotton culture. Cap. Dallas. P. 3376.

Polk, county of Central Florida. Area, 1580 sq. m. It is chiefly occupied by dense pine forests. It has a light, productive soil, fit for cotton, corn, and sugar culture. Cattle-raising is the principal pursuit. Cap. Peace Creek. P. 3169.

Polk, county of N. W. Georgia. Area, 360 sq. m. It is level in the N., broken in the S. The soil is generally good. Corn and cotton are leading products. The county is traversed by Cherokee R. R. Cap. Cedartown. P. 7822.

Polk, county of Central Iowa. Area, 567 sq. m. It is level, fertile, and produces large quantities of corn and wheat. Good coal is found abundantly, and the county is well timbered and watered. It is traversed by various railroads, centring at Des Moines, the capital of the county and State. Des Moines is also the seat of important and increasing manufactures. P. 27,857.

Polk, county of N. W. Minnesota. Area, 4800 sq. m. It is but slightly developed, and is in part occupied by Indian reservations. The soil is in general adapted to wheat-culture. The county is traversed by Wild Rice and Red Lake rivers, and bounded W. by Red River of the North, which separates it from Dakota. Cap. Crookston.

Polk, county of S. W. Missouri. Area, 576 sq. m. It is uneven, well wooded, and generally fertile. Live-stock, grain, and wool are leading products. It is traversed by Pomme de Terre River. Cap. Bolivar. P. 12,445.

Polk, county of Central Nebraska. Area, 490 sq. m. It is bounded N. W. by Platte River, and is rolling, fertile, and finely adapted to stock and grain raising. Cap. Osceola. P. 136.

Polk, county of North Carolina, bounded S. by South Carolina and W. by the Blue Ridge. Area, 250 sq. m. It is broken and rough, with fertile valleys. Corn is the principal product. Gold and other metals are found. Cap. Columbus. P. 4319.

Polk, county of N. Oregon. Area, 920 sq. m. It is bounded E. by navigable Willamette River and W. by the Coast Range of mountains. The E. is level, extremely fertile, and well settled; the W. is mountainous and heavily timbered. Wheat, oats, wool, and cattle are largely produced. Cap. Dallas. P. 4701.

Polk, county of Tennessee, bounded E. by North Carolina and S. by Georgia. Area, 400 sq. m. It is mountainous, and has valuable ores of copper. Corn is a leading product. It is traversed by Hiawassee and Ocooee rivers. Cap. Benton. P. 7369.

Polk, county of S. E. Texas, bounded W. by Trinity River, which is navigable during high water. Area, 1188 sq. m. It is all fertile land, well wooded, producing corn, cotton, live-stock, some sugar and tobacco. Cap. Livingston. P. 8707.

Polk, county of N. W. Wisconsin, bounded W. by Minnesota, from which it is separated by St. Croix River. Area, 950 sq. m. It is well timbered, and adapted to wheat and small grains. Cap. Osceola Mills. P. 3422.

Polk, tp., Arkansas co., Ark. P. 613.

Polk, tp., Calhoun co., Ark. P. 286.

Polk, tp., Montgomery co., Ark. P. 304.

Polk, tp., Newton co., Ark. P. 369.

Polk, tp., Huntington co., Ind. P. 960.

Polk, tp., Marshall co., Ind. P. 1812.

Polk, tp., Monroe co., Ind. P. 843.

Polk, tp., Washington co., Ind. P. 920.

Polk, tp., Benton co., Ia. P. 1196.

Polk, tp., Bremer co., Ia. P. 1267.

Polk, tp., Jefferson co., Ia. P. 1211.

Polk, tp., Marion co., Ia. P. 879.

Polk, tp., Taylor co., Ia. P. 724.

Polk, tp., Wapello co., Ia. P. 1113.

Polk, tp., Adair co., Mo. P. 769.

Polk, tp., Atchison co., Mo. P. 562.

Polk, tp., Cass co., Mo. P. 1307.

Polk, tp., Christian co., Mo. P. 1243.

Polk, tp., Dade co., Mo. P. 1453.

Polk, tp., De Kalb co., Mo. P. 957.

Polk, tp., Madison co., Mo. P. 320.

Polk, tp., Nodaway co., Mo. P. 3427.

Polk, tp., Ray co., Mo. P. 1368.

Polk, tp., St. Clair co., Mo. P. 316.

Polk, tp., Sullivan co., Mo. P. 1415.

Polk, p.-v., Jackson tp., Ashland co., O., on Atlantic and Great Western R. R.

Polk, tp., Crawford co., O. P. 4369.

Polk, tp., Jefferson co., Pa. P. 256.

Polk, tp., Monroe co., Pa. P. 1076.

Polk, tp., Washington co., Wis. P. 2220.

Polk (JAMES KNOX), eleventh President of the U. S., b. in Mecklenburg co., N. C., Nov. 2, 1795, of Scotch-Irish stock originally named Pollock, was a grand-nephew of Col. Thomas Polk, celebrated in connection with the Mecklenburg Declaration of Independence; removed to Tennessee with his father, Samuel Polk, 1806; graduated at the University of Nashville 1818; studied law with Felix Grundy; was admitted to the bar at Columbia 1820; was a member of the State legislature 1823–25; acquired prominence as a lawyer; was elected to Congress 1824, and continuously re-elected until 1839; was an able speaker and debater; conspicuous as an opponent of the administration of Adams, of all Federal appropriations for internal improvements, of protective tariffs, and of the national bank; was an early and influential supporter of Jackson, whose conduct in the removal of the deposits he vindicated in the session of 1833–34, being then chairman of the committee of ways and means; was defeated as Democratic candidate for Speaker 1834, but elected 1835, and re-elected 1837, presiding over the House with dignity and ability; was governor of Tennessee 1839–40; was proposed by the legislatures of Tennessee and of other States 1840 as a suitable candidate for Vice-President of the U. S.; was defeated in 1841 as a candidate for re-election as governor; was nominated by the Democratic national convention at Baltimore (May 27, 1844) for the Presidency in opposition to Henry Clay, and elected by 170 electoral votes against 105, the chief issue being the annexation of Texas, which was accomplished by the expiring administration of Tyler the day before Polk's inauguration, Mar. 4, 1845. Pres. Polk formed an able cabinet, consisting of James Buchanan, Robert J. Walker, William L. Marcy, George Bancroft, Cave Johnson, and John Y. Mason; settled the Oregon boundary question; created the department of the interior;

succeeded in carrying the low tariff of 1846; reorganized the financial system of the government, and conducted the Mexican war, which resulted in the acquisition of California and New Mexico and had far-reaching consequences upon the later fortunes of the republic. Declining to seek a renomination, Polk retired from the Presidency Mar. 4, 1849, when he was succeeded by Gen. Zachary Taylor; retired to Nashville, and d. there June 19, 1849. Without being possessed of extraordinary talents, he was a capable administrator of public affairs and irreproachable in private life. PORTER C. BLISS.

Polk (LEONIDAS), b. at Raleigh, N. C., in 1806; graduated at the U. S. Military Academy, and entered the artillery July, 1827; resigned Dec. 1, 1827; in 1831 was ordained in the P. E. Church; was missionary bishop of Arkansas and the Indian Territory S. of 36° 30′, with provisional charge of the diocese of Alabama, Mississippi, and Louisiana, and missions in the republic of Texas, 1838–41; bishop of Louisiana 1841–61. In 1861 he accepted the appointment of major-general in the Confederate army, and commanded at Columbus; subsequently commanded a division in the West; at Murfreesboro', Chattanooga, Chickamauga, and in the Georgia campaign of 1864 commanded a corps, ranking then as lieutenant-general. Was killed at Pine Mountain, Ga., June 14, 1864.

Polk (THOMAS), b. probably in Mecklenburg co., N. C., about 1732; became the proprietor of a large estate near Charlotte, and colonel of the county militia; issued in May, 1775, the summons for the election of the delegates who framed May $\frac{20}{31}$ the MECKLENBURG DECLARATION OF INDEPENDENCE (which see); took part in the Revolutionary conflict; led an expedition of 700 men against the Tories of South Carolina, and was commissary-general of provisions for the State of North Carolina, but incurred the suspicion of Gen. Gates by accepting protection from Cornwallis 1780. The date of his death is unknown.

Polk (TRUSTEN), b. in Sussex co., Del., May 29, 1811; graduated at Yale 1831; studied in the law school at New Haven, Conn., and in 1835 became a lawyer of St. Louis; was chosen to the constitutional convention of 1845; Presidential elector 1848; governor of Missouri 1857; U. S. Senator 1857–62, when he was expelled on account of his hostility to the U. S. government.

Polk (WILLIAM), son of Col. Thomas, b. near Charlotte, N. C., in 1759; was present at the Mecklenburg Declaration of Independence, May, 1775; joined the Revolutionary army 1777; was engaged in the battles of Brandywine and Germantown; accompanied Gates and Greene in their Southern campaigns; was wounded at Eutaw Springs; represented Mecklenburg county in the North Carolina legislature 1787; subsequently removed to Raleigh; took an active part in State politics; declined a nomination as brigadier-general 1812, being opposed to the war with England; was a prominent witness in behalf of the Mecklenburg Declaration of Independence, and collected testimony to establish its genuineness. D. at Raleigh Jan. 14, 1835, being then the last surviving field-officer of the North Carolina line.

Polk (WILLIAM H.), brother of President Polk, b. in Maury co., Tenn, May 24, 1815; educated at Chapel Hill, N. C., and at the University of Tennessee; was admitted to the bar 1839; elected to the legislature 1841 and 1843; appointed by Pres. Tyler chargé d'affaires to Naples 1845; served as a major of dragoons in the Mexican war; was a delegate to the Nashville convention 1850; member of Congress 1851–53, and a firm opponent of secession. D. at Nashville Dec. 16, 1862.

Pol'ka [Czechic, *pulka*, "half," from its characteristic half-step], a dance in $\frac{2}{4}$ time, with an accent on the third quaver of the measure. It is reputed to have been invented about 1831 by a peasant-girl of Elbeteinitz in Bohemia. It was introduced into Paris in 1840.

Polk'ton, tp., Ottawa co., Mich. P. 2416.

Polkton, p.-v., Anson co., N. C., on Carolina R. R., 144 miles W. of Wilmington, has a school, 2 churches, 1 newspaper, 2 steam saw-mills, 1 cotton-gin, and carriage factories. P. about 400. C. D. GALE, ED. "ANSONIAN."

Polk'ville, v., Calhoun co., Ala. P. 434.

Pol'la, town of Southern Italy, province of Salerno, on the Negro, in a district very fertile in the cereals and abounding in rich pasturage. P. in 1874, 5706.

Pollanarrua, once the capital of Ceylon, now only a heap of ruins, situated about 60 miles N. E. of Candy, and consists of an immense tank and a number of remains of curious constructions. It was first visited by Europeans in 1820, and the place is now generally called *Toparé*.

Pol'lard [from *poll*, to "clip the hair"], a tree whose branches are cut off completely from time to time for the purpose of obtaining fuel, stakes, vine-props, bark, etc. The trees most frequently pollarded are the willow, poplar, elm, and oak. The custom prevails extensively in Europe, and, judiciously managed, yields a larger amount of wood than almost any other plan.

Pollard, p.-v., cap. of Escambia co., Ala. P. 1087.

Pollard (EDWARD A.), b. in Nelson co., Va., in 1838, a son of Maj. Richard Pollard, U. S. A.; was educated at the University of Virginia and at William and Mary College; visited California, Mexico, and Nicaragua; was a government clerk at Washington under Mr. Buchanan's administration; edited the Richmond *Examiner* during the war of 1861–65; edited *Southern Opinion* 1867–69; author of *Black Diamonds* (1859), *Eight Months in Prison* (1865), *Southern History of the War* (1866), *The Lost Cause* (1866), *Lee and his Lieutenants* (1867), *Life of Jefferson* (1868), *Life of Jefferson Davis* (1869), *The Lost Cause Regained* (1868), and a series of political works.

Pol'len [Lat., "fine flour"], the fine dust-like substance produced within the anthers of phanerogamous plants, and discharged by the bursting of the anther. It serves to fertilize the ovules contained within the female organs of the plant. The forms of pollen-grains when seen under the microscope are exceedingly various, but are constant for the same species, and sometimes for genera or orders. Each pollen-grain possesses two envelopes, the inner one exceedingly delicate. Functionally, the pollen-grain represents the phytozoön (antherizoid) of the cryptogamous plant, but in structure it more nearly resembles the spore. A. GRAY.

Pollen'za [*Montemilone*], town of Italy, province of Macerata, in the Marches, about $5\frac{1}{2}$ miles from the town of Macerata. Pollenza stands on a hill in the midst of a district rich in pasturage and producing the best olive oil; it is still surrounded by old walls. Near Pollenza, Stilico gained his great victory over the Goths in 403 A. D.

Pollen'zo, small town of Northern Italy, province of Cuneo, noticeable as the site of the ancient *Pollentia*, of which interesting ruins remain.

Pol'lio (CAIUS ASINIUS), b. at Rome in 76 B. C.; began his career as an orator; sided in the war between Cæsar and Pompey with the former, whom he accompanied from the Rubicon to Rome, and again on the march to Pharsalia; commanded in Spain against Sextus Pompeius; was consul in 40 B. C., during the first triumvirate; made a successful campaign in Illyria in 39; retired from public life, and devoted himself to literary pursuits; was a friend of Virgil, Horace, and Catullus; founded the first public library in Rome, and wrote a history of the civil war, which is lost. D. 4 A. D. A few letters from him to Cicero have been preserved.

Pöll'nitz, von (KARL LUDWIG), BARON, b. Feb. 25, 1692; d. June 23, 1775; was maintained through all his life by some royal person in some court quality—latest by Frederick the Great—and wrote in French *Mémoires* (3 vols., 1734) and *Nouveaux Mémoires* (2 vols., 1737), which may be read with interest.

Pol'lock, a name of the *Pollachius* (or *Merlangus*) *carbonarius*. (See COAL-FISH.)

Pollock, p.-v., Perry tp., Clarion co., Pa., on Allegheny River.

Pollock (FREDERICK), BART., b. in London, England, Sept. 23, 1783; graduated at Cambridge 1806; became fellow of Trinity College 1807; studied law at the Middle Temple; was called to the bar Nov., 1807; had great success in his profession; became king's counsel 1827; sat in Parliament for Huntingdon 1831–44; was knighted Dec., 1834; was attorney-general during the first and second administrations of Sir Robert Peel; succeeded Lord Abinger as chief baron of the court of exchequer and privy councillor Apr., 1844, which post he held until July, 1866, when he retired with a baronetcy. D. at Hatton, near London, Aug. 23, 1870.—Sir DAVID POLLOCK, an elder brother, was also distinguished at the bar and as a magistrate, rising to the post of chief-justice of Bombay, India.—Sir CHARLES EDWARD POLLOCK, son of Sir Frederick, b. Oct. 21, 1823, has been queen's counsel and baron of the exchequer, is author of several legal textbooks, and was knighted in 1873.

Pollock (Sir GEORGE), b. in London in 1786; educated at the Woolwich academy, but in 1802 entered the military service of the East India Company; became captain of the Bengal artillery in 1805, colonel 1829; participated in the sieges of Dieg and Bhurtpore 1802–05; commanded the artillery in the Burmese war 1821, and the armies W. of the Indus in the Afghanistan war 1842, having attained the rank of major-general in 1841. For his services in Burmah he was made C. B., and his services in Afghanistan were recognized by many marks of distinction. The East

India Company granted him a pension of £1000. He was one of the earliest to receive the order of grand commander of the Star of India, was brevetted field-marshal in 1870, and succeeded the late Sir John Burgoyne as constable of the Tower in 1871. In Mar., 1872, he was created a baronet. D. at Walmer Oct. 6, 1872.

Pollock (James), LL.D., b. in Milton, Northumberland co., Pa., Sept. 11, 1810, of Scotch-Irish ancestry; graduated with first honors at Princeton in 1831; was admitted to the bar in 1833; was district attorney 1835–38; a Whig member of Congress 1843–49; became in 1850 president judge of a State district court; was governor of Pennsylvania 1855–58; was director of the U. S. mint, Philadelphia, 1861–66, and again received the same office in 1869.

Pollockshaws′, town of Scotland, county of Renfrew, on the White Cart, has manufactures of silk and cotton goods, cotton-spinning, and calico-printing. P. 7648.

Pol′lok (Robert), b. at Muirhouse, Renfrewshire, Scotland, in 1799; graduated at the University of Glasgow; studied theology, and was licensed as a preacher of the United Secession Church 1827. D. at Southampton Sept. 15, 1827. Author of *Tales of the Covenanters* (1833) and of *The Course of Time* (1827), a poem in blank verse which gave great promise of future excellence. It became extremely popular both in Great Britain and in the U. S., where for many years it was used in schools as a parsing-book.

Pol′loksville, tp., Jones co., N. C. P. 1263.

Pollux. See Castor and Pollux.

Pol′lux (Julius), b. at Naucratis, Egypt, about 130 A. D.; lived in Athens as teacher of rhetoric and philosophy. His *Onomasticon*, edited by Dindorf (Leipsic, 1824) and Bekker (Berlin, 1846), is a kind of dictionary in which the principal words relating to certain subjects are collected into groups, defined, and illustrated by quotations. The work is of manifold interest to the student of the Greek language, literature, and art.

Po′lo, p.-v., Buffalo tp., Ogle co., Ill., on Illinois Central R. R., has a public library, good schools, 2 banks, 2 grain-harvester manufactories, 7 churches, 1 weekly and 2 monthly papers, 3 hotels, and stores. P. 1805.

J. W. Clinton, Ed. "Ogle Co. Press."

Po′lo, Mar′co. The name is the most remarkable in the history of travel, though the individual in his dim personality can hardly rank as one of the greatest men among travellers. The Polos were a noble family of Venetian merchants represented about 1260 by three brothers, Marco, Nicolo, and Maffeo. In the year named Nicolo, who had left a family at Venice, and Maffeo went on a mercantile venture to the Tartar court at Sarai on the Volga. Thence circumstances carried them to Bokhara, and a party of Mongol envoys, passing that way, invited their company to the court of the Great Khan in the far East. Kublai, the ablest descendant and successor of Chinghiz, was then reigning. His nominal supremacy embraced all Asia except the great southern peninsulas, though his kinsmen in Turkestan, in Persia, and on the Volga were now practically independent. Never before having seen European gentlemen, he took the Polos into great favor, and after a time sent them back, in the character of envoys to the papal court, to ask, among other things, for a great body of priests to instruct his people. Kublai seems to have had no religious motive, but he felt the want of religious aid to civilize his Tartars, and saw, no doubt, that men of this Frank stamp were likely to render higher aid than lamas or degenerate Nestorians. The two brothers reached Acre in Apr., 1269, and, hearing that the papal see was vacant, went home. Nicolo found that his wife was dead, but that his son Marco, the subject of this article, was now a fine lad of fifteen. After waiting two years vainly for a new pope, the brothers started again for the East, taking young Marco. They were yet on the Gulf of Scanderoon when they heard at last of a pope's election in the person of Tedaldo Visconti, a church dignitary of Acre, who had shown great interest in their mission, and who afterward reigned creditably as Gregory X. He recalled them to Acre to receive his letters, but in lieu of the hundred teachers asked by Kublai he could give but two, and the hearts of these failed at the outset. The long journey to Cathay occupied three years and a half. It lay through Southern Armenia, Persia, the valley of the Oxus, and Badakhshan, thence over the high plateau of Pamir, a route since followed by no European until the spirited exploration of Lieut. Wood in 1838 to the sources of the Oxus—an exploration only now (Mar., 1874) followed up. From Pamir the Venetians descended upon Kashgar, and thence by Khotan and across the Gobi desert to *Tangut*, as the country at the western end of the Great Wall was then called. Here they were met as the Great Khan's guests, and conducted to his summer-seat at Shangtu on the plateau of Mongolia, 200 miles nearly due N. of Peking (*Cambaluc—i. e. Khan-bâligh*, "imperial city"). Kublai received the party cordially, and showed especial favor to Marco. The young man applied himself to acquire some languages current at the Mongol court (though Chinese was certainly not one of his acquisitions), and soon got employment in the khan's service. Under 1277, M. Pauthier has found a Chinese record of his nomination. His first important commission carried him through Western China and the wild Tibetan frontier to Yun-nan, called by the Mongols Karajang (*Carajan*), and thence to the borders of Burma (*Mien*). Marco had observed the khan's interest in strange countries, remarkable objects, and peculiar manners, and had heard his frank disgust expressed at the stupidity of travelled officials who could only give a dry report of business. He therefore stored his memory with curious facts, and related them with vivacity at court. Favor followed him, and he was often employed on foreign or domestic business. Our information on this is only incidental. But a mission to India was one of his charges, and the government of the great city of Yangchew, with its district, was another. The khan grew old, and the Polos began to fear what might follow his death; they desired to depart, but he heard them with displeasure, and but for a happy accident we should have lost our mediæval Herodotus. Kublai's kinsman, Arghûn, khan of Persia in 1286, lost his favorite wife, Bulugân. Dying, she begged him to fill her place with a Mongol lady of her own family in Cathay. Envoys were sent to Cambaluc, and Kukâchin, a beautiful maiden, was selected to return with them. The envoys desired to return by sea, and sought the company of the experienced Venetians. Kublai was reluctant, but consented, and fitted the party out nobly for the voyage, charging the Polos with friendly messages for the kings of France, England, and Spain. Their fleet of fourteen vessels sailed from Fokien in the beginning of 1292; the voyage was long and disastrous, but the Polos after two years landed in Persia. Arghûn had long been dead, and his brother reigned, but Ghazan, his son, afterward a famous king, succeeded to the bride's hand. She quitted her noble Frank guardians with tears, and we learn from a Persian writer that she did not long survive. After a time the Polos proceeded to Europe, and reached Venice late in 1295. Venetian tradition preserved the story of their cold reception, and of the quaint means which they took to have their identity acknowledged; for which we have no space here. Venice and Genoa were then in hot and often sanguinary rivalry. In 1298 the Genoese sent forth a powerful armament under Lamba Doria to strike the foe in her own waters. Venice hastily augmented her Adriatic fleet under Andrea Dandolo, and under him went Marco Polo as gentleman-commander (*sopra comito*) of a galley. On Sunday, Sept. 7, 1298, the fleets came to action off Curzola, with disaster to the Venetians: 7000 prisoners were carried to Genoa, Polo among them. At Genoa he fell in with a certain Rusticiano or Rustichello of Pisa, an inmate also of the prison there, and known otherwise as a *littérateur* of humble claim. To him we owe the preservation of Polo's travels and memory, for he probably suggested the record of his experiences, and certainly he wrote them down from Polo's dictation. In the summer of 1299 peace was made and the prisoners were liberated. Marco Polo survived to Jan., 1324, the date of his will still extant, but died soon after—certainly before June, 1325. He had married, and left three daughters; two of them married before his death. One of these, Fantina Bragadino, survived in 1379. Nicolo, the father, was dead before Aug., 1300; Maffeo, the uncle, was alive and made a will in 1309.

The *Book of Marco Polo* consists of two unequal sections. The first, called *Prologue*, is a personal narrative of great interest, but too great brevity. The second consists of a long series (232 in the oldest form) of chapters, extremely various in length and interest, descriptive of the regions of Asia visited by the Polos in their different journeys, but especially of the emperor Kublai, his court and dominions. It is a curious fact, only ascertained within the last half century, but now quite proved, that the original work, dictated by Marco, a Venetian, to Rustichello, a Pisan, was written in *French*, and very bad French too. The greatest number of MSS. is, however, in Latin, a version by Friar Pipino, executed in Polo's lifetime, having been much diffused. Italian versions are also numerous, the French less so, but far more valuable. The whole number of MSS. known is under 80. Polo's recognition as prince of mediæval travellers is due to his romantic story and to the vast compass of his travels, anticipating so many supposed discoveries of the sixteenth century, rather than to transcendent character or capacity. It is a mistake to place him beside Columbus, as declaimers and enthusiastic

biographers have done. We trace in him nothing of the genius and lofty enthusiasm or ardent previsions of the great admiral. But he has his own real, indisputable, and unique claims to glory. He was the first traveller to trace a route across the whole longitude of Asia, naming and describing kingdom after kingdom from the shores of Cilicia to the Yellow Sea—the first traveller to reveal China in all its wealth and vastness, with its mighty rivers, its huge cities, its swarming population, and rich manufactures; to tell us of the nations on its borders, with their eccentricities of manners and worship; of Tibet, of Burma, of Laos, of Siam, of Cochin-China, of Japan; the first to speak of that museum of beauty and wonder, the Indian Archipelago; of Java, the pearl of islands; of Sumatra (*Java Minor*); of Ceylon with its Mountain of Adam; of India, not as a mythical region, but as a country seen and partially explored; of the secluded Christian kingdom of Abyssinia; of Zanzibar, Madagascar, and Socotra; and in remotely opposite quarters of the high plateaus of Pamir, with their wild sheep; of Siberia and the Arctic Ocean; of white bears, sledge-dogs, and reindeer-riding Tunguses. That all these should be the revelations of one man and one book surely accounts for and amply justifies the author's high place on the roll of fame, without our seeking to invest him with imaginary attributes. His book has presented many difficulties, but progress in exploration and in the translation of Oriental literature has made most of them now clear. Marsden's (London, 1818) was the first edition of value; Pauthier's (Paris, 1865) brought a vast amount of curious and interesting Chinese learning to bear upon the subject. The present writer in 1871 published an edition on which great labor had been bestowed, and this is about to issue afresh with many additional elucidations and illustrations. H. YULE.

Polotsk', town of Russia, government of Vitebsk, on the Dwina, is one of the oldest towns of Russia, the see of an archbishop, and has many educational institutions, but no manufactures and only a small trade. P. 11,418.

Polta'va, government of European Russia, bordering S. and W. on the Dnieper, comprises an area of 19,265 sq. m., with 2,102,614 inhabitants. The surface is level, the soil fertile, and the climate mild and agreeable. Agriculture and rearing of cattle are almost the only branches of industry pursued. Corn, hemp, tobacco, and fruits are raised; bees and silkworms are extensively reared. Manufactures are few, and the inhabitants often emigrate to the adjacent governments to find employment.

Poltava, town of European Russia, capital of the government of Poltava, on the Vorskla, is a neat and handsome place, though most of its houses are built of wood. It has some manufactures and four annual fairs, at which large commercial transactions take place. On June 27, 1709, Peter the Great won here a decisive victory over Charles XII., in commemoration of which a large monument has been raised in the principal square. P. 31,852.

Polyan'dry [Gr. πολύς, "many," and ἀνήρ, ἀνδρός, "man," "husband"], the custom which prevails extensively in many wild tribes in various parts of the earth of marrying a woman to several husbands at once. The Todas of India, the people of Thibet, and other tribes of Asia follow this practice. Very commonly the husbands are all brothers, and in some tribes they together take but one wife.

Polyan'thus ("many-flowered"), a popular name for a large class of primroses, probably belonging to *Primula grandiflora*, and quite closely allied to the auriculas, cowslips, oxlips, etc. The polyanthus is a hardy perennial, and the flowers are often beautiful and profuse.

Polyatomic Alcohols. See ALCOHOL.

Polybasic Acids. See ACIDS.

Polyb'ius, b. about 204 B. C. at Megalopolis in Arcadia of a wealthy and influential family; entered early into the military and political service of the Achæan league, and was one of the 1000 Achæans who were summoned to Rome after the battle at Pydna (167 B. C.) to answer before the senate why the league had not sent auxiliaries to the Roman army in Macedonia. The trial never came off, but the hostages were detained for sixteen years in Italy, having been distributed among the towns of Etruria. Polybius, however, was allowed to live in Rome, and stayed in the house of Æmilius Paulus. Here he formed an intimate friendship with Scipio Æmilianus, whom he accompanied on his African campaign, where he witnessed the destruction of Carthage. On the outbreak of the war between Rome and the Achæan league he hastened home, and arrived in Greece just after the fall of Corinth, in 146. He now exerted himself successfully to mitigate the fate of his countrymen, and statues were afterward raised in honor of him by several Greek cities. Of the latter part of his life very little is known; he is said to have died in the eighty-second year of his age from a fall with his horse. His principal work, and the only one of which anything has come down to us, is his history of Rome, in 40 books, from 220 to 146 B. C., with an introduction giving a sketch of the rise of the city from its conquest by the Gauls to the outbreak of the Second Punic war. Only the first five books and fragments of the rest are still extant, edited by Schweighäuser (Leipsic, 1789–95, 8 vols.), I. Bekker (Berlin, 1844), and L. Dindorf (Leipsic, 1866); translated into French by Thuillier, with military notes by Folard (6 vols., Paris, 1727–39), and into English by Hampton (2 vols., 1772). In artistic respects the history of Polybius can hardly be said to occupy any high rank, though perhaps it would be unjust to form any definite judgment from the existing fragments. But the author was possessed of accurate and extensive geographical and military knowledge, and his representation is impartial and conscientious.

Pol'ycarp, one of the apostolic Fathers, apparently of Christian parentage, a disciple of St. John and bishop of Smyrna, where he suffered martyrdom. It has generally been supposed that his martyrdom occurred in the year 166 or 167 A. D. But recent investigations (of Waddington and others) have changed the whole chronology, making it probable that he was b. in 69 or 70 and d. 155 or 156 A. D. Most of what is known of him comes from his pupil Irenæus, who was bishop of Lyons 177–202 A. D. In his letter to Florinus (preserved by Eusebius, *Hist.*, v. 20) Irenæus gives a graphic account of Polycarp as remembered by him. Another extract (*Adv. Hær.*, iii. 3, 4) emphasizes Polycarp's hostility to heretics. And there is still another extract from a letter of Irenæus to Victor, bishop of Rome (preserved by Eusebius, *Hist.*, v. 24), in relation to the Passover dispute, describing a visit of Polycarp to Anicetus, bishop of Rome from 154 A. D. What purports to be an epistle from the Church in Smyrna to a neighboring Church in Philomelium, describing the martyrdom of Polycarp, if genuine, must have been largely interpolated. But some features of the narrative are quite above suspicion and in keeping with the best traditions of the age. When entreated to save his life by reviling Christ the answer of the martyr was, "Eighty and six years have I served him, and he has done me no ill, and how can I blaspheme my King who has saved me?" The spot now pointed out as the site of this martyrdom is marked by a tall cypress on the face of Mount Pagus, overlooking the city of Smyrna. Polycarp's Epistle to the Philippians appears to have been written shortly after the martyrdom of Ignatius, 115 A. D. Its genuineness, though disputed by writers of the Tübingen school, is now generally conceded. Its tone is hortatory; its most important characteristic, great profuseness of quotation from the apostolic writings. The best editions are those by Hefele (1839; 4th ed. 1855), Dressel (1857; 3d ed. 1876), and Jacobson (1838; 4th ed. 1866). (See an essay by Prof. Lightfoot in the *Contemporary Review*, May, 1875.) R. D. HITCHCOCK.

Polycen'tridæ [from *Polycentrus*, Gr. πολύς, "many," and κέντρον, "spine"], a family of teleocephalous fishes peculiar to the fresh waters of tropical South America. The body is much compressed; the scales ctenoid; the lateral line undeveloped; the head compressed; the opercular bones more or less armed; mouth with a lateral cleft; upper jaw very protractile; teeth small; branchial apertures extensive; branchiostegal rays six; dorsal and anal fins long, each armed with numerous spines, and with the soft portions comparatively short and opposite each other; pectorals with branched rays; ventrals thoracic, each with a spine and five rays. The family is composed of two genera—(1) *Polycentrus*, without a barbel, and (2) *Monocirrus*, with a barbel. Two species of the former and one of the latter are known. THEODORE GILL.

Pol'ychrome, synonymous with ÆSCULIN (which see).

Polychrome Printing. See PRINTING.

Polycle'tus, b. at Sicyon, Achæa, subsequently made a citizen of Argos; received instruction, together with Phidias and Myron, from Ageladas, and made the celebrated chryselephantine statue of Hera in the Heræum of Argos, and the still more celebrated statue of the *Spear-bearer*, which was afterward studied by other artists as containing the *canon* with respect to the proportions of the human body. He was also famous as an architect, and built the theatre of Epidaurus.

Polyc'rates, tyrant of Samos, one of the most daring and most successful of the many sea-kings who in ancient times swarmed over the Ægean Sea; was warned by his friend, King Amasis of Egypt, that he should sacrifice something which he valued very highly in order to ward off the envy of the gods. He consequently threw his ring, a jewel of immense value, into the sea, but the next day the ring was found in the stomach of a fish served up on his table. His life, which was one long series of brilliant

victories, ended, nevertheless, in a pitiful manner. One Orœtes, satrap of Sardis, lured him into Magnesia, and seized and crucified him for some unknown reason about 522 B. C.

Polydip'sia [Gr. πολύς, "much," and δίψα, "thirst"], a name given to the disease sometimes called *diabetes insipidus*, in which the patient drinks large quantities of water. The name has also been given to the morbid appetite for alcoholic drink, a far more formidable disease.

Polygala'ceæ, or **Milkworts,** a natural order of polypetalous exogenous herbs and shrubs, of which the large genus *Polygala* is the typical one. The order is remarkable for the seemingly papilionaceous character of its flowers, although the structure is really quite different; the parts which have been called wings belong to the calyx, and the pistil is compound, with two cells to the ovary; the stamens are eight or fewer, and the anthers open by a terminal pore. The order is extremely well marked, but its relationship obscure. It is widely distributed over the world, and several species of *Polygala* (called milkwort, but not milky) are prized for their ornamental flowers. The Atlantic U. S. have numerous species, all low herbs; among them, the principal officinal plant of the order *P. Senega*, the Seneca snake-root, the acrid root of which is used as a stimulating expectorant and diuretic. It has an old reputation as an antidote to the bite of the rattlesnake; and in various parts of South America, also in South Africa, the same property is ascribed to certain species of *Polygala*. The roots of several European and one U. S. species have been used as bitter tonics.

ASA GRAY.

Polyg'amy [from the Gr. πολύς, "many," and γαμεῖν, to "marry"], the state of a man having two or more wives at the same time. The state of a woman having two or more husbands at the same time is generally called POLYANDRY, and is treated under that head. In ancient times polygamy was practised by all the Eastern nations, and was sanctioned, or at least tolerated, by their religions. In the Homeric age it seems to have existed to some extent among the Greeks, but during the later development of Greek civilization it entirely disappeared. To the Romans and the Gotho-Germanic races it was unknown. With the Jews it was common among the patriarchs and tolerated by the law of Moses, but toward the beginning of our era the custom appears to have died out. The Koran sanctions it, but among the Arabs it does not prevail as a general rule. Among Christians, although the New Testament contains no positive injunction against it, it was never tolerated until, in 1843, Joseph Smith introduced it among the Mormons in accordance with a special "revelation" he had received. (See MORMONS and BIGAMY.) In our times polygamy is common only among the savage African and Malayo-Polynesian races, and among the degraded Asiatic nations.

Pol'yglot [from the Gr. πολύς, "many," and γλῶττα, "tongue"], a book with versions of its text in several languages, but generally used only of such editions of the Bible. Of Origen's *Biblia Hexapla* only a few fragments are extant. The first great polyglot printed was the Complutensian (Alcalá de Henares, Spain, 1522); it was followed by the Antwerp (1569–72), the Parisian (1628–48), and the London (1654–57).

Polygno'tus, b. in the beginning of the fifth century B. C. in the island of Thasos; was an intimate friend of Cimon, and lived mostly in Athens, where he decorated the temple of Theseus, the Anaceum, and the Pœcile; afterward also the inner halls of the Propylæa. His pictures were very celebrated in antiquity, and the whole art of painting appears to have been elevated to a high standard by his genius.

Pol'ygon [Gr. πολύς, "many," and γωνία, "angle"], a limited plane figure bounded on all sides by straight lines. The bounding lines are called *sides* of the polygon, and the points at which they meet are called *vertices* of the polygon; the entire bounding line is called the *perimeter*. Polygons are divided into classes according to the number of their sides or angles. Polygons of three sides are called *triangles;* those of four sides are called *quadrilaterals;* those of five sides, *pentagons;* those of six sides, *hexagons;* those of seven sides, *heptagons;* those of eight sides, *octagons;* those of ten sides, *decagons;* and so on. If the sides of a polygon are equal, the polygon is said to be *equilateral;* if its angles are equal, it is called *equiangular*. A *regular* polygon is both equilateral and equiangular. If the circumference of a circle is divided into any number of equal arcs, the chords of these arcs form a regular polygon having a corresponding number of sides; if the number of sides of such a polygon is greater than any assignable number, or *infinite*, the value of each side is less than any assignable line, or *infinitesimal*, and the polygon is then said to become a circle. The circle is therefore the limit of an inscribed regular polygon having a varying number of sides. A closed broken line, all of whose sides are not in a single plane, is often called a *twisted polygon*.

W. G. PECK.

Polygona'ceæ, a natural order of apetalous exogenous herbs, shrubs, or rarely trees, found in most parts of the world and containing about 700 species. The essential marks of the order are the nodose stems or swollen joints, usually entire leaves, and ochreate stipules—*i. e.* the stipules form sheaths around the stem; the stamens seldom accord in number with the divisions of the usually colored calyx; and the ovary contains a solitary orthotropous ovule, rising from the base of the cell. The properties of the order are somewhat diverse, and the economical uses of some species important. Several have purgative roots, of which the officinal rhubarb is the noted representative. Many, such as docks, bistort, etc., have very astringent roots. A volatile acridity characterizes the herbage and gives name to water-pepper and smart-weed, common species of *Polygonum;* and some of these species yield a yellow dye for domestic use, while the wood of *coccoloba* dyes red. The fruit or succulent calyx of the latter is eaten under the name of seaside grape. Sorrel and some species of rhubarb, etc. are noted and useful for their pleasantly acid herbage, and the farinaceous grain of buckwheat takes the place and well fulfils the office of a cereal grain. ASA GRAY.

Polyg'onal Numbers, series of numbers each term of which is formed from the preceding by adding to it the corresponding term of an arithmetical progression. They are called polygonal numbers because the number of points in each series can be arranged in the form of a polygon, which gives the name to the series. Thus, the numbers 1, 3, 6, 10, 15, etc. are triangular numbers, because they indicate the proper number of points necessary to form triangles. The numbers 1, 4, 9, 16, 25, etc. are square numbers, since the corresponding number of points may be arranged in squares. The numbers 1, 5, 12, 22, etc. are pentagonal numbers.

Polyhe'dral Angle, an angular space bounded by three or more planes passing through a common point. The intersections of the bounding planes are called *edges* of the polyhedral angle, and their common point is called the *vertex* of the angle. If a sphere is described about the vertex as a centre with a radius equal to 1, the part of its surface included within the bounding planes is taken as the measure of the angle.

Polyhe'dron [Gr. πολύς, "many," and ἕδρα, "side"], a volume bounded on all sides by polygons. The polygons are called *faces*, and the lines in which they meet are called *edges* of the polyhedron. The points in which two or more edges meet are called *vertices* of the polyhedron. The simplest polyhedron is bounded by four triangles, and is known as pyramid or tetrahedron.

Polyhym'nia, one of the nine Muses, the inventor of the lyre and the genius of lyric poetry, is generally represented by ancient artists in a pensive attitude.

Polymer'ic Isomorph'ism. (For ISOMORPHISM see that head.) Polymeric isomorphism is a term applied to a class of facts first observed by Scheerer, to the effect that in minerals containing both magnesia and combined water the crystalline form is not altered by the substitution of three equivalents of water for one equivalent of magnesia. MgO was therefore claimed by Scheerer to be isomorphous, or crystallogenically equivalent to $3H_2O$. Scheerer's observations, published in 1846, were followed up in 1853 by Prof. Sterry Hunt, who maintained that in mineral species water plays the same part that H_2C does in organic compounds, and that series of *homologues* (see the article HOMOLOGY) are formed by successive additions of single molecules thereof, which homologues must of course be also *isomorphs* to satisfy this view. Laurent had before pointed out cases among organic salts where additional water does not change the crystalline form. Prof. Hunt appears also to have extended his idea so as to include other metallic oxides besides magnesia. The subject is still involved in much obscurity. H. WURTZ.

Polymerism. See ISOMERISM.

Polymyxi'idæ [from *Polymixia*, Gr. πολυμιξία, "a mingling of many characteristics"], a family of teleocephalous fishes distinguished by the peculiar union of characters. The body is rather elongated and compressed; the scales are not serrated; the lateral line is continuous with the back; head compressed and with a decurved profile; preoperculum serrated; mouth with a lateral and nearly horizontal cleft; teeth villiform, on the jaws as well as palate; branchiostegal apertures large; branchiostegal rays four; dorsal moderately elongated, with several spines increasing backward; anal opposite the posterior portion of the dorsal,

armed with three or four spines; pectorals with branched rays; ventral fins thoracic, each with a spine and six or seven rays. The skeleton has the vertebræ in increased number (29). The family is distinguished by the combination of chin barbels, increased number of rays, and small number of branchiostegals. Its affinities are doubtful, but on the whole seem to be rather with the Mullidæ. But two species are known—(1) *Polymixia nobilis*, from the seas of Madeira and St. Helena, and (2) *Polymixia Lowii*, of the Caribbean Sea. THEODORE GILL.

Polynem'idæ [from *Polynemus*, Gr. πολύς, "many," and νῆμα, "thread"], a family of teleocephalous fishes peculiar for the free filiform rays below the pectoral fins. The body is rather elongated and moderately compressed; the scales ctenoid; the lateral line continuous; the head projecting at the snout; the opercula more or less armed; mouth inferior, with the cleft lateral; upper jaw scarcely protractile; teeth villiform, and on the jaws as well as palate; branchiostegal apertures enlarged; branchiostegal rays seven; dorsal fins two, and far apart; the anterior dorsal short, with seven or eight spines; posterior dorsal and anal short, nearly equal, obliquely opposite to each other, and covered with scales; caudal fin separate and more or less emarginated; pectorals divided into two parts, the upper normal fin and a lower row of thread-like simple filamentary rays entirely disconnected; ventrals sub-abdominal, each with a spine and five rays; the skeleton has the vertebræ in normal or nearly normal number (9–10 + 14–15); the skull is traversed by muciferous canals; the air-bladder is either present or wanting, and variously developed. The family is represented by about twenty-five species, distributed in almost all tropical regions, and one (*Trichidon octofilis*) occasionally wanders northward as far as New York. THEODORE GILL.

Polyne'sia [from the Gr. πολύς, "many," and νῆσος, "island"], formerly employed, especially by French geographers, as the common name for all the islands and groups of islands situated between the eastern shore of Asia and the western shore of America; other names, however, such as Oceanica and Australasia, were also used. Subsequently, the islands of the Indian Ocean were separated, forming a group by themselves under the name of Malaysia. Australia and the islands situated nearest to it were gathered into another group, named Australasia; and thus the name Polynesia was restricted to those islands or groups of islands lying between lon. 100° W. and the Philippines—Papua, New Britain, New Hebrides, New Zealand, etc., including the Hawaiian, Marquesas, Society, Friendly, Feejee, Caroline, Ladrone Islands, etc.

Polynices. See ETEOCLES.

Polyodont'idæ [from *Polyodon*, Gr. πολύς, "many," ὀδούς, "tooth"], a family of ganoid fishes remarkable for the extension of the snout into a long, thin, and depressed shovel-like process. The body resembles somewhat that of the sturgeon, to which the form is nearly related; the skin is almost naked or merely studded with minute stellate ossifications; the head is chiefly distinguished by the projection of the snout into the shovel-like process above indicated; neither a preoperculum or suboperculum developed; operculum more or less produced backward; the mouth has a lateral cleft and is quite wide; the upper jaw formed by the premaxillaries; teeth minute, on the jaws; branchial apertures continuous below; a broad branchiostegal ray is developed on each side; dorsal and anal fins far behind; caudal heterocercal and provided with fulcra above; pectorals with numerous rays; ventrals abdominal; the skeleton has numerous peculiarities (see SELACHOSTOMI); the stomach is cæcal; pyloric appendages are developed in the form of a broad, divided, and subdivided, leaf-like organ; the air-bladder is cellular, and not bifid. This remarkable type is represented by but two or three species in the present epoch—(1) *Polyodon folium*, of the Mississippi River and its tributaries, and (2) *Psephuri*, of China and Japan. THEODORE GILL.

Polyphe'mus, the famous Cyclops, a son of Poseidon, a gigantic monster with one eye in the centre of the forehead; lived in the island of Thrinacia, where he captured Odysseus on his return from Troy; but Odysseus escaped by making him drunk and burning out his eye.

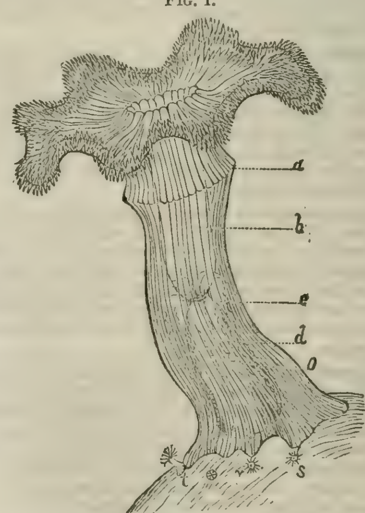
Polyphon'ic [Gr. πολύφωνος, "many-voiced"], in music, a term referring to such compositions as consist of numerous parts or voices, and are thus distinguished from duets, trios, etc., in which the parts are few.

Polyplacoph'ora [Gr. πολύς, "many," πλάξ, πλακός, "plate," and φορός, "bearing"], a sub-class or order of gasteropod mollusks pre-eminently distinguished by the multi-articulated shell. The body is symmetrical, more or less oblong, with a large coraceous mantle, and with a broad foot, as in the limpets; the heart is median and elongated; the branchiæ are developed in a series of laminæ between the foot and the mantle around the posterior region of the body; the head is extensible into a proboscis; cartilaginous jaws are developed, and an elongated radula or lingual ribbon; no eyes or tentacles exist; the sexes are united in the same individual; the organs of generation are symmetrically arranged and repeated on the respective sides, and have two orifices; the intestine is straight and median, and the anal aperture posterior. The shell is composed of eight transverse plates, which are lodged in the mantle, and inserted therein by apophyses from their anterior margins; the first and last are convex toward their respective extremities; the six median divided by lines of sculpture into a dorsal and two lateral areas; these, as well as the first, have each the apex posterior, while the last has its apex near the anterior margin. Such are the principal characters of the very peculiar mollusks which form the families Chitonidæ and Chitonellidæ. The peculiarities of structure are numerous, and indicate for the group the value of at least an order, and probably a sub-class, of gasteropods, whose relations are nearest with the Dothoglossa (limpets, etc.). The order has been represented by species from the Silurian to the present epoch. Although occurring in all regions, in the salt waters and wherever rocks abound, they are most numerous in the tropics. THEODORE GILL.

Pol'ypod, or **Pol'ypody** [Gr. πολυπόδιον, "many-footed," alluding to the branching root-stock], popular names given to many ferns, but the name properly belongs to those of the genus *Polypodium*, of which the U. S. have several species, growing on rocks, tree-trunks, etc.

Pol'yps, or **Pol'ypi** [Lat. *polypus*, from Gr. πολύς, "many," and πούς, "foot"], a name applied by many zoologists to one of the classes of Radiata, and equivalent to Anthozoa of other authors. Formerly, before their anatomy was known, the Hydroida, Polyzoa, and compound ascidians were also called polyps. The true polyps, or Anthozoa, constitute an important and diversified group, including most of the true coral-producing animals, as well as many that secrete no coral. Those kinds that abound in tropical seas and have a firm skeleton of coral, from which coral-reefs and islands are formed, are the most important. Most species of polyps form compound colonies or clusters composed of numerous more or less closely-united individual zoöids, each of which usually has at least a mouth and stomach of its own. The zoöids of such a colony all originate from one primary polyp, either as successive generations of buds that do not separate completely, or by repeated incomplete spontaneous divisions of the first one and its successors. Most kinds of sea-anemones (Fig. 1) and many corals (*Fungia*, etc.) al-

FIG. 1.

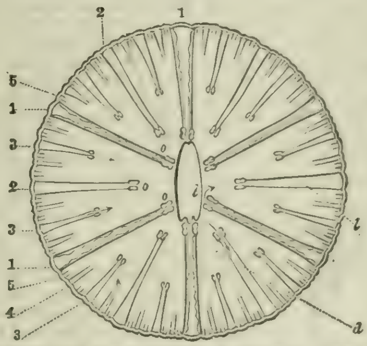


Metridium marginatum, Edw.: a young translucent specimen, reduced one-half.

ways remain simple, or if they produce buds they soon separate completely. Some of these simple kinds grow to a large size, often becoming several inches, or even more than a foot, in diameter; while among the compound species the individual zoöids are generally small, and often quite minute, though never really microscopic; but the entire colony produced by the many thousands thus united together may be several feet in height or breadth, as in certain species of *Porites*, *Madrepora*, *Astræa*, *Gorgonia*, etc.

Nearly all polyps, when first hatched from the egg, have the form of oblong or oval ciliated larvæ or *planulæ*, and swim free in the ocean; but most of the species very soon attach themselves to some solid substance and remain fixed for life, whether they are to remain simple or become compound by budding. But the simple sea-anemones (*Actiniæ*, etc.) adhere by a muscular locomotive basal disk, with

FIG. 2.



Transverse section of an Actinia: *b*, stomach; *d*, body-cavity; *l*, a radial chamber; *o*, ovaries; 1, 1, 2, 2, 3, 3, 4, 5, 5, radial partitions of the five successive series.

which they can creep slowly; and certain compound species (Pennatulaceæ, Fig. 3) have a hollow muscular locomotive stem common to the whole colony, by means of which they can unitedly move about.

Polyps have a tubular body, which may be long and cylindrical, or short and broad, or even almost disk-like; the base or lower end sometimes tapers to a point, but is oftener broad for adhesion, and is perforated in only a few species; the upper end of the body terminates in a circular or elliptical disk, in the centre of which there is an oblong or elliptical mouth, with the lips usually bordered by more or less prominent lobes (Fig. 1); the disk is surrounded by one or several circles of hollow tentacles, varying greatly in form, size, number, and position in different species. In some cases the tentacles are scattered over the disk as well as around the margin, and there may be thousands of them, while in other species (Fig. 4) there are never more than eight, which form a single marginal circle. The tentacles are usually very contractile, and are covered with great numbers of minute nettling-cells, with which they capture their prey. In the interior the stomach (Figs. 1 and 2, *b*) occupies the centre, in the upper portion of the body. It is a capacious flattened sac, with a corrugated internal surface, communicating directly with the mouth at its upper end, and having an orifice (Fig. 1, *c*) at the lower end, opening directly into the general cavity of the body (*d*). The body-cavity is longitudinally divided by a number of symmetrically arranged fleshy radial partitions (Fig. 2), which extend inward from the outer wall of the body, the principal ones reaching the stomach, to which they are attached by their inner edges along most of its length, but, being narrower below, they leave a large open central chamber beneath the stomach. (Figs. 1 and 2, *d*.) In those species that have more than eight radial partitions they are arranged in pairs, and there are between the pairs of broad primaries pairs of narrower ones, which are formed successively later, and do not usually become attached to the stomach. (Fig. 2, *2*, *2*, *3*, *3*, *4*, *4*.) The radiating chambers formed by these partitions communicate freely with the central cavity below the stomach; and by means of a circular opening through each partition, near its upper margin, all the chambers are also in direct communication at their upper ends; the cavity within each of the hollow tentacles is also a direct prolongation of the radiating chamber beneath it. The radiating partitions are filled with muscular fibres, which, by contracting at the same time with the outer wall, serve to withdraw the disk and tentacles and contract the upper end of the body

FIG. 3.

Rophobelemnum clavatum, Verrill.

into a small compass when disturbed. In polyps the sexes are generally separate, though exceptions have been observed, but the ovaries and spermaries (Figs. 1 and 2, *o*) are alike attached to the inner margins of the radial partitions in the body-cavity, below the stomach. The eggs are discharged into the body-cavity, where they often remain until developed into ciliated planulæ, and even into well-formed young polyps; they are usually discharged by passing into the stomach and thence out of the mouth. Certain species of Actinaria (*Sagartia*) have openings through the outer wall of the body, from which long, white, thread-like defensive organs (*acontia*) covered with nettling-cells can be protruded when they are alarmed. Other species (*Bunodes*) have adhesive suckers in vertical rows along the sides; and in certain genera there are variously branched, gill-like organs below the tentacles or on the disk, and sometimes these are large and arborescently divided. In several genera (*Actinia*, etc.) there is a row of rounded, bright-colored organs below the bases of the tentacles; these are regarded as visual organs, and clusters of nerve-cells connected with them have been described, but no connected nervous system has been discovered in any of the polyps. The nutritive fluid contained within the general cavity of the body and in the hollow tentacles is kept in constant circulation by the vibrating cilia that cover the internal membranes, and no special blood-vessels have been detected. After feeding, the undigested parts of the food are discharged from the mouth, and the nutritive parts pass directly into the general body-cavity, mingling with the fluid contained therein, which is also mixed with a large proportion of sea-water when the polyp expands.

FIG. 4.

A zoöid of Fig. 3, enlarged.

FIG. 5.

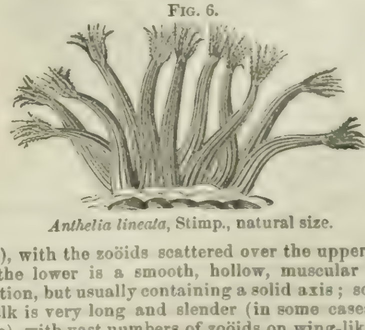
Astrogorgia Sinensis, V.: *a*, natural size; *b*, a retracted zoöid, enlarged.

Polyps are naturally divided into three orders—Alcyonaria, Actinaria, and Madreporaria.

I. ALCYONARIA.—In these the body-cavity is divided into eight chambers by eight simple radial lamellæ or partitions, the lamellæ between adjacent chambers being united together or common to the two: there are eight broad tentacles, which are pinnately branched or lobed along the sides. In these the radiating chambers never secrete coral, but in a few cases the external wall of the body becomes calcified and rigid in its lower part, thus forming tubular corals (*Tubipora*, *Heliopora*), and all the species secrete, more or less abundantly, small nodules, grains, or plates of carbonate of lime in the outer wall, and usually also in the tentacles and various other parts. (Fig. 5, *b*.) These are known as spicula, and vary widely in size and form both in the different species and in different organs of the same species; but their characters are peculiar and distinctive in each genus and species. These spicula are variously and often very brightly colored, and give to these polyps their brilliant hues. They are most commonly fusiform, and covered with rough, wart-like grains, but wheel-shaped, club-shaped, and scale-like forms are common, and also various forms of crosses, some of them very elegant.

The Alcyonaria are divided into three sub-orders: (1) *Pennatulacea*.—In these the zoöids are united together into a free locomotive colony, sometimes club-shaped (Fig. 3), with the zoöids scattered over the upper portion, while the lower is a smooth, hollow, muscular bulb for locomotion, but usually containing a solid axis; sometimes the stalk is very long and slender (in some cases six feet or more), with vast numbers of zoöids on wing-like projections along the sides (*Virgularia*, *Stylatula*, etc.): others

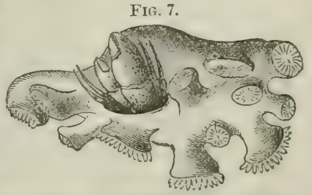
FIG. 6.



Anthelia lineata, Stimp., natural size.

have short and thick colonies, with broad pinnæ bearing the zoöids on their edges, and a stout bulbous base (*Pennatula*); and the genus *Renilla*, common on our Southern coasts, has the zoöids on the upper surface of a broad reniform, leaf-like disk, with a hollow, muscular, and very contractile peduncle on the lower side, with which the colony creeps about. Most Pennatulacea have a second and less complete form of zoöids, differing widely from the normal ones by lacking tentacles and other organs; they may be scattered among the ordinary ones, as in *Renilla*, but more commonly occupy special areas. (2) *Gorgonacea* (Fig. 5).—In these the zoöids have short bodies, and are united together laterally by a porous, crust-like, common tissue, or *cœnenchyma*, filled with spicula, and surrounding a solid axis, which is attached by its base and generally much branched, commonly forming large shrub-like and fan-shaped corals, often several feet high. The axis is a secretion from the cœnenchyma, and may be horn-like and flexible, as in *Gorgoniæ* (Fig. 5); or solid and calcareous, as in the precious red coral (see CORAL); or it may consist of alternate solid and flexible segments, as in *Isis*; or it may be fibrous and composed of spicula. The axis is surrounded externally by a series of longitudinal tubes, by which the numerous zoöids are united together, and these tubes cause the longitudinal grooves, which are always to be seen along the surface of the axis of these corals. (3) *Alcyonacea* (Fig. 6).—In this group the zoöids are elongated, and more or less united at their basal portions, forming fleshy lobed or branched colonies (*Alcyonium*), or broad encrusting groups, with the zoöids rising from the creeping base (Fig. 6), or small shrub-like tufts. These colonies are attached at base to some solid substance, but have no solid axis. The genus *Tubipora* forms a coral consisting of many parallel red tubes united at intervals by transverse plates.

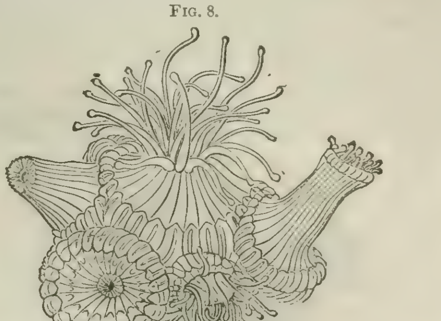
FIG. 7.



Epizoanthus Americanus, V., encrusting a shell occupied by a hermit crab.

II. ACTINARIA.—In this order the zoöids have the outer walls of the body flexible and muscular to the base, with a large central body-cavity extending, like the radial chambers, quite to the base, no coral being secreted either in the walls or radial chambers. The radial chambers have each a lateral radial lamella of its own on each side, so that adjacent chambers are separated by two radial partitions. These chambers and the corresponding tentacles vary in number from ten to many hundreds in the different species, but are commonly in multiples of six. As the polyps grow new chambers and tentacles are introduced, in successive sets, in the spaces between the older ones. (Fig. 2.) There are three sub-orders: (1) *Actinacea* (Fig. 1).—This includes the sea-anemones, or *Actiniæ*, etc. The body has a muscular basal locomotive disk or bulb, by which they adhere and also glide slowly along. They are all simple, but some species produce, from the base, buds which soon separate. (Fig. 1, *r, s, t*.) Many of the species are brilliantly colored, and the forms are usually elegant in expansion. Some tropical species grow to the diameter of fifteen inches, and the *Cerianthus borealis*, from deep water off the coast of Maine, becomes twenty inches long, with tentacles spreading six inches. (2) *Zoanthacea* (Fig. 7).—These are mostly compound, with the zoöids united at base into encrusting colonies permanently attached to rocks, shells, etc. The tentacles are numerous, smooth, and tapering. (3) *Antipathacea*.—In this group the zoöids are short, with six to twenty-four conical tentacles, and they are united by a membranous cœnenchyma, which secretes a horn-like axis, generally arborescently branched, usually black, and resembling that of *Gorgoniæ*, except that it is generally spinulose and not sulcated.

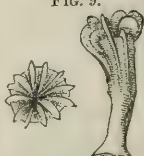
FIG. 8.



Astrangia Danæ, Ag.: a group of the coral-polyps in different states of expansion, enlarged.

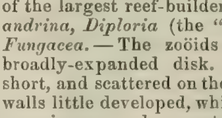
III. MADREPORARIA.—This order includes nearly all true reef-building corals, as well as many smaller and more delicate kinds, found in all seas, and even at great depths in the ocean. Most of the species form large compound colonies, firmly attached to the bottom or to one another, but many remain always simple (Fig. 9), and many of the simple species and some of the compound ones are attached only when young. Among the compound species the forms are very diverse, according to the mode of increase. Some form large tree-like or shrubby clusters of branches (*Madrepora*, etc.); others grow in low encrusting forms (Figs. 8, 10) or in flat fronds, and many of the reef corals form large, solid, hemispherical or irregular masses, sometimes several feet in diameter. Some of these increase in size by the budding of new zoöids, others by the repeated subdivisions of the old ones. (Fig. 10.) In this order the tentacles are simple and usually elongated, varying in number from twelve to several hundred. The disk and upper parts of the wall are flexible and retractile, but the lower part of the wall secretes coral and becomes rigid; coral is also secreted in the lower part of the radiating chambers, and often in the central cavity among the ovaries, and by the cœnenchyma. The radial and central chambers are therefore smaller and less developed than in the previous groups. There are several sub-orders: (1) *Madreporacea* (Fig. 10).—These have long cylindrical zoöids, much exsert in expansion, with twelve or more slender marginal tentacles. Their corals have porous walls, and mostly increase by budding, forming either much-branched species (*Madrepora*), or rounded masses (*Porites*). Many of them are very important reef-corals. The extinct genus *Favosites* and other related tabulate corals, found in Palæozoic rocks, belong to this group, and were ancient reef-building corals. (2) *Oculinacea* (Figs. 8, 9).—These also have the zoöids much exsert in expansion, with the tentacles slender and marginal, but the corals have compact walls. They increase by budding, and sometimes by fissiparity. They form both massive and slender-branched corals, and also encrusting kinds. (Fig. 8.) *Pocillopora* and allied tabulate corals belong here. (3) *Astræacea*.—In these the zoöids are broader and but little prominent in expansion, and the tentacles are shorter and more numerous. The corals are firm, with compact walls and radiating plates, and the spaces between the plates are usually much divided by transverse septa. The zoöids mostly multiply by incomplete spontaneous fission, and usually form rounded or hemispherical masses or low clumps. Many of the largest reef-builders belong to this group—*e. g. Meandrina, Diploria* (the "brain coral"), *Astræa*, etc. (4) *Fungacea*.—The zoöids in this group are low, with a broadly-expanded disk. The tentacles are numerous, short, and scattered on the disk. The coral has the external walls little developed, while the radial plates are broad and conspicuous, and connected together laterally by transverse bars. Many of the species are simple and free, forming broad circular disks (*Fungia*, etc.), or large elliptical ones (*Ctenactis*), sometimes sixteen inches across; but others are compound; the zoöids, multiplying by marginal budding, usually form rather thin frondose and lichen-shaped corals, though sometimes massive (*Siderastræa*). (5) *Stauracea, or cyathophylloid Corals*.—The corals of this group are abundant in the Palæozoic rocks, and they were important reef-corals in those early geological ages, but, unless a few doubtful kinds be excepted, they have long been extinct. The outer walls of these corals were formed mostly of epitheca, and while some had numerous radial plates, these were lacking in others. Many have successive transverse septa across the central cavity, but in others this structure is wanting or irregular. Many of the species were simple and cornucopia-shaped, others were compound and massive.

FIG. 9.



Desmophyllum simplex, Verrill.

FIG. 10.



Heteropsammia geminata, Verrill.

Modern reef-forming corals are restricted to the warmer parts of the ocean, where the average temperature of the coldest month is not below 68° F. For the same reason they do not flourish beyond about 100 feet in depth, below which the water is too cold, even in the tropics. But in Palæozoic times reef-forming corals of many kinds were abundant in the region of the Northern U. S.; at the island

of Anticosti, near Southern Labrador; and even on the shores of the Arctic Ocean. A. E. VERRILL.

Polypter'idæ [Gr. πολύς, "many," and πτερόν, "wing" or "fin"], a family of African ganoid fishes remarkable for the combination of characters, and connecting the dipnoan fishes with the typical Ganoids. The body is more or less elongated and sub-cylindrical; the scales lozenge-like, and in numerous oblique rows; lateral line decurrent; head depressed, with the bones externally visible; operculum and suboperculum well developed, the other elements wanting; mouth cleft laterally; lower teeth rasp-like, and in broad rows on the jaws as well as palate; branchiostegal apertures continuous below; branchiostegal rays replaced by a single bony plate; the dorsal fin is represented by a variable number of separate spines, to each of which an articulated finlet is attached; anal far back; anal small and near the caudal; caudal recurrent forward above; pectoral supported by an oval scaly peduncle; the ventrals are far behind or wanting. The skeleton is composed of numerous vertebræ, of which the abdominal are much more numerous; the stomach (in *Polypterus*) is without a blind sac, and but one pyloric appendage is developed; the air-bladder is developed, and connects (as in the dipnoans) by a duct with the ventral wall of the pharynx, and not with the dorsal, as in other fishes. The family is most interesting as containing the only surviving representatives of a group of fishes which were predominant in the early epochs of our earth's history. It is now represented by two genera—(1) *Polypterus*, with a moderately elongated body, and with ventral fins, and represented in the tropical parts of Africa; and (2) *Calamoichthys*, with a very elongated body and without ventral fins, whose single known species is a native of Old Calabar. THEODORE GILL.

Polytech'nic Schools [from the Gr. πολύς, "many," and τέχνη, "art"], a kind of higher educational institution in which the sciences of mathematics, physics, and chemistry are taught, either exclusively or principally, and with a more or less strongly marked practical bearing. The first and most celebrated of these institutions, the École Polytechnique in Paris, was founded in 1794 by decree of the National Convention. It has since been somewhat modified in its plan, and under Napoleon I. its discipline received a certain military cast; but it has fostered all the greatest scientists which France has produced in this century. After finishing the general course in the École Polytechnique the pupils enter the special schools—École des Mines, de Génie, de la Marine, des Ponts et Chaussées, etc.—and thence they generally enter the service of the government. For private industry, however, this school is not of great importance, but it is supplemented for this purpose by the École Centrale des Arts et Manufactures. Similar schools on more or less modified plans have been established in all European countries.

Polytheism. See GOD, by PROF. A. A. HODGE, S. T. D.

Polyu'ria, a disease characterized by excessive excretion of urine, consisting chiefly of water, but not dangerous and seldom met with. (See also DIABETES.)

Polyzoa. See POLYZOANS.

Polyzo'ans [Gr. πολύς, "many," and ζῶα, "animals"], a class of invertebrates most closely related to the brachiopods. Its exact relation to other classes is still involved in some obscurity. By Cuvier and the older naturalists generally the constituents of the class were associated together with the hydroids in the class of acalephs; by H. Milne-Edwards the class was referred to the branch of mollusks, and in that it has been by many retained; some, however, combine the polyzoans and brachiopods with the tunicates in a peculiar branch (Molluscoidea); others segregate the polyzoans and brachiopods in a still more limited group; and still others combine them with the worms. They are all small animals, and generally live in communities, which are either ramose, like branching plants, or incrusting, like lichens or mosses. The single individuals (see illustration of the *Plumatella*, Fig. 24, in COMPARATIVE ANATOMY) are erect, bag-like forms, with a long intestine doubled on itself, the mouth being at one side, in a disk called the lophophore, at the free end, and the anus at the other, but near the mouth; between the intestinal canal and parietes of the body is an extensive perivisceral cavity; the lophophore has its margins provided with many ciliated tentacles; above or overhanging the mouth, in some forms, is a peculiar appendage called the "epistoma," and homologized by certain naturalists (*e. g.* E. Ray Lankester) with the foot of the true mollusks; the only nervous ganglion developed exists between the mouth and anus. The separate individuals are retractile each into a crust-like chitinous case or "cell." These separate individuals are designated as "polypides," and the colony which they form in combination is a "polyzoarium." The differences in other respects as to detail have furnished the criteria for subdivision of the class into several orders and numerous families. The orders are Entoprocta, Gymnolæmata, Phylactolæmata, and Rhabdopleuræ: about fifty families are known. Species are abundant in all marine waters, and a few fresh-water representatives are known. THEO. GILL.

Pomacen'tridæ [from *Pomacentrus*, Gr. πῶμα, "lid," and κέντρον, "spine"], a family of teleocephalous fishes characteristic of tropical seas. The body is more or less compressed and oval; the scales ctenoid; the lateral line either interrupted or discontinued under the dorsal fin; the head compressed and more or less rounded in front; the opercula variable as to armature; the mouth with a lateral oblique cleft; the upper jaw protractile; teeth on the jaws, none on the palate; branchial apertures continuous below; branchiostegal rays five to seven; dorsal fin long, with the spinous portion longer than the soft; the soft portion of the dorsal and anal fins corresponding opposite to each other; the anal with two (rarely three) spines; pectorals with branched rays; ventrals thoracic, with a spine and five soft rays; the vertebræ are in moderate number (11–12 + 14–15); the intestinal canal of moderate length; the pyloric appendages in small numbers; three and a half gills developed. The family is composed of numerous rather showy small fishes found in the tropical seas of all parts of the globe. Between 150 and 200 species have been described. (See Günther, *Cat. Fishes in Brit. Mus.*, vol. iv. pp. 2–64.) THEODORE GILL.

Pomàri'ca, town of Italy, province of Potenza, situated on a hill about 18 miles S. E. of Matera, and enjoying a most healthful climate. P. in 1874, 5100.

Pombal' (SEBASTIÃO JOSÉ DE **Carvalho e Mello**), MARQUIS OF, b. at Lisbon, Portugal, May 13, 1699; studied law at the University of Coimbra; spent some years in the army; afterward entered the civil service and obtained the favor of the court: was sent in 1739 as minister to London, and in 1745 to Vienna, where he married the wealthy countess of Daun, and succeeded as mediator in averting the threatened rupture between the court of Austria and Pope Benedict XIV.; became minister of foreign affairs of Portugal 1750; acquired a great influence over his sovereign, King Joseph; displayed great vigor and judgment as a political reformer; exercised a kind of beneficent dictatorship during the days of panic following the great earthquake of Nov., 1755; superintended the rebuilding of the city with greater magnificence; became first minister 1756, and caused the banishment from Portugal of all the members of the Society of Jesus by royal decree of Sept. 3, 1759, they having been suspected of connection with the attempted assassination of the king in the previous year; created count of Oeiras in 1759, he was made marquis of Pombal in 1770, and retained nearly supreme power until the death of Joseph in 1777. On the accession of Pedro III. he was superseded in favor at court, and retired to his estates. D. at Pombal May 5, 1782. He is still known in Portugal as the "great marquis."

Pomegran'ate [Lat. *pomum granatum*, "fruit abounding in seeds"], the *Punica granatum*, a shrub of the Old World, and of the order Granataceæ, now naturalized in most warm countries. It grows finely in the Gulf States. Its fruit is of fine appearance. Some of the varieties are sub-acid and others sweet. Most of the sorts abound in small seeds, but some are seedless. The fruit is very grateful in hot climates. The plant is sometimes used for hedges. The flowers are very fine, and sometimes are double. The bark is used in tanning. The rind of pomegranates is a good astringent for medicinal use. The bark of the root is a good anthelmintic. The *Punica nana*, a small West Indian shrub, is cultivated for its fine flowers.

Pomeran'ce, town of Italy, province of Pisa, about 15 miles S. E. of Volterra. It is situated on a hill at the foot of which flows the Cecina, and the castellated walls of the fifteenth century are still standing. The chief industry of this place is the manufacture of borax, which is carried on largely. P. in 1874, 7373.

Pomera'nia, province of Prussia, bordering N. on the Baltic, and bounded W. by Mecklenburg and S. and E. by the provinces of Brandenburg and West Prussia, comprises an area of 12,304 sq. m., with 1,431,633 inhabitants. The ground is low and the surface perfectly level. Along the Oder and the Baltic the soil is marshy and produces good pasture; in other places it is sandy and little productive. Rye, wheat, potatoes, and hemp are cultivated; cattle and poultry are reared; the fisheries are important; smoked geese and pickled eels form two quite considerable items of exportation. The inhabitants of Pomerania are of Wendish origin, and formed an independent Wendish dukedom during the Middle Ages. On the death of Boleslaus XIV., in 1637, the ruling dynasty became extinct, and the country was divided between Prussia and Sweden, which during the Thirty Years' war had made

large conquests in Germany. After the downfall of Charles XII., Sweden was compelled in 1720 to cede its part of Pomerania to Prussia, of which state it since that time has formed a part. It is divided into the three districts of Stettin, Stralsund, and Cöslin.

Pomeranus. See BUGENHAGEN.

Pom'eroy, city, Orange tp., cap. of Meigs co., O., situated equidistant from Pittsburg, Pa., and Cincinnati. It is the fifth of the river-towns in point of trade and commerce above Cincinnati. It contains good schools, churches of all denominations, rolling and nail mills, steam-engine and machine shops, flouring, woollen, saw, and planing mills, 1 newspaper, insurance-offices, several banks, temperance and Odd Fellows' societies, and stores. Rich veins of bituminous and cannel coal underlie this section, and deposits of salt are extensive and profitably mined. P. 5824. SAM. WYLLYS POMEROY.

Pomeroy (JOHN NORTON), LL.D., b. at Rochester, N. Y., Apr. 12, 1828; graduated at Hamilton College in 1847; studied law, and was admitted to the bar 1851; professor of law and dean of the law faculty in the University of New York City 1864–69, during a portion of which period he also occupied the chair of political science; returned to Rochester and resumed the practice of his profession; in 1865 published *An Introduction to Municipal Law,* and in the following year received the degree of LL.D. from Hamilton College; in 1868 published *An Introduction to the Constitutional Law of the U. S.* (3d ed. 1875), adopted as a textbook in the U. S. Military Academy at West Point and in many of the leading colleges; in 1874 prepared a second edition of Mr. Sedgwick's *Statutory and Constitutional Law,* with notes; in 1876 published a treatise on *Remedies and Remedial Rights, according to the Reformed American Procedure,* adapted to use in all the States and Territories where that system prevails, and also in England; has been a regular writer for the *Nation,* and contributed numerous articles to the *American Law Review* and the *North American Review* upon topics connected with constitutional and international law, general jurisprudence, and the science of politics.

Pomeroy (SAMUEL C.), b. at Southampton, Mass., Jan. 3, 1816; educated at Amherst College; was elected from his native town to the Massachusetts legislature 1852; took part in organizing the New England Emigrant Aid Society 1864, of which he became financial agent; went to Kansas the same year; was actively engaged in the anti-slavery struggle in that territory as a member of the defence committee; was a delegate to the Pittsburg and Philadelphia conventions 1856, and to that of Chicago 1860; was chairman of the relief committee during the famine in Kansas, and U. S. Senator from that State 1861–73.

Pomeroy (SETH), b. at Northampton, Mass., about 1715; was major in the Massachusetts forces at the capture of Louisburg 1745; lieutenant-colonel of the regiment commanded by Col. Ephraim Williams, at whose death, in the battle of Lake George, Sept. 8, 1755, he took command and gained a complete victory over Baron Dieskau. By occupation a mechanic, he was skilled in the manufacture of arms. He was a delegate to the Massachusetts provincial congress 1774–75, by which he was elected a general officer Oct., 1774, and a brigadier-general Feb., 1775; fought at Bunker Hill as a private soldier, and was soon afterward appointed senior brigadier by the Continental Congress, but declined the honor in consequence of disputes which arose about military rank, and retired to his farm. In the autumn of 1776 he raised a considerable military force for the relief of the army under Washington, and marched to the Hudson River. D. at Peekskill, N. Y., in Feb., 1777.

Pomeroy (THEODORE M.), b. at Cayuga, N. Y., Dec. 31, 1824; graduated at Hamilton College 1845; studied law; was district attorney for Cayuga co. 1850–56; member of the State legislature 1857; a Republican member of Congress 1861–69; took a prominent part in legislation, and was chosen Speaker Mar. 3, 1869 (the last day but one of the term), to fill the post vacated by Schuyler Colfax, the Vice-President elect.

Pom'fret, p.-v. and tp., Windham co., Conn., on Quinebaug River and Boston Hartford and Erie R. R. Residence of Gen. Israel Putnam previous to the Revolution, and scene of his famous adventure with the wolf. P. 1488.

Pomfret, Chautauqua co., N. Y., on Lake Erie and Canadaway Creek, traversed by Lake Shore and Michigan Southern and Dunkirk Allegheny Valley and Pittsburg R. Rs. Includes the village of Fredonia. P. 4306.

Pomfret, p.-v. and tp., Windsor co., Vt., on White River. P. 1251.

Pomiglia'no d'Ar'co, town of Italy, province of Naples, about 7½ miles N. of Vesuvius, of which it commands a superb view. Very considerable ancient ruins exist here, and among them what is supposed to have been a palace of the family of Pompey, alluded to by Cicero. In the excavations made there are found no less than four successive layers of lava. P. in 1874, 10,045.

Pomme de Terre, tp., Wilkin co., Minn. P. 178.

Pomol'ogy [Lat. *pomum,* "fruit"], the study and culture of fruit. (See FRUIT-CULTURE, by F. R. ELLIOTT.)

Pomo'na, the Roman goddess of fruits, beloved of all the rural deities, and especially of Vertumnus. The *flamen Pomonalis,* her chief priest, was one of the minor flamens, chosen from the plebs.

Pomona, or **Mainland,** the largest of the Orkney Islands, comprises 150 sq. m., with 17,193 inhabitants. It is high, sloping toward the E., with good pasture-grounds, on which numerous sheep and swine are reared, and some fertile tracts in the valleys, in which oats and beans are cultivated. Principal towns, Kirkwall and Stromness.

Pompadour', de (JEANNE ANTOINETTE POISSON), MARCHIONESS, b. at Paris Dec. 29, 1721, the natural daughter of a butcher; was married in 1741 to Le Normand d'Étoiles, a farmer of the taxes; became the mistress of Louis XV. in 1744; was presented at court as marchioness of Pompadour, and splendidly established in the royal residences at Paris, Versailles, and Fontainebleau; received several magnificent estates and an annual income of 1,500,000 francs, and exercised a most decided influence on the government of France for nearly twenty years, in all its branches—its finances, foreign alliances, military operations, etc.—bringing loss and disgrace over the country at every point. D. at Versailles Apr. 15, 1764, detested by the whole French people and lamented by none.

Pompanoo'suc, p.-v., Norwich tp., Windsor co., Vt., on Connecticut River and Passumpsic R. R.

Pompe'ii, an ancient city of Campania, situated at the foot of the S. S. E. slope of Vesuvius, near the Sarnus, about 14 miles S. E. of Naples. Pompeii first appears in history as a flourishing commercial town in the fourth century B. C. That it was originally founded by the Oscans, and afterward passed successively under Etruscan, Samnite, and Carthaginian rule, before becoming a permanent part of the Roman territory (91 B. C.), is confirmed by the architectural character of the ruins and by the inscriptions upon them, but its art and its culture were at all periods rather Greek than Italic. Under the emperors it continued to thrive until 63 A. D., when it suffered so severely from an earthquake that the inhabitants left their shattered houses and the Roman senate seriously debated the expediency of rebuilding it. The fertility of the soil of its territory, the charm of the climate, and the beauty of the site were, however, powerful arguments; the question was decided in the affirmative, and, aided by the government, the citizens began the work of reconstruction with great zeal. But before it was completed, in 79 A. D., in the midst of a public festival, a still more awful calamity befel the ill-fated city. Vesuvius (a name then embracing the whole mountain-elevation, including Somma and the site of the present cone of Vesuvius), which had been inactive during the whole historic period, and was only *suspected* to be of igneous origin, suddenly shot forth clouds of smoke, and soon buried, fathoms deep under volcanic ashes, sand, pebbles, and scoriæ, Pompeii, Herculaneum, and several smaller towns. The population of Pompeii at this time is very variously estimated at from 50,000 to 12,000, the best recent authorities inclining to the smaller number; but the fatal shower was not so suddenly overwhelming as to preclude flight, and nearly all except the sick, prisoners, sentinels, and a few who returned to secure some treasure seem to have saved their lives in that way. This catastrophe is often mentioned by contemporaneous and by subsequent writers, and the volcanic phenomena attending it are most vividly described in two celebrated letters of Pliny the Younger. Titus proposed to excavate and rebuild the buried city, but his plans were not carried out, and later the event seems to have been almost forgotten. Indeed, the physical changes caused by the first and by following eruptions were so great as to perplex the geographers of the Middle Ages in their search for the site of the lost city. In 1592, Fontana began to construct the aqueduct that now passes through these ruins, but no important discoveries were made, and it was not till 1748 that some objects found by a peasant attracted the notice of Charles III. of Naples, and led him to make experimental excavations. The results were such as to induce his successors to continue the work; but, though the museum of Naples was enriched by choice specimens of ancient art, by inscriptions, and by an immense number of objects illustrating ancient South-

Italian life with the most astonishing minuteness, yet, except during the reign of Murat, little was done in the true spirit of antiquarian research until the government of Victor Emmanuel appointed in 1861 the accomplished Fiorelli to superintend the excavations. Since that time the work has been conducted with system and with care; the ruins previously exposed are protected; the police is admirable, as are also the facilities afforded the visitor. Only about one-third of the space included within the irregular oval formed by the old walls has as yet been uncovered. This oval, about 1⅝ miles in circumference, extends lengthwise from W. to E., the western or sea wall having been removed or destroyed before 79. Even on the other sides the wall, though once flanked by strong towers, was evidently in a ruinous state. The city was entered by eight gates, named from the towns toward which they led, the southern or Stabian gate being the oldest, and the north-western or Herculanean gate being remarkable for the Street of Tombs extending beyond it. The space within the walls was divided into nine *regiones*. The streets (the widest 30 feet, others much narrower, and some mere lanes) run nearly at right angles, are solidly paved with polygonal lava-blocks, and are provided with sidewalks and raised crossing-stones. The wheel-tracks are deeply worn, and the width between the parallel ruts is only 4½ feet. The general system of naming the streets appears to have been by *numbers*, and the recently discovered inscription "VIA III.," on a house near the Stabian gate, strengthens this supposition. Of the public structures already uncovered (and it would seem from their character that few so considerable remain to be unearthed) the first found (1748) was the amphitheatre, not far from the Stabian gate, differently estimated to seat from 10,000 to 20,000 persons; then followed the theatres, the temple of Isis, the Forum Civile, the latter surrounded on three sides by a Doric portico enclosing an area 515 feet long and 108 feet broad, in which are the pedestals of many statues; the temples of Mercury and of Jupiter, the latter being very large and adorned with magnificent Corinthian columns; the Pantheon or temple of Augustus, rich in frescoes; the Forum Triangulare, with an area enclosed by 100 Doric columns, in the midst of which stands a fine old Greek temple; the Basilica or temple of Venus, dating from about 100 B. C.; the Chalcidicum, built by a priestess, and probably used as an exchange; the thermæ or baths; the so-called courts of justice, the prisons, etc. Near a large barrack-like building were found sixty-four skeletons, supposed to be of soldiers on guard. In most of the above-named edifices, as well as in the private houses, statues, statuettes, frescoes, mosaics, etc. of various ages and degrees of merit have been found in profusion. The choicest of these are in the museum at Naples, but the present policy is to preserve objects, as far as may be, on the spot where they are found. The private houses, usually small, are for the most part built of rubble, held together, not very firmly, by mortar, and bound here and there, especially at the corners, by bricks or blocks of *tufa*, the walls within and without being afterward covered with stucco. The plastic ornamentation of these walls proves that the art of moulding, if not of taking casts, in plaster, was known to the ancients. The upper stories of the houses, except in a single instance, no longer exist, but the stairs which led to them are often still standing. In a Pompeian house the wall facing the street was generally blank, or broken only by small grated openings, with the exception of the wide entrances to the shops that usually occupied the front of the lower story, and of the vestibule which led to the *atrium* or court, from which the family apartments received light and air—a style of building not unfrequent at this day in Southern France and Italy. This court is enclosed by a colonnade, the centre of the space being uncovered and occupied by the *impluvium*, where the rain was collected and conducted into a cistern. The street-doors, as did those of all public buildings, *always opened outward*. Among the private dwellings richest in art are the House of the Quæstor or of the Dioscuri, beautifully adorned with frescoes and overflowing with sculptures, vases, candelabra, etc.; the House of the Faun, so named from an exquisite dancing faun found here among endless artistic treasures, of which the most celebrated is a mosaic supposed to represent the battle of Issus, and pronounced by Overbeck the *chef d'œuvre* of ancient mosaics; the House of Sallust, one of the largest and finest; the House of M. Lucretius, very rich and curious; the House of the Tragic Poet, where, among other valuable mosaics, was found the dog with the motto "*Cave Canem*;" the House of Procolus, more recently excavated, and containing paintings of great freshness and beauty. The graceful statuettes known as the *Narcissus*, the *Ganymede* or *Paris*, *Aphrodite gathering up her hair*, and an invaluable painting representing *Laocoon*, are among late discoveries. Several of the statuettes show indisputable traces of having been *painted*. About 200 men and boys are now at work, and new buildings, new objects, and new inscriptions are almost daily brought to light. A few months since a large woollen-factory was laid open, and near it a private house with exquisite wall-paintings. The famous *wood tablets* found during the past summer appear to have belonged to a broker, who was a usurer as well. They contain receipts, contracts, statements of sales, etc. Indeed, precious as is the artistic wealth drawn from Pompeii, the great interest of the buried city lies in the revelation it has made to us of the daily life and habits of its citizens. We see them in their streets, in their temples, in their theatres, in their dwellings, their factories, their bakeries, their shops—in short, everywhere—and surrounded by the objects of their worship, their pleasure, their convenience, and their business. The political canvasser tells us, by a chalk-mark or a scratch on the wall, who was his candidate; the wit records his jest of the day, the misanthrope his bitter sarcasm, the soldier his oath. By other means even the scenes of that last awful night are brought before us with fearful reality, and the visitor may chance to see some unhappy victim of this disaster lifted from his stony couch, after the lapse of nigh 2000 years, and borne in solemn silence to the funeral hall in which these strange relics of humanity are now preserved. The whole number of skeletons hitherto found is variously stated at from 400 to 600. Popular descriptions of Pompeii will be found in the volumes *Pompeii* of the "Library of Entertaining Knowledge;" in Marc Monnier's *Pompei et les Pompejens* (1865); in Bulwer's novel, *Last Days of Pompeii*. For more elaborate accounts see Mazois and Gau, *Les Ruines de Pompei* (4 vols., 1812–38); Gell and Gandy, *Pompeiana* (1875); Fiorelli, *Scavi di Pompei dal 1861 al 1872*, and *Descrizione di Pompei* (1875); Helbig, *Die Campanische Wandmalerei* (1874). CAROLINE C. MARSH.

Pom'pey, p.-v. and tp., Onondaga co., N. Y., on Syracuse and Chenango R. R. (ORAN STATION). P. 3314.

Pompey the Great, a son of the ill-famed Cn. Pompeius Strabo, b. Sept. 30, 106 B. C. Cicero describes the father as "cruel, avaricious, and perfidious," but he had some military talent. The son was educated in his camp, and distinguished himself both in the battle at the Colline Gate and still more during the immediately following dangerous circumstances when Cinna attempted to have Strabo assassinated and the soldiers became mutinous. These complicated affairs came to a sudden and unexpected issue when in the same year (87 B. C.) Strabo was killed by lightning, leaving to his son immense wealth. The position of the young Pompey was dangerous, however, on account of the victory of the popular party. He did not venture to show himself in public until after the death of Marius (86 B. C.), and when his enemies made out a case against him he found it necessary, in order to defend himself, to marry the daughter of the prætor who presided at the trial. Meanwhile, Sulla had finished the Mithridatic war and was on his way to Italy. The popular party made the greatest preparations to oppose him, while the nobles hastened to join him at Brundusium, where he landed 83 B. C. Pompey, however, was too vain to come to Sulla simply as a man who needed his protection. Although he had no office, no commission from the senate, no authority at all, he raised an army on his own account, and his military talent and great personal valor procured for him a victory over the force of the democratic party. Sulla received him with great compliments, and in the following years he distinguished himself still more, fighting, as the legate of the dictator, with great success in Sicily against Carbo, and in Africa against Cn. Domitius Ahenobarbus, the two leaders of the now scattered democratic party. On his return to Rome (81 B. C.) he asked for a triumph, and although it was unheard that a man who was merely a simple *eques* had ever received the honors of a triumph, and although even Sulla opposed the demand, it was at last granted. After the death of Sulla (79 B. C.), and after a short but successful contest with Lepidus, Pompey became the acknowledged head of the aristocratic party and the most powerful man in the republic. In Spain, however, the popular party still held the ascendency; Sertorius, one of Marius's generals, could not be reduced. Pompey was sent against him (76 B. C.) with a brilliant army, but the war lasted four years, and was not brought to a conclusion until after the assassination of Sertorius by Perperna. In 71, Pompey entered Rome for the second time in triumph. A much more brilliant feat was his war against the pirates. The Mediterranean Sea literally swarmed with robbers, who made all commerce unsafe, disturbed the communication between Rome and her provinces, captured the corn-fleets, and caused famine in Rome, and sometimes even descended on the cities along the coasts and plundered and

devastated them. In 67 B. C., Pompey was invested with almost absolute power in order to stop their ravages, and in less than three months he swept the sea clear, chasing the pirates from the Straits of Gibraltar to the coast of Cilicia, where he finally broke their power in the battle of Coracæsium. The term of his power was extended, and he now formed a new army, with which he marched through Asia Minor against Mithridates and his allies. Mithridates was defeated in several battles, and driven back into the inaccessible parts of his dominions in Cimmerian Bosphorus. Armenia, Pontus, Syria, and Palestine were conquered, and (in 61) Pompey entered Rome for the third time in triumph. The procession lasted two days. It was opened with pictures and tablets which told how he had taken 1000 fortresses, 900 towns, and 800 ships; how he had founded 39 cities and raised the revenue of the republic from 50,000,000 to 85,000,000, etc.; then followed thousands of wagons loaded with the treasures of the East; then the 324 kings and princes whom he had taken prisoner; and at last Pompey himself on his triumphal chariot. This moment was the culminating and also the turning-point of his life. He was a soldier, and not a statesman. Although he was too sensible a man to meddle with what he did not understand, yet his vanity and his military habits made him believe that in a developed republican society he could vindicate for himself a position above all parties. The consequence was, first, that all parties mistrusted him; next, that the multitude laughed at him. And he had no redeeming personal qualities. He was cold, haughty, and fantastic. Even his honesty, frugality, justice, and loyalty isolated him. His dealings with CÆSAR are told in that article. After the battle of Pharsalia (Aug. 9, 48 B. C.) he fled to Egypt. Sept. 29 he reached that country, descended from the trireme, and was rowed toward the shore, where the Egyptian king stood waiting for him. But when he rose to salute him, he was stabbed from behind by one of his own centurions, then in the service of the king of Egypt; his body was thrown naked on the shore, and his head was sent to Cæsar, who burst into tears at the sight and had the murderers put to death.—His son, SEXTUS POMPEIUS, b. in 75 B. C., maintained himself for a long time in Spain, and occupied Sicily, Sardinia, and Corsica during the confusion after the assassination of Cæsar. By intercepting the corn-fleets destined for the supply of Rome he caused famine in the capital, and became very dangerous to the triumvirs. In the beginning all their endeavors to reduce him failed, but in 35 he was completely defeated at Messana by M. Vipsanius Agrippa. He fled to Asia Minor, but was killed in the same year at Miletus. CLEMENS PETERSEN.

Pompey's Pillar (so-called) was erected, according to an inscription on its base, by one Publius, prefect of Egypt, in honor of Diocletian. It stands on an eminence just S. of Alexandria. The shaft, 73 feet long, is of beautiful red granite, highly polished, and is thought to have served originally some other purpose. The total height of the column is 98 feet 9 inches. It was erected about 296 A. D.

Pomponius Mela. See MELA.

Pomp'ton, p.-v. and tp., Passaic co., N. J., on Pompton River and New Jersey Midland R. R. P. 1840.

Pona'ny, or **Paniani,** town of British India, in the presidency of Madras, on a small river of the same name, near its mouth, has valuable fisheries and an active trade in rice, pepper, iron, and building-timber. P. 8600.

Pon'ca, p.-v., cap. of Dixon co., Neb., near Missouri River. P. 843.

Ponca Indians, a tribe of Dakota stock. They have a reservation of 576,000 acres near the mouth of Niobrara River. They are considerably advanced in civilization, and are generally peaceable and quiet. P. 735.

Pon'ce de Leon' (JUAN), b. in Leon, Spain, about 1460, of an ancient family; became page to Don Fernan, afterward the renowned Ferdinand V.; served in the Moorish wars, and (according to some authorities) in 1493 sailed with Columbus to Hispaniola, where he was commandant of the eastern province; in 1509 he conquered Porto Rico, where he became *adelantado* and acquired great wealth; sailed in 1512 in search of the island Bimini with its miraculous fountain of youth; landed (Apr. 8) upon the coast of Florida, whose coasts he explored; went to Spain 1513, and was named governor of Florida, which he was directed to conquer and colonize; led in 1514 an expedition against the Caribs, and in 1521 invaded Florida: was repelled by the Indians, and received a wound of which he died in Cuba 1521.

Ponce de Leon (LUIS). See LEON, DE.

Ponchatou'la, p.-v., Tangipahoa parish, La., on New Orleans Jackson and Great Northern R. R. P. 320.

Pon'cho [Sp.], a Spanish-American garment consisting of a blanket with a slit in the middle, through which the head is thrust. It thus becomes a sort of cloak. Waterproof ponchos, made of painted cotton cloth or rubber-cloth, are used in the army, chiefly for mounted troops.

Pond, tp., Winston co., Ala. P. 411.

Pond (ENOCH), D. D., b. at Wrentham, Mass., July 29, 1791; graduated at Brown University 1813; studied theology under Dr. Emmons; was pastor of a Congregational church at Auburn, Mass., 1815–28, when he became editor of the *Spirit of the Pilgrims,* an orthodox monthly magazine established in Boston. In 1832 he became professor of systematic theology in the seminary at Bangor, Me.; was made president, professor of church history, and lecturer on pastoral duties in 1856; and since 1870 has been president and professor emeritus. Besides many minor works, he has published *Pastoral Theology* (1866), *Christian Theology* (1868), and *History of God's Church* (1871).

Pond (JOHN), F. R. S., b. in England about 1767; educated at Trinity College, Cambridge; studied astronomy under Wales, the companion of Capt. Cook; settled at Westbury near Bristol, where he made observations proving that the quadrant in use at Greenwich had changed its form; removed to London 1807; succeeded Dr. N. Maskelyne as astronomer-royal 1811; devoted himself to cataloguing and determining the exact places of the principal fixed stars; translated La Place's *System of the World* (2 vols., 1809); wrote the introduction to astronomy prefixed to Pinkerton's *Geography,* and published numerous papers in the *Transactions* of the learned societies. D. at Blackheath Sept. 7, 1836.

Pond City, tp., Wallace co., Kan. P. 40.

Pond Creek, tp., Greene co., Mo. P. 882.

Pondicher'ry, a French settlement in India, on the Coromandel coast, 83 miles S. W. of Madras, in lat. 11° 55' N., comprises an area of 107 sq. m., with 171,217 inhabitants. It consists of a low, flat plain, with a sandy, not very productive soil, and is only partly watered by the river Gingee. The town of Pondicherry, which is the capital not only of this settlement, but of all the French possessions in India, is regularly laid out and well built, with fine promenades and plantations. Its manufactures of fine cotton cloth and cotton thread are important; but it has no harbor, vessels are compelled to anchor in an open roadstead, and landing is difficult on account of the surf. P. 30,000, of whom 4000 are Europeans.

Poniatow'ski, the name of a celebrated princely family of Poland directly descending from the Italian family of the Torelli, which settled in Poland in the middle of the seventeenth century, and closely allied to the Leszczynskis and Czartoryskis. The most prominent members of the family are (1) STANISLAS AUGUSTUS, the last king of Poland, b. in Lithuania Jan. 17, 1732; ascended the throne in 1764 by the influence of Catharine II.; resigned in 1795, and d. at St. Petersburg Feb. 12, 1798. He was weak, irresolute, and utterly incapable of grappling with the party fury of his subjects and the treachery of his allies. The principal events of his unhappy reign are told in the history of Poland.—(2) JOSEPH ANTONY, b. at Warsaw May 7, 1762, a nephew of the king; received a military education; served in the Austrian army in the Turkish war; entered the Polish army in 1789 as a major-general; commanded against the Russians in 1792, but retired from service when the king joined the confederation of Targovitza; fought again in 1794 against Russia under Kosciusko; repaired to Vienna in 1795, but returned to Warsaw in 1798, and lived on his estates, at that time under Prussian dominion. In 1807 he commanded the Polish army against Russia, and when the duchy of Warsaw was established by the Peace of Tilsit he was appointed minister of war. In 1812 he commanded the Polish contingent of the grand army during the Russian campaign, and distinguished himself both by his valor and by tactical talent. Shortly before the battle of Leipsic he was made a marshal of France, and after the battle he was charged with covering the retreat of the army, but was drowned (Oct. 19, 1813) in crossing the river Elster.—(3) JOSEPH, b. at Rome Feb. 20, 1816; d. at London July 3, 1873; became known as a composer of several operas and masses. *Don Desiderio* was performed at Paris in 1868 with considerable success.

Ponsard' (FRANCIS), b. June 1, 1814, at Vienne, department of Isère, France; was educated at Lyons; studied law in Paris; began to practise as an advocate in his native city, but removed afterward to Paris, and devoted himself exclusively to literature. In 1837 he translated Byron's *Manfred;* in 1843, his tragedy, *Lucrèce,* was performed with great success in the Odeon Theatre of Paris, and from that time he stood at the head of the classical

party in the French literature, attacking and attacked by the romantic school formed by Victor Hugo. His principal works are the tragedies, *Agnès de Méranie* (1846), *Charlotte Corday* (1850), *Ulysse* (1852); and the comedies, *L'Honneur et l'Argent* (1853), *La Bourse* (1856), and *Œuvres complètes* (2 vols., Paris, 1866). D. at Paris July 13, 1867.

Pons Varolii. See BRAIN.

Pon'ta Delga'da, town of the Azores Islands, situated on the southern coast of St. Michael. Its harbor is shallow and the roadstead outside the harbor unsafe, yet it has a large trade, especially in oranges to Great Britain, corn to Portugal, and earthenware to Brazil. P. 15,885.

Pont-à-Mous'son, town of the German empire, in the Lorraine, on the Moselle, has manufactures of oil, vinegar, candles, and cutlery. P. 8211.

Pontarlier', town of France, department of Doubs, on the Doubs, is noted for its manufactures of absinthe. P. 5007.

Pontassie've, town of Italy, province of Florence, prettily situated near the junction of the Sieve with the Arno, and lying 12½ miles E. of the city of Florence. It is a walled town, the streets are tolerably well kept, the principal church is large, and the main square handsomely decorated. The inhabitants, for the most part cultivators of the soil, are generally in comfortable circumstances, and the fairs of Pontassieve, which exhibit in profusion all the rich products of Tuscany, are extremely animated. This town formed a part of the old Florentine territory, and was a fief of the Filicaja family. P. in 1874, 11,000.

Pont-Audemer', town of France, department of Eure, stands on the Rille, which here becomes navigable, is well built and surrounded with walls and ditches. It carries on an active trade, and manufactures paper, leather, saddlery, and cotton fabrics. P. 6136.

Pontchartrain', Lake [named after Jérome Phélypeaux, comte de Pontchartrain, minister of marine under Louis XIV.], a lake of Louisiana, about 40 miles in its longest dimension E. and W. and 25 miles N. and S., the southern shore of which is but about 5 miles distant from, and nearly parallel to, the Mississippi River in its local easterly course in this region. It is separated by a peninsula of cypress swamp from Lake Maurepas (named after Count Maurépas, son and successor of Pontchartrain) on its W. (a much smaller lake), with which it communicates by the Pass Manchac. One of the numerous outlets or delta-arms of the Mississippi, the Iberville bayou, formerly discharged through Amite River into the latter lake. This was closed as a measure of defence by Gen. Jackson in 1815, and there is now no connection between the lakes and the river, though the numerous *crevasses* which have occurred near and below the Bonnet Carré Bend pour their waters through the marginal swamps into these lakes, and have sometimes inundated the more depressed rear portions of the city. New Orleans communicates with the lake by Pontchartrain R. R. (almost the earliest in the U. S.), and by two canals navigable by schooners and smaller craft, one of which, and the earliest made, enters the head of the bayou St. John, by which the navigation is continued to the lake; the other is wholly artificial. These canals have their heads in "basins" in the rear of the city; they do not communicate with the Mississippi. The lake communicates with Lake BORGNE and MISSISSIPPI SOUND (which see) by the passes of the Rigolets and Chef Menteur, through which there is a tidal flow of the salt (or sea) water. FORTS PIKE and MACOMB (which see) defend these passes. An important commerce in lumber, firewood, bricks, etc. is carried on through the lake and the Rigolets; and indeed, previous to the construction of the Mobile R. R. steamers from the lake terminus of the Pontchartrain Railway constituted the almost sole means of communication from New Orleans with Mobile, Pensacola, and the shores and watering-places of Mississippi Sound. The northern shore of the lakes, a continuation westerly of the "pine-woods" region, is elevated and healthful. The southern and western shores are the cypress swamps of the Mississippi margins; nevertheless, the *termini* of the Pontchartrain R. R. and the two canals, accessible by roads along the canal margins affording agreeable drives, furnish delightful places of resort to the New Orleans population during the hot season. It is a project partially carried out, but now suspended for want of means, to connect the shore of the lake and the city by a boulevard consisting of a heavy embankment and road along the shore, and lateral *levees* and roads through the swamps, connecting, above and below the city, with the river levees. The Great Northern or Jackson R. R. from New Orleans, skirting Lake Pontchartrain, threads, through the cypress swamps, the peninsula between the lake and Maurepas, and crosses Pass Manchac by a long trestle bridge. The Mobile R. R., taking the reverse (easterly) direction, by a very similar route crosses the Chef Menteur and Rigolets, and finally escapes from the swamps and *prairies tremblantes* to the pine woods of the Gulf shore. J. G. BARNARD.

Pont du Gard, the remains of one of the most magnificent Roman structures in France, is a bridge 156 feet high and consisting of three tiers of arches, on which the aqueduct which brought the water of the Aure to Nîmes crossed the river Gard 10 miles N. E. of that city. The lowest tier contains 6 arches, the middle 11, and the uppermost, on which the channel of the aqueduct rests, 35.

Pontecor'vo, town of Southern Italy, province of Caserta, about 28 miles S. of Sora. It is situated on a hill, the top of which is quite level and occupied by the portion of the city known as the Cività, while on the slope hangs the so-called Pastina, both commanding very fine views of the rich surrounding country. The old walls and towers, once very strong, are now in a ruinous condition. A bridge, originally of Pelasgian construction, and from the curved form of which the town takes its name, connects the city with its suburbs. This bridge was broken down to check the march of Hannibal, and afterward beautifully restored. In 1860 it was blown up by the Bourbon troops, but was rebuilt soon after. There are some fine churches in and near the town which contain admirable frescoes, and among the archives of the cathedral are Lombard, Gothic and mediæval Latin MSS. of considerable interest. The episcopal residence and several private palaces deserve notice. On a neighboring height, now crowned by a sanctuary, once stood the formidable *Arx tutica Fregellano*, mentioned by Livy. The ruins of the ancient *Fregellæ* are distinctly traceable, and among them are found mosaics of great beauty. Pontecorvo first appears in mediæval history in the ninth century, and afterward plays no inconsiderable part in the confused drama of Southern Italy. Bonaparte created Bernadotte prince of Pontecorvo in 1806. It was the first town of the Terra di Lavoro to declare itself (1860) in favor of the national movement. Macaroni and works in plaster constitute the chief industries of the place. P. in 1874, 10,760.

Ponte, da. See BASSANO.

Pontede'ra, town of Italy, province of Pisa, situated near the junction of the torrent Era with the Arno, 13 miles E. of the city of Pisa. It was a strongly fortified town during the wars between Pisa and Florence, and was fiercely contended for by these rival powers, which held it alternately. At present the town has a respectable appearance, and its manufactures are of importance. Bricks are made on an extensive scale, and cotton, woollen, and hempen stuffs are largely woven by women, not less than 1000 private looms being in operation. P. in 1874, 10,817.

Pontefract (pom'fret), town of England, county of York, on the Aire, trades chiefly in corn, cattle, malt, and garden produce. P. 5372.

Pon'te La'go Scu'ro, town of Italy, province of Ferrara, about 3 miles N. W. of the city of Ferrara, and 40 miles from the mouth of the Po, which is here crossed by the lowest bridge on its course. This bridge, built for the Venice-Bologna railway, is of iron, and is 745 feet long. Ponte Lago Scuro is an important place in the hydrography of the Po, which receives no affluents at any lower point. It is here that all the measurements of the discharge of the river have been made, and it is also from the mean low-water mark at Ponte Lago Scuro that the rise of the water in inundations is usually reckoned.

Ponteve'dra, town of Spain, province of Pontevedra, is beautifully situated on a peninsula formed by the confluence of the Lereg, Alta, and Tomaso, the latter of which is crossed by a noble bridge from the Roman times (*pons vetus*). The city is neatly and substantially built, and the surroundings belong to the most fertile and beautiful regions of Spain. P. 6623.

Pontevi'co, town of Italy, province of Brescia, on the left bank of the Oglio. This town dates from 700 A. D., and its strong walls and castle gave it importance in the wars of the Venetian republic. It is at present a place of no special interest. P. in 1874, 6600.

Pon'tiac, the north-westernmost county of Quebec, Canada, bounded on the S. by Ottawa River. It is rapidly settling up. It is a great lumber-region. It abounds in sterile, rocky hills, but the valleys are fertile. Cap. Havelock. P. 15,791.

Pontiac, p.-v. and tp., cap. of Livingstone co., Ill., at the junction of Chicago Alton and St. Louis and Chicago and Paducah R. Rs., 90 miles S. of Chicago, has 3 public schools, 6 churches, a State reform school, 3 banks, 2 flouring-mills, an iron-foundry, coal-mine, and 1 weekly newspaper. P. of v. 1657; of tp. 2438.

FRED. L. ALLES, ED. "SENTINEL."

Pontiac, p.-v. and tp., cap. of Oakland co., Mich., on Clinton River and Detroit and Milwaukee R. R., 20 miles N. W. of Detroit, has 3 weekly newspapers, some manufactures, and a large trade in wool and agricultural productions. P. of v. 4867; of tp. 5942.

Pontiac, p.-v., Evans tp., Erie co., N. Y. P. 100.

Pontiac, a chief of the Ottawa Indians, b. near the river Ottawa in 1720; became an ally of the French in Northern Michigan, and in 1746 defended Detroit against Indian attacks. In 1755 he was present, it is believed, at Braddock's defeat, and after the English in 1760 had displaced the French in the North-west, Pontiac organized a conspiracy among the various Indian tribes with the purpose of murdering the English garrisons at all points. In May, 1763, nine garrisons (ranging from Western Pennsylvania to Mackinaw) were destroyed or dispersed on the same day, and the whole frontier was ravaged. The attack on Detroit, led by Pontiac himself, was anticipated by the English, but the chieftain besieged the town May 12–Oct. 12, 1763, maintaining his force by the issue of birch-bark notes, all of which he subsequently redeemed. Deserted by his followers, he still endeavored to arouse his people to the dangers in store for them, but in 1766 he was obliged to submit to the British rule. He was murdered at Cahokia, Ill., in 1769, by an Illinois Indian while intoxicated. (See Parkman's *Conspiracy of Pontiac*, 1867.)

Pontianak', town of Borneo, situated on the W. coast of the island, at the confluence of the Landak and the Kapnas, which from here to its mouth is called the Pontianak, and lined on both sides with impenetrable forests peopled with immense swarms of parrots and monkeys. Pontianak is the capital of the Dutch dominions of Western Borneo, the residence of the governor, and is defended by Fort du Bus. Its population varies between 6000 and 19,000, most of whom are Chinese, very few Europeans, but its trade in diamonds, gold-dust, sugar, rice, cotton, and coffee is rapidly increasing.

Ponticel'li, town of Southern Italy, province of Naples, and very near the city of Naples. P. in 1874, 6593.

Pon'tifex [Lat., probably from *pons*, "a bridge," and *facio*, to "make," because (says Varro) the pontiffs built and sustained the Sublician bridge at Rome; but perhaps referring to the making of sacrifices upon that bridge], a member of the great college of priests in ancient Rome, of whom there were at first four, besides the pontifex maximus, their chief, but the number varied, and finally became fifteen. The name is usually rendered *pontiff* in English. The duties of the pontifical college were the supervision of religious rites and the execution of certain civil duties, which thereby attained a religious solemnity. The office of pontiff was one of great dignity, and such men as Cæsar and Crassus, besides several of the emperors, were honored by the office of pontifex maximus. Besides the above, there were *minor* pontiffs, secretaries to the regular college. The pope of Rome has long been called *pontifex maximus*, and a few of the German emperors assumed the title.

Pontifical States. See PAPAL STATES.

Pon'tine Marsh'es [Lat. *Pomtinæ Paludes*], a tract of marshy ground in the province of Rome in Italy, much resembling in its general features the Maremme of Tuscany (see MAREMME), but less elevated above the level of the sea. The area and boundaries of these marshes are somewhat variously estimated, but they are generally described as extending from the vicinity of Cisterna, near which were probably the "Three Taverns" of St. Paul, S. W. to the sea at Terracina, a distance of about 28 miles, with a mean width of little more than 5 miles. Geological evidence is thought to show that this tract was once a bay of the Tyrrhenian, bounded N. E. by the Volscian Mountains, S. W. by a long spit consisting chiefly of sand thrown up by the sea. This bay, it is supposed, was gradually filled up by the sediment of the numerous torrents of those mountains, and raised to the present level of its surface, which near Cisterna is about 30 feet above the sea, while at Terracina it dips below the sea-level. It has been contended that this change has taken place within the historic period, but the probability is that it belongs to a remoter era. The slope of the marshes toward their general outlet at Terracina is too gentle for the discharge of their waters, and though about one-third of the surface has been drained and converted into very fertile arable land and luxuriant permanent pastures, it is nearly all subject to occasional overflow, and most of it is either a swampy waste, or at best capable only of serving as a range for half-wild horses, ordinary domestic quadrupeds, and buffaloes, which latter animals are very serviceable in clearing the ditches of aquatic plants that encumber them. Both the marshes and the boggy and tangled forest on the low sands which bound them on the S. W. are very unhealthy during the warm season, and the miasmata they exhale are borne by the S. winds even to the city of Rome. They can hardly be said to be inhabited, though there are a few agricultural, pastoral, and police stations upon them, and numbers of hardy mountaineers come down to them to labor at seed-time and harvest. The Romans made many partially successful attempts to drain and reclaim this territory. They built a great road through the centre of it, the Appian Way, commenced 312 B. C. and finally continued to Brundusium, and they constructed a navigable canal not far from the line of the road, quite down to Terracina. It was on this canal that "I and honest Heliodorus" performed a part of the journey to Brundusium humorously described by Horace in the *Iter Brundusinum*. Pliny states that this district was anciently thickly inhabited and contained twenty or thirty large towns, besides numerous villages and hamlets; but few ruins of old constructions are found on its soil, and it is now generally believed that its condition was never much better than at present so long as its history is known. The drainage-works got out of repair in the troublous times of the civil wars and the decaying Empire. They were more or less thoroughly restored during the Middle Ages, and especially under the enlightened administration of Theodoric the Goth, but nothing very effectual was accomplished until the last quarter of the eighteenth century, when, by an expenditure of about $2,000,000, Pope Pius VI. brought them nearly to their present state. They now yield to the government an annual revenue of about $18,000, derived from long leases to a few large farmers. (See Prony, *Description hydrographique et statistique des Marais Pontins* (1813, 4to); Giordani, *Gita alle Paludi Pontine* (1872, pamphlet).)

GEORGE P. MARSH.

Pontoise', town of France, department of Seine-et-Oise, manufactures hosiery, sailcloth, vinegar, chemicals, etc., and carries on a considerable trade. P. 6480.

Pontoon, or **Ponton.** See BRIDGE, by GEN. J. G. BARNARD, A. M., LL.D., M. N. A. S.; and DOCKS, by SAMUEL H. SHREVE.

Pontoo'sic, p.-v. and tp., Hancock co., Ill., on Carthage division of Chicago Burlington and Quincy R. R. (DALLAS STATION). P. 1946.

Pontop'pidan (ERIK), b. at Aarhuus, Jutland, Denmark, Aug. 24, 1698; studied theology at the University of Copenhagen; became professor in 1738, bishop of Bergen, Norway, in 1747, chancellor of the University of Copenhagen in 1755; wrote *Menoza* (3 vols., 1742), a sort of theological romance, *Annales Ecclesiæ Daniæ* (4 vols., 1741–52), *Gesta et Vestigia Danorum extra Daniam* (3 vols., 1740), *Danske Atlas* (7 vols., 1763–81), *Glossarium Norvagicum* (1749), etc. D. at Copenhagen Dec. 20, 1764. As a theologian he was a disciple of Spener; as an historical writer he was careful and accurate and possessed of immense learning.

Pontotoc', county of N. E. Mississippi. Area, 474 sq. m. It is level and very fertile. Products, live-stock, corn, and cotton. It is drained by branches of the Tallahatchie River. Cap. Pontotoc. P. 12,525.

Pontotoc, p.-v., cap. of Pontotoc co., Miss., has 1 weekly newspaper, schools, and U. S. land-office. P. 384.

Pontrem'oli, town of Italy, province of Massa-Carrara, situated at the foot of a narrow gorge of the Apennines, at the point where the torrent Verde falls into the Magra. It stands 700 feet above the sea, and the castle Piagnaro, once its defence, still overlooks it from a hill above. A part of the town is very old, but the modern portion has an air of comfort. The streets are well paved, and the cathedral is large and crowned with a remarkably fine cupola. Pontremoli was a place of some consequence during the Middle Ages, and suffered the usual miseries resulting from the Guelph and Ghibelline party factions. In the winter of 1834 it was so severely shaken by an earthquake that the inhabitants fled from their houses, not one of which remained uninjured, but the only loss of life was from cold and hunger. In 1859, Pontremoli passed from the tyranny of the duke of Parma under the sceptre of Victor Emmanuel. The principal trade of the town consists in cattle, in homespun linen, and in woollen cloths, silk, etc. P. in 1874, 12,625.

Pont Saint-Esprit', town of France, department of Gard, on the Rhone, carries on a varied manufacturing industry, comprising candles, linen fabrics, silk, and articles of copper, tin, faïence, and crystal. P. 5123.

Pon'tus, the name of a territory of Asia Minor, extending along the southern coast of Pontus Euxinus or the Black Sea between Cappadocia and Paphlagonia. It belonged alternately to one or the other of these two countries, and formed, together with the latter, an independent

kingdom from the middle of the fourth century to 66 B. C., when it was conquered by Pompey, and dismembered. In A. D. 63 it was made a Roman province. The most celebrated of its rulers was Mithridates the Great, under whom it culminated and fell.

Pontus Euxinus. See BLACK SEA.

Po'ny [Fr. *poni*], a name applied to the small varieties of the horse. The most famous European ponies are the Shetland, Iceland, Welsh, Dartmoor, Corsican, and Greek. In North America there are the Canadian, Sable Island, Gay Head, Sea Island, and Mustang. These little animals are tough and spirited, but often vicious. Their small size and unusual development of the hair, mane, and tail are due to exposure and scanty food for many generations.

Poole, town of England, county of Dorset, on the estuary of the Trent, has some shipbuilding, manufactures of sailcloth and cordage, and exportations of pipeclay and potter's clay. P. 10,129.

Poole (JOHN), b. in England in 1785; d. in London Feb. 5, 1872; author of a large number of successful dramas and farces, of which the best known were *Paul Pry* (1825), *Deaf as a Post*, *Turning the Tables*, and an adaptation of Shirley's *Wife's Stratagem*. He also wrote novels, essays, and character sketches, among which *Little Pedlington and the Pedlingtonians* (2 vols., 1839) took high rank for originality and racy humor. In his last years Poole enjoyed a pension from the civil list, procured by the good offices of Charles Dickens.

Poole (MATTHEW), b. at York in 1624; educated at Emmanuel College, Cambridge; took orders in the Church of England, and became rector of St. Michael-le-Querne, London, but was ejected for non-conformity in 1662; wrote much against Roman Catholicism; is said to have narrowly escaped being murdered at the time of the "Popish plot," and removed to Amsterdam, where he d. Oct., 1679. Author, among other works, of a famous compendium of the critical views of 150 biblical commentators, entitled *Synopsis Criticorum* (5 vols., 1669–76), and of *Annotations upon the Holy Bible* (1683–85), left unfinished, but completed by eminent nonconformists.

Poole (WILLIAM FREDERICK), b. at Salem, Mass., in 1821; graduated at Yale College 1849; published while at college an *Index to Subjects in Reviews and Periodicals* (1848), subsequently expanded into the valuable *Index to Periodical Literature* (1853); was librarian of the Boston Mercantile Library 1852–56, of the Boston Athenæum 1856–69, of the Cincinnati Public Library 1869–73, and since the latter date of the Chicago Public Library, and is noted for his vast acquaintance with bibliography. Author of *The Battle of the Dictionaries* (1856), *Websterian Orthography* (1857), *The Orthographical Hobgoblin* (1859), *The Mather Papers* (1868), *Cotton Mather and Salem Witchcraft* (1869), and other miscellaneous publications, and has written frequently for the *North American Review*.

Poolville, p.-v., Hamilton tp., Madison co., N. Y., on Utica Chenango and Susquehanna Valley R. R. P. 163.

Poo'nah, town of British India, capital of a district of the same name, in the presidency of Bombay, on the Moota, near its influx in the Moola, on a dry and treeless plain, 2000 feet above the sea. Although the climate is hot and dry and water is scarce, the place is considered healthy, and has been made the station of the army of Bombay. The city is well built, and contains many fine barracks, a college (where the Indian and English languages and literature are taught), a prosperous female school (the first in India), and several other educational institutions. Its trade in the raw products of the interior and in manufactured goods from Bombay is considerable. P. 80,000.

Poon Tree, the *Calophyllum angustifolium* and *C. inophyllum*, a tree of Farther India, used in shipbuilding. Poon spars are famous in the East. The tree is of the order Clusiaceæ, and abounds in a resin called tacamahac.

Poor (DANIEL), D. D., b. at Danvers, Mass., June 27, 1789; graduated at Dartmouth College 1811, at Andover Theological Seminary 1814; went to Ceylon as a missionary of the A. B. C. F. M. 1815; resided first at Tillipally, then at Barricotta, where he founded an educational institute; published a number of religious and educational works in the Tamil language; removed to Madura 1836, to Jaffna 1841; spent two years lecturing on Indian missions in the U. S. 1848–50; wrote for American religious periodicals. D. at Jaffna, Ceylon, Feb. 3, 1855.—His son, DANIEL WARREN POOR, D. D., b. at Jaffna, Ceylon, Aug. 21, 1818; graduated at Amherst in 1837; spent two years at Andover; was pastor of the Central (Congregational) church at Fairhaven, Mass., 1843–49, of the High street (Presbyterian) church in Newark, N. J., 1849–69, and of the First Presbyterian church at Oakland, Cal., 1869–72, when he was appointed professor of ecclesiastical history in the San Francisco Theological Seminary. He received the degree of D. D. from the College of New Jersey in 1857. Besides occasional sermons and pamphlets, he has published *Select Discourses from the French and German* (1858, with Dr. Fish) and *First Corinthians*, in the American edition of Lange's *Commentary* (1868). R. D. HITCHCOCK.

Poor (ENOCH), b. at Andover, Mass., 1736; became a merchant of Exeter, N. H., a colonel of provincial troops 1776, brigadier-general in the Continental army 1777; served with great distinction against Burgoyne and at Monmouth; was in Sullivan's expedition of 1779 against the Six Nations, and in 1780 took command of one of La Fayette's light infantry brigades; was killed near Hackensack, N. J., in a duel with a French officer, Sept. 8, 1780.

Poor (JOHN ALFRED), b. at Andover, Me., Jan. 8, 1808; studied law, practised at Bangor; removed to Portland; edited the *State of Maine* newspaper; served in the legislature; was the first active promoter of the railroad system of Maine, having originated the European and North American line; published *A Vindication of the Claims of Sir Ferdinando Gorges as the Founder of English Colonization in America* (New York, 1862), and delivered the address at the commemoration of the founding of the Popham Colony at Fort St. George, mouth of the Kennebec, Aug. 15, 1863.

Poor Debt'ors (law). Three general types of statutory provisions are found in the legislation of the several States and Territories in reference to poor debtors, the first and second relating to all insolvents, the third referring exclusively to those who are in confinement under arrest either on mesne process—that is, a preliminary warrant of arrest or *capias*—or on final execution against the person. In many of the States there is no legislation on the subject of insolvents generally, and the common law is left in force, which permits assignments in trust for the benefit of creditors even when preferences are given by the failing debtor. The first class of statutes above referred to simply provide for general assignments to trustees for the benefit of creditors made by insolvents, and regulate the proceedings of the assignees therein and the mode of settling the estate. They generally require that the assignment must be for all the creditors without preference; they prescribe its form and contents, the mode of proving claims by the creditors, the steps to be taken by the trustee—there being of course much diversity in the detail among the statutes of the different States. The debtor himself is not discharged from his existing liabilities. Statutes of this character are found in the following States: Illinois, Iowa, Kansas, Kentucky, Maine, Missouri, New Hampshire, New Jersey, Ohio, Pennsylvania (but wages due to minors, mechanics, and laborers, if not exceeding $200 to any one person, must be first paid in full by the assignee), and Vermont. The second class of statutes authorize a similar assignment to trustees for the benefit of creditors, and thereupon the insolvent, in the absence of fraud, may be discharged from his liabilities. There is here also much diversity in the provisions of the legislation among the various States. In some the debtor is discharged by the mere act of making a proper assignment of all his non-exempt property; in others it is necessary that the assets should pay a certain percentage of the claims; in others the consent of a portion of the creditors is made requisite; while in others, still, certain classes of debts, especially those accompanied by a breach of the debtor's fiduciary duty, are not included in the discharge. In one or two States, particularly in Massachusetts, a complete system of bankruptcy has been enacted. In the following States the legislation belongs to the class thus described: California, Connecticut (but the assets must pay 70 per cent. of the debts, and an allowance is made to the debtor for the support of his family), Idaho, Massachusetts, Michigan, New York (but creditors representing two-thirds of the claims must unite with the debtor in asking the discharge), South Carolina (the debtor is discharged from the demands of all those creditors who accept a dividend under the assignment), and Wisconsin. The operation of all these statutes, so far as they conflict with the U. S. bankrupt law, is suspended thereby. Finally, there is a class of enactments found in very many States which relate to debtors imprisoned on civil process, and permit their discharge from confinement upon the performance by them of certain conditions, which generally consist in the taking an oath, termed "the poor debtor's oath," in furnishing an inventory of all their property, with an affidavit that it comprises their entire property not exempt from execution, and in executing an assignment thereof to a trustee, to the intent that it may be appropriated in payment of debts. Statutes of this character exist in all the States which permit the arrest and imprisonment of debtors either on mesne or on final process.

JOHN NORTON POMEROY.

Poore (Benjamin Perley), b. at Newbury, Mass., Nov. 2, 1820; learned the printing business; edited the *Southern Whig* at Atlanta, Ga., 1838–40; became an attaché of the U. S. legation in Belgium 1841; made a valuable collection of historical MSS. from the French archives for the State of Massachusetts 1844–48; travelled in Egypt, Palestine, and other Eastern countries as correspondent of the Boston *Atlas* 1843–48; published *The Rise and Fall of Louis Philippe* (1848), *The Life of Gen. Taylor* (1848), *The Early Life of Napoleon* (1851); became editor and proprietor of the *American Sentinel* (1851); wrote several novels in the columns of *Gleason's Pictorial:* has a residence at Newburyport, but has lived since 1854 chiefly at Washington, D. C., as correspondent of the Boston *Journal*, secretary of the U. S. Agricultural Society, and clerk of Senate committees. He edited the volumes of the *Conspiracy Trials* of 1865 and the *Congressional Directory* since 1867.

Poor Handmaids of Jesus Christ, a Roman Catholic sisterhood founded in 1849 at Dernbach, Germany, by Catharine Caspar, under the auspices of the bishop of Limburg; received papal approbation in 1860 and 1870. Their mother-house in the U. S. is at Fort Wayne, Ind.

Poor Laws. See Pauperism, by Rev. C. L. Brace.

Poor, Little Sisters of the. See Little Sisters of the Poor.

Popayan′, town of the United States of Colombia, South America, capital of the state of Cauca, is beautifully situated on the Cauca, at the foot of the Andes, on a plain 6000 feet above the sea, whose wonderful climate ripens the strawberry and the coffee-fruit to equal perfection. It was founded by the Spaniards in 1537, and rose rapidly, but in 1834 it was almost entirely destroyed by an earthquake, and the wars of independence and the unsettled condition of the state have prevented it from fully recovering. Its trade in agricultural produce is increasing, however. P. 16,000.

Pope, county of N. W. Arkansas. Area, 900 sq. m. It is partly bounded S. by Arkansas River, which traverses the S. W. part. It is uneven, very fertile, and abounds in coal and timber. Cotton, live-stock, and corn are leading products. Cap. Dover. P. 8386.

Pope, county of S. E. Illinois. Area, 372 sq. m. It is bounded S. E. by Ohio River, which separates it from Kentucky. It is undulating, very fertile, and yields large amounts of tobacco, corn, cotton, wool, etc. Mineral springs and kaolin are found. Cap. Golconda. P. 11,437.

Pope, county of Central Minnesota. Area, 720 sq. m. It is rolling, fertile, and abounds in small lakes. It is well adapted to the production of wheat, oats, and hay. The S. W. corner is traversed by St. Paul and Pacific R. R. Cap. Glenwood. P. 2691.

Pope [Gr. πάπας; Lat. *papa*], a term applied in the Greek Church to all priests, and originally used in the same manner also in the Western Church, but in the latter part of the fifth century it began to be applied exclusively to the bishop of Rome, and since the time of Gregory VII. (1073–85) it has become his official title. He is also called "Sovereign Pontiff," "Vicar of Christ," and "Holy Father." He is addressed as "Your Holiness," and subscribes himself *Servus Servorum Dei* ("Servant of the Servants of God"). The pope was elected in olden times by the clergy and people of Rome, but since Nicholas II. (1058–59) he has been elected by the college of cardinals assembled in the conclave. A simple majority is not sufficient to elect a pope; two-thirds of the votes are necessary. During the election all communication between the conclave and the outside world is interrupted. When elected, the pope is crowned with the tiara and enthroned; instead of a sceptre he wields the *pedum rectum*, a staff, not bent like that of the bishops, but ending in a cross. The supremacy of the pope over the Roman Catholic Church is nothing but a simple historical development. Not the circumstance of St. Peter being bishop of Rome, which is at least very uncertain, but that of Rome being the capital of the world, gave prominence to its bishop. Nevertheless, no supremacy was either claimed or recognized during the first, second, and third centuries, and when, in 343, at the Council of Sardica, the supremacy of the Roman see over the Christian Church was spoken of for the first time in undisguised terms, the Oriental bishops protested and left the council. Thus from the very beginning the primacy of the Roman bishops was confined to the Occidental Church, and the Council of Chalcedon (451) determined that the see of Constantinople should occupy the same rank in the Eastern Church as that of Rome in the Western. But originally no power, either secular or spiritual, was connected with this supremacy of rank. Charlemagne treated the pope simply as the first metropolitan, and considered himself the head of the Church, its patron, and its legislator; and up to the middle of the eleventh century the pope remained subordinate to the emperor and the councils. But with Gregory VII. a change took place, and in the course of the two following centuries the hierarchical position of the pope became fully developed and firmly established, especially by the exertions of Alexander III. (1159–81), Innocent III. (1198–1216), Gregory IX. (1227–41), Innocent IV. (1243–54), and Boniface VIII. (1294–1303). He was now acknowledged as the vicegerent of Christ on earth and as the highest authority in all matters of faith and discipline in the Church. He alone could convoke an œcumenical council and make its decrees valid by confirming them. He alone could give a bishop the episcopal institution or deprive him of his dignity. The Vatican Council of 1870 declared the infallibility of the pope, which before had been a matter of dispute between the Gallicans and the Ultramontanes. (For further information see the biographies of the popes and the articles on the Roman Catholic Church, Gallicanism, etc.) We subjoin a list of the popes (compiled from Herzog's *Real-Encyklopädie für protestantische Theologie und Kirche*), giving the year of accession to the throne, and the names of the antipopes in italics:

St. Peter.	
Linus.	
Cletus.	
Clement I.	
Evaristus, about	100
Alexander I	110
Sixtus I	116 or 119
Telesphorus	128
Hyginus	138
Pius I	142
Anicetus, about	151
Soter	168
Eleutherius	177
Victor I	185
Zephyrinus	197
Calixtus I	220
Urban I	226
Pontianus	230
Anterus	235
Fabianus	236
Cornelius	251
Novatianus.	
Lucius I	252
Stephen I	253
Sixtus II	257
Dionysius	259
Felix I	269
Eutychianus	275
Caius	283
Marcellinus	296
Marcellus I	308
Eusebius	310
Melchiades	311
Sylvester I	314
Marcus	336
Julius I	337
Liberius	352
Felix II.	
Damasus I	366
Ursicinus.	
Siricius	384
Anastasius I	398
Innocent I	402
Zosimus	417
Boniface I	418
Celestinus I	422
Sixtus III	432
Leo I., the Great	440
Hilarius	461
Simplicius	468
Felix III	483
Gelasius I	492
Anastasius II	496
Symmachus	498
Hormisdas	514
John I	523
Felix IV	526
Boniface II	530
John II	532
Agapetus I	535
Sylverius	536
Vigilius	540
Pelagius I	555
John III	560
Benedict I	574
Pelagius II	578
Gregory I	590
Sabinianus	604
Boniface III	606
Boniface IV	608
Deusdedit (or Deodatus) I	615
Boniface V	619
Honorius I	625
Severinus	638
John IV	640
Theodorus I	642
Martin I	649
Eugenius I	654
Vitalianus	657
Deusdedit II	672
Domnus I	676
Agatho	678
Leo II	682
Benedict II	684
John V	685
Conon	686
Sergius I	687
John VI	701
John VII	705
Sisinnius	708
Constantine	708
Gregory II	715
Gregory III	731
Zacharias	741
Stephen II	752
Stephen III	752
Paul I	757
Stephen IV	763
Adrian I	772
Leo III	795
Stephen V	816
Paschal I	817
Eugenius II	824
Valentinus	827
Gregory IV	827
Sergius II	844
Leo IV	847
Benedict III	855
Nicholas I	858
Adrian II	867
John VIII	872
Martin II	882
Adrian III	884
Stephen VI	885
Formosus	891
Sergius and *Boniface VI.*	
Stephen VII	896
Romanus	897
Theodorus II	897
John IX	898
Benedict IV	900
Leo V	903
Christopher.	
Sergius III	904
Anastasius III	911
Lando	913
John X	914
Leo VI	928
Stephen VIII	929
John XI	931
Leo VII	936
Stephen IX	939
Martin III. or Marinus II	943
Agapetus II	946
John XII	955
Leo VIII	*963*
Benedict V	964
John XIII	965
Benedict VI	972
Domnus II	974
Benedict VII	974
John XIV	983
Boniface VII.	
John XV	985
John XVI	996
Gregory V	996
Sylvester II	999
John XVII	1003
John XVIII	1003
Sergius IV	1009
Benedict VIII	1012
John XIX	1024
Benedict IX	1033
Sylvester.	
Gregory VI	1044
Clement II	1046
Damasus II	1048
Leo IX	1048
Victor II	1055
Stephen X	1057
Benedict X	1058
Nicholas II	1058

Alexander II	1061
Gregory VII	1073
Clement III.	
Victor III	1086
Urban II	1088
Paschal II	1099
Albert and *Theodoric.*	
Gelasius II	1118
Calixtus II	1119
Honorius II	1124
Innocent II	1130
Anacletus.	
Celestinus II	1143
Lucius II	1144
Eugenius III	1145
Anastasius IV	1153
Adrian IV	1154
Alexander III	1159
Victor, *Paschal*, and *Calixtus.*	
Lucius III	1181
Urban III	1185
Gregory VIII	1187
Clement III	1187
Celestinus III	1191
Innocent III	1198
Honorius III	1216
Gregory IX	1227
Celestinus IV	1241
Innocent IV	1243
Alexander IV	1254
Urban IV	1261
Clement IV	1265
Gregory X	1271
Innocent V	1276
Adrian V	1276
John XXI	1276
Nicholas III	1277
Martin IV	1281
Honorius IV	1285
Nicholas IV	1288
Celestinus V	1294
Boniface VIII	1294
Benedict XI	1303
Clement V	1305
John XXII	1316
Nicholas.	
Benedict XII	1334
Clement VI	1342
Innocent VI	1352
Urban V	1362
Gregory XI	1370
Urban VI	1378
Clement VII	*1378*
Benedict XIII	*1394*
Boniface IX	1390
Innocent VII	1404
Gregory XII	1406
Alexander V	1409
John XXIII	1410
Martin V	1417
Eugenius IV	1431
Felix.	
Nicholas V	1447
Callixtus III	1455
Pius II	1458
Paul II	1464
Sixtus IV	1471
Innocent VIII	1484
Alexander VI	1492
Pius III	1503
Julius II	1503
Leo X	1513
Adrian VI	1522
Clement VII	1523
Paul III	1534
Julius III	1550
Marcellus II	1555
Paul IV	1555
Pius IV	1560
Pius V	1566
Gregory XIII	1572
Sixtus V	1585
Urban VII	1590
Gregory XIV	1590
Innocent IX	1591
Clement VIII	1592
Leo XI	1605
Paul V	1605
Gregory XV	1621
Urban VIII	1623
Innocent X	1644
Alexander VII	1655
Clement IX	1667
Clement X	1670
Innocent XI	1676
Alexander VIII	1689
Innocent XII	1691
Clement XI	1700
Innocent XIII	1721
Benedict XIII	1724
Clement XII	1730
Benedict XIV	1740
Clement XIII	1758
Clement XIV	1769
Pius VI	1775
Pius VII	1800
Leo XII	1823
Pius VIII	1829
Gregory XVI	1831
Pius IX	1846

CLEMENS PETERSEN.

Pope (ALEXANDER), b. at London May 21, 1688. His father, who was a Roman Catholic, was a man of means, but not finding London a fit place for a papist to live in after the revolution of 1688, he retired from business and settled at Binfield in Windsor Forest. The son was educated partly at home, partly in Twyford, and partly in London, but the instruction he received was very loose and desultory, and his poor health made a systematic education almost impossible. He was very small, very feeble, and a little crooked. In one point, however, his education was unremitting and consummate. He had by nature a wonderful sense for form, not only theoretically, so as to feel any break or blunder, but also practically, so as to produce perfect expression. And by self-study and exercise he developed this sense to the highest degree of sharpness and refinement. He had no originality of thought; all his ideas are borrowed. His imagination was without spontaneity; he took his inspiration from books, not from nature. But in adopting other people's ideas and images he not only refined them, but by combining them he actually produced something new; and this new production was often very brilliant. He began writing epics and tragedies when he was twelve years old, but he had the good sense to burn what had no value, and to keep in his desk what needed to be rewritten in order to become valuable. Meanwhile, he was introduced to the literary world in London, and was for some time (about 1704) very busy correcting Wycherley's verses. He followed the famous dramatist "as a dog;" he later on followed Addison in the same manner, and Swift and Lady Montagu, and indeed during his whole life there was always some one to whom he clung passionately. But one day Wycherley became a little haughty, and in the same moment Pope became "malicious," and the friendship was at an end. In 1709 he published his *Pastorals*, written several years before, and almost immediately he was acknowledged as one of the first poets of his age. Then followed the *Essay on Criticism* in 1711; *Rape of the Lock* in 1712; *Windsor Forest* in 1713; *Temple of Fame* in 1715; and *Eloisa to Abelard* in 1717. In this year, after the death of his father, he moved with his mother to Twickenham, on the banks of the Thames, where he spent the rest of his days in an elegant retirement, visited by all the first men of literature and society. He had become not only the fashion, but the rage of his time, and he knew how to punish any dissentient, for his wit and satire were as ready and effective as his sentiments and descriptions were airy and charming. He was also rich. From 1715 to 1726 he translated the *Iliad* and *Odyssey*, for which he received nearly £8000, and in 1725 he published a new edition of Shakspeare, also with good profit, though to people who know Homer his translation is as singular a work as his edition is to those who know Shakspeare. The best of all his productions are perhaps the *Dunciad*, published in 1728, and the *Essay on Man*, published in 1734. D. at Twickenham, Middlesex, May 30, 1744. CLEMENS PETERSEN.

Pope (CHARLES A.), M. D., b. at Huntsville, Ala., Mar. 15, 1818; graduated at the University of Alabama; studied medicine at Huntsville, Cincinnati, and Philadelphia; spent two years studying surgery in France and Germany; settled at St. Louis, Mo., 1841, where he soon established an extensive practice; became professor of anatomy and afterward of surgery in the St. Louis University; aided in founding the St. Louis Medical College; was president of the American Medical Association in 1853; took an active part in promoting general education; retired from practice about the close of the civil war, and took up his residence at Paris, Mo. D. at Paris July 6, 1870.

Pope (JOHN), b. in Prince William co., Va., about 1770; lost an arm by accident in his youth, and was thereby led to study law; practised first in Shelby co., Ky.; afterward settled at Lexington; was many years a member of the State legislature; U. S. Senator 1807–13; president *pro tem.* of the Senate 1811; governor of Arkansas Territory 1829–35, and member of Congress 1837–43. D. in Washington co., Ky., July 12, 1845.

Pope (JOHN), b. in Louisville, Ky., Mar. 16, 1823; graduated at the U. S. Military Academy, and commissioned brevet second lieutenant topographical engineers July 1, 1842, captain 1856. Prior to 1846 he was engaged in Florida and in the survey of the N. E. boundary-line between the U. S. and Great Britain; in the war with Mexico he participated in the battles of Monterey and Buena Vista, gaining the brevets of first lieutenant and captain for gallantry; returning to duty with his corps on the termination of war, for six years (1853–59) he conducted the survey of a route for the Pacific R. R.; on lighthouse duty until the outbreak of civil war. Appointed brigadier-general of volunteers May 17, 1861, he held important commands in Missouri, and in Dec., 1861, surprised a Confederate camp at Milford, which he captured with large supplies, thus forcing the Confederate general Price to S. E. Missouri; following up his success, now in command of the Army of the Mississippi, in co-operation with Admiral Foote New Madrid was taken (Mar. 14, 1862). Promoted to be major-general Mar. 21, 1862, and a month later (Apr. 8) captured Island No. 10 in Mississippi River, with upward of 6500 prisoners and about 125 cannon and 7000 small-arms. Uniting with the combined armies under Gen. Halleck, he participated in the advance upon Corinth, and upon the evacuation of that place (May 30) pursued the Confederate army as far as Baldwin. Called to the East in June, he was made a brigadier-general in the regular army (July 14, 1862) and placed in command of the Army of Virginia, comprising the forces of Fremont, McDowell, and Banks, to which were added those of the Army of the Potomac arriving from the Peninsula of Virginia. The unsuccessful battle of Bull Run was fought Aug. 29–30, and the next day (Sept. 1) that of Chantilly; a few days later Pope resigned his command, and resumed command of the department of the North-west. Since the war he has commanded various military divisions and departments.

Poperinghe', town of Belgium, province of West Flanders, has manufactures of linens, lace, tobacco, and earthenware, and extensive cultivation of hops in the vicinity. P. 10,691.

Pope's Mills, p.-v., Macomb tp., St. Lawrence co., N. Y., on Black Lake. P. 76.

Pop'ham (GEORGE), b. in Somersetshire, England, about 1550, brother of Sir John Popham, lord chief-justice of the king's bench (b. 1531; d. June 10, 1607), who was one of the patentees, with Sir Ferdinando Gorges, of an extensive territory in the present State of Maine; sailed from Plymouth, England, May 31, 1607, with two ships and 100 men, Raleigh Gilbert, nephew of Sir Walter Raleigh, being in command of one of the vessels. They landed Aug. 15, 1607, at the mouth of Kennebec or Sagadahock River, where on the western peninsula they built a storehouse and a rude fortification which they named Fort St. George. This was the first English settlement in New England, but Popham having died Feb. 5, 1608, the colonists became discouraged at the inclemency of the region, and returned

to England in the spring.—Sir FRANCIS POPHAM, probably a son of Sir John, was a patentee of New England and a member of Parliament 1620. The anniversary of the foundation of the "Popham Colony" was celebrated in 1862, and several times since, under the auspices of the Maine Historical Society, and a *Memorial Volume* was prepared "in vindication of the claims of Sir Ferdinando Gorges as the founder of English colonization in America." (See POOR, JOHN A.)

Popish Plot. See OATES (TITUS).

Pop'kin (JOHN SNELLING), D. D., b. at Boston, Mass., June 19, 1771; graduated at Harvard College 1792; was tutor there 1795–98; pastor of the Federal street Congregational church, Boston, 1799–1802, of the First church at Newbury 1804–15, and professor of Greek at Harvard College 1815–33. D. at Cambridge Mar. 2, 1852. A volume of writings, chiefly lectures, sermons, and addresses, was edited, with a *Memoir*, by Prof. C. C. Felton (1852).

Pop'lar [Lat. *populus*], properly the name of the trees belonging to the genus *Populus* and order Salicaceæ, but popularly and very incorrectly extended to the TULIP TREE (which see) of the U. S. The poplars have a light, white wood, which is very perishable if exposed to the weather or if not carefully seasoned. The common balsam poplar, tacamahac, or balm of Gilead tree (*P. balsamifera*), produces a copious fragrant resin on its buds; it is a handsome tree of North America and Asia. Several of the poplars of the U. S. are called cottonwood. (See COTTONWOOD TREE.) The cottonwoods are useful for fuel and timber, but liable to warp unless prepared with care. The *P. tremuloides*, or white poplar, American aspen, is a handsome tree, as is the *P. grandidentata*. *P. angulata* and *heterophylla* are large cottonwoods with rather large leaves. The abele, or silver-leaf poplar of Europe (*P. alba*), is sometimes planted in the U. S. It spreads rapidly by the roots, but its timber is excellent, as is that of the *P. canescens* and *nigra*, the gray and black European poplars. The Lombardy poplar (*P. fastigiata*) is remarkable for the singular upward tendency of its branches. One of the most important of the more recent economic uses of the poplars is the manufacture of paper-pulp from their wood. Paper is not usually made from this pulp alone, but it may be profitably mixed with rag-pulp in the manufacture of ordinary qualities of printing paper. REVISED BY A. GRAY.

Poplar, tp., Orangeburg co., S. C. P. 730.

Poplar Bluff, p.-v. and tp., cap. of Butler co., Mo., on St. Louis and Iron Mountain and Cairo Arkansas and Texas R. Rs., has 1 newspaper, a stave-factory, and hotels. P. 840. KITCHENS & KELLY, PUBS. "HEADLIGHT."

Poplar Branch, p.-v., Currituck co., N. C., on Currituck Sound. P. 1140.

Poplar Grove, p.-v., Caledonia tp., Boone co., Ill., on Kenosha division of Chicago and North-western R. R.

Poplar Plains, p.-v., Fleming co., Ky. P. 1565.

Poplar Ridge, p.-v. and tp., Madison co., Ala. P. 611.

Poplar Springs, tp., Tallapoosa co., Ala. P. 638.

Poplar Tent, tp., Cabarrus co., N. C. P. 1280.

Popocatepetl' [Aztec, *popoca*, "smoking," and *tepetl*, "mountain"], a volcano, still smoking, though no eruption has taken place since 1540, 10 miles S. W. of the City of Mexico. It rises 17,720 feet above the level of the sea, is of conical form, and covered with forests to a height of about 13,000 feet, where vegetation ceases and perpetual snow begins.

Pop'oli, town of Italy, province of Aquila degli Abruzzi, situated most picturesquely at the confluence of the Pescara and the Sagittario. The attention of physicists has been drawn to certain curious periodical air-currents which are observed here. P. in 1874, 6708.

Pop'pi, town of Italy, province of Arezzo, situated on an isolated hill, at the foot of which flows the Arno, the torrent Sora falling into it at a point just opposite. Poppi was a strongly-fortified town, but few traces of its mediæval life remain except the castellated palace of the counts Guidi. P. in 1874, 6414.

Pop'py [Ang.-Sax. *papig*], the common name of the *Papaver* genus of plants of the natural order Papaveraceæ. The flower is large and showy, the corolla being generally four-petalled and the calyx two-leaved. The stigma is in the form of rays, ranging from four to twenty in number. It springs directly from the germen, and persists upon the capsule. The latter is one-celled, though with imperfect partitions, and contains numerous seeds which escape by pores under the flaring stigma. The poppy is an annual or perennial herbaceous plant, and abounds in a milky juice. There are about twenty species, natives of Europe and Asia, most of which are found only in the warm temperate regions. By far the most important species is *P. somniferum*, from which the drug opium is obtained. (See OPIUM.) There are several varieties of this species, of which the most prominent are called the *white* and *black* poppy, respectively, from the color of the seeds. The flower of the former is white—that of the latter generally red or violet, though also sometimes white. This species of poppy has been known from a remote period in the countries bordering on the eastern coast of the Mediterranean, and is now extensively grown in Asiatic Turkey, Persia, Egypt, Europe, India, and China. In the Oriental countries it is cultivated for opium, but in France and Germany principally for a bland fixed oil, *poppy oil*, found in the seeds. This oil exists in the seeds in about the proportion of 40 per cent., is entirely devoid of narcotic properties, and is used extensively for the same purposes as olive oil, which it much resembles. In England there occurs in abundance a species of poppy called the *red poppy* or *corn-rose* (*P. Rhœas*), characterized by a fiery-red flower. The scarlet petals of this are used in pharmacy to impart their brilliant color to mixtures. In America, *P. somniferum* has been naturalized, but is cultivated principally as a garden-flower. EDWARD CURTIS.

Popula'tion [Lat. *populatio*]. The matter of chief interest on this topic respects the ratio between the increase of population and the increase of food for its subsistence. The subject should be considered in the light of facts rather than of theories. It is evident, as the Scriptures affirm, that the whole earth, with its manifold forces and resources, is under the dominion of man, to be subjected and made subservient to his support. But the greater part of the earth's surface is as yet but thinly peopled, and in hardly any portion are its resources for the support of human life fully drawn out. Many of the richest lands lie almost desolate. The law of reproduction in mankind no doubt tends to increase population in a geometrical ratio. But there is also in the vegetables and animals on which man feeds a structural provision for increase in a higher geometrical ratio. Both are subject to natural checks, which tend to preserve the balance between them, yet so that always the earth shall yield all, or more than all, that mankind need.

Turning to the actual occupancy of the earth by man, it is evident that those most scantily provided with means of subsistence are the nations which, in a savage state, are scattered thinly over wide territories. In such circumstances population tends to decline rather than increase, because there is no disposition or ability to unfold the hidden resources of nature by labor, no stimulus to production from genial social life, and what Malthus calls the positive checks to increase of population—viz. war, disease, and famine—work with freest and most destructive effects. When civilized men come to occupy such countries the increase of population is rapid, but that increase of population becomes itself a means of increasing subsistence more rapidly. The industries of civilized society open new treasures of earth, control new forces of nature, and tend always to a production of means of satisfaction even beyond the ever-multiplying desires of an ever-growing people. If confined within narrow limits they may in time exhaust the capacity of their own soil for yielding food, but they are producing a surplus of wealth which, through the exchanges of commerce, will bring food from other lands, perhaps colonized by their own surplus people. It needs but freedom of intercourse between all parts of the world for both people and products, and the most crowded country will be able to command a full supply of food for the needs of all. The history of the world furnishes no instance of a country depopulated, or a nation turned backward on the line of civilization, by the mere fact that its population had outgrown the means of subsistence.

Under a highly-developed civilization where industry is active and wealth is increasing, it is found that the poorer classes increase most rapidly, and that there is a steady diminution in the rate of increase as the social condition improves; that is, the ratio of increase is greatest where the means of support are least. This fact is most manifest where social distinctions are most fixed and the poorer classes can have little hope of bettering their condition. It is accounted for by the recklessness of sheer desperation. With nothing better in the future to aspire to, men cast off all prudential restraint and live only for present indulgence. Misery, instead of being the effect, is itself the cause of this excess of population. Ignorance, degradation, and vice tend to perpetuate this condition of things. On the contrary, under the inspiration of hope, full force is given to all those considerations which affect men's future condition. Regard is had not merely to the bare necessities of life, but to the decencies which belong to social position, and to the luxuries which adorn and refine

life. With reference to these, marriage is postponed and self-restraint is imposed, and thus naturally are brought in those which Malthus calls the prudential checks on excess of population. Hence, the true relief for the apparent wretchedness of crowded populations is to be found in the removal of whatever in the structure of society or the form of government tends to divide society into castes and to perpetuate inequalities of wealth and condition, and in special efforts, by education and moral influence, to inspire the lower classes with hopefulness, prudence, thrift, and energy to lift themselves to a higher level both of self-development and of social position. Here there is place for the application of sound principles of political economy to secure a more equitable distribution of wealth produced to laborers engaged in its production, and a reduction of the wastful consumption of wealth in harmful luxuries and ruinous vices. An increase of population under these conditions must be always a source of strength and a sign of prosperity in any state. With free interchange of friendly and commercial intercourse between the nations we may regard the time to be far off in the indefinite future when the population of this earth shall be brought up to the full measure of the earth's resources to support human life. These views are confirmed by the following statistics: The number of inhabitants to the square mile is, in Belgium, the most densely-peopled state of Europe, 436; in England, which stands next in order of density, it is 389; for the whole of Europe the average is but 71. In China it is estimated at 420 to the square mile; the average is 46 for all Asia, and 16 for all of Africa. The State of Massachusetts has 201 inhabitants to the square mile; Ohio, 66; the average for the whole U. S. is 11, and for the American continent as a whole, 6 to the square mile. In Australia there are nearly 2 square miles for every inhabitant. A. L. CHAPIN.

Por'celain [the origin of the word, which is found in many languages, is unknown; the French word *porcelaine* means also "sea-snail"], a name applied to the finer varieties of earthenware, composed essentially of silicates of alumina. In the making of true porcelain, however, besides fine pure, white clay—mineralogically, *kaolinite*—a certain proportion of white *feldspar* is always incorporated with the mass before burning, which, by virtue of the alkali contained in its composition, gives rise to a sort of semi-vitrification, imparting to the mass, after burning, a certain translucency to which the peculiar beauty of porcelain is due. To the same cause is due a certain toughness, infrangibility, and a crypto-crystalline homogeneity, which imparts a sonorous character like that of glass. (See POTTERY, by S. BIRCH.) H. WURTZ.

Porcelain Clay. The finer varieties of white clay, after being purified by washing, are thus designated. (See CLAY and KAOLIN.) Technically, we may define porcelain clays as those fine white and plastic clays which are free, or almost so, from *iron* and *manganese*. The following are analyses of some French porcelain clays:

	St. Yrieux, by Berthier.	Aue, by Kühn.		St. Tropez.		Halle, by Biey.
Silica	47.09	47.64		55.8		39.62
Alumina	36.41	35.97		26.0		45.00
Potash	1.56	.....		8.2		......
Magnesia	2.94	......		0.5		3.32
Lime	......	1.57	Ox. iron	1.8	Ox. mang.	0.19
Water	12.00	13.18		7.2		10.00

HENRY WURTZ.

Porcelain, Réaumur's, a porcelain-like substance, first obtained by Réaumur by *devitrifying* ordinary glass. Excessively slow cooling will sometimes produce devitrification, particularly in very calcareous glasses, but it often occurs in actual glass-working as an effect of careless and repeated heating and cooling. The glass becomes opaque, tougher, and less susceptible to fracture from sudden heating and cooling, having really something of a porcelain-like character. It is attributed to the formation of crystalline compounds in the mass, which, when once formed, are difficult of refusion. H. WURTZ.

Porchet' (FRANCIS PEYRE), M. D., b. in St. John's, Berkley, S. C., 1825; graduated A. B. at South Carolina College, Columbia, and in 1847 M. D. in the Medical College in Charleston. With Dr. Cain he issued 5 vols. there of the *Medical Journal and Review* before the war, and is now publishing the 3d vol. (new series); served in the military hospitals at Norfolk and Petersburg, Va.; author of *Resources of the Southern Fields and Forests*, and a prize essay, *Illustrations of Disease with the Microscope* (1861). PAUL F. EVE.

Porcu'na, town of Spain, province of Jaen, has manufactures of serges, woollen fabrics, and soap. P. 7645.

Por'cupine [It. *porco-spinoso*—*i. e. porco*, "a pig," and *spinoso*, "spiny"], a name given to certain rodents of the families Hystricidæ and Spalacopodidæ, distinguished by the development of spines among the hairs. The forms thus characterized are found in America, as well as Asia and Africa, but belong to two quite different groups, and their relations in other respects are with forms having hair little more harsh than ordinary mammals. The Old-World species have much stouter spines, and form the family Hystricidæ, the nearest relatives of which are South American animals without spines. The genera of Hystricidæ are (1) *Hystrix*, with four or five species, found in Asia and Africa, as well as Southern Europe; (2) *Acanthion*, with two species in Southern Asia; and (3) *Athenura*, with five species in Asia and Africa. It is the *Hystrix cristata* of Africa that furnishes chiefly the quills used as pen-handles. The South American porcupines belong to the family Spalacopodidæ and sub-family Cercolabinæ. The genera are (1) *Erethizon*, including the North American porcupine, (2) *Cercolabes*, and (3) *Chætomys*; the first of these has a short tail; the last two a prehensile one. The quills of *Erethizon* are used by the Indians in ornamental work. The quills of all the porcupines are nothing but modified and greatly developed spine-like hairs, and almost every grade of hair is exemplified either in the same animal or in representatives of related types. Belonging to the same family with the American porcupines are numerous genera, some of which have hairs little less robust than the porcupines. The name porcupine has been also extended to the Australian *Tachyglossus*, a representative of the order of Monotremes, but this animal has no relation whatever with the typical porcupines. (See also HYSTRICIDÆ and SPALACOPODIDÆ.) THEODORE GILL.

Porcupine Ant-eater, the popular name of the ECHIDNA (which see).

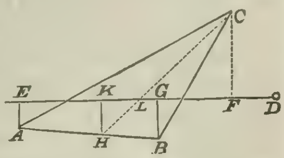
Pordeno'ne, town of Italy, province of Udine, beautifully situated on the right bank of the Noncello, about 30 miles from the city of Udine. Of its ancient walls and once-splendid castle only the ruins remain. In the cathedral (begun 1347) and in several smaller churches may be seen oil-paintings and frescoes of rare beauty by Pordenone and others of his school. The Palazzo Communale also contains most valuable frescoes by the same artists. Pordenone has utilized its abundant water-power, and the large cotton, silk, and earthen and iron ware manufactories employ more than 2000 persons. P. in 1874, 8269.

Pore [Gr. πόρος], a very narrow passage in any solid substance, but the name is more particularly applied to the efferent ducts of the glands in the skin of animals. The largest of these and the least abundant are the ducts of the sebaceous glands, which secrete an oily substance. They are numerous on the head and face and near the orifices of the body, but elsewhere fewer or even wanting. The ducts of the sweat-glands are most numerous on the palm of the hand, where 2800 have been counted in one square inch. Krause estimates the number on a single person at 2,381,248. In calibre they are extremely variable.

Por'gy [*Stenotomus argyrops*, or the *Pagrus argyrops* of Cuvier and old American authors], a species of the family Sparridæ peculiar to the coasts of the Atlantic States. This name is the one given at New York and its vicinity, but it is also known as the scup about Vineyard Sound, etc., scuppaug, bream in Rhode Island (formerly), and fairmaid on the E. coast of Virginia. It ranges from the southern side of Cape Cod southward to Cape Florida, at least; on the southern coast it occurs throughout the year, but is most abundant in June and July, and on the northern coasts is only found in considerable quantities in the summer, before and after which time it probably inhabits the deeper waters off the coast. It attains not unfrequently a length of eighteen inches and a weight of about four pounds or more; this size is reached probably in about five or six years; the female, however, even in the second year, has mature eggs. It is highly regarded as food, and is one of the most prominent fishes of the markets of New York, Philadelphia, and the Southern coast cities generally. It feeds quite indiscriminately; worms, crustaceans, mollusks, etc. contribute to its wants; it readily takes the hook, which is most frequently baited with clams. It is, however, chiefly taken for the market in nets, and especially in pound-nets, along the southern New England coast. It varies considerably in abundance, in some seasons or periods of seasons being excessively numerous, and in others comparatively scarce. A late period of such comparative scarcity has led to the investigation of the causes thereof, and it has been attributed to the indiscriminate use of pounds throughout the season and for every day; legislation has been attempted in regard to the matter. Although a very savory fish, its abundance compared with other fishes renders it a cheap article of food; formerly it was sold as low as ten to twenty-five cents a barrel, and was even used as a manure at or near the places of capture; it now, however, fetches about six to eight cents a pound, wholesale, at Newport, and at

New Bedford about ten cents. (For further information see *Report of the U. S. Commissioner of Fish and Fisheries,* part i. pp. 228–235.) THEODORE GILL.

Po′rism [Gr. πόρισμος], a name given by ancient geometers to a class of propositions having for their object to show what conditions will render certain problems indeterminate. In order that the solution of a problem may be determinate, there must be as many independent conditions as there are parts to be determined. If, therefore, any supposition can be made on the *data* of the problem that will cause one of the given conditions to depend upon one or more of the others, the solution will become indeterminate; that is, the problem will have an infinite number of solutions. The object of the porism is, then, to discover an hypothesis that will make one of the given conditions of a determinate problem dependent upon one or more of the others. The nature of a porism will be illustrated by an example: Let A B C be a given triangle, and D any point in its plane; it is required to draw a line through D such that the sum of the perpendiculars to it from the two vertices on one side shall be equal to the perpendicular to it from the vertex on the other side.



Suppose the problem solved, and let D E be a line such that the sum of A E and B G is equal to C F. Draw C H bisecting A B at H and cutting D E at L; also draw H K perpendicular to D E: then will $HK = \frac{1}{2}(AE + BG)$, or $CF = 2HK$. From the similar triangles L K H and L F C we have $HK : HL :: CF : CL$, or $CF = 2HL$. Hence, the line D E must cut H C at a point one-third of the distance from H to C, and this no matter what may be the position of D. In the general case—that is, when D and L do not coincide—the problem is determinate, and admits of but one solution. Now let it be required to determine the condition that will make the problem indeterminate. If we suppose D to coincide with L, the preceding proportion will be true whatever may be the direction of E K; hence, the condition required is that D shall coincide with L, and the operation of determining this condition constitutes the essential part of the porism. The porism just considered may be enunciated as follows: To find in the plane of a triangle a point such that if any line is drawn through it, and perpendiculars let fall upon it from the vertices, the sum of the perpendiculars on one side shall be equal to the perpendicular on the other side. Playfair's definition of a porism is as follows: "A porism is a proposition affirming the possibility of finding such conditions as will render a certain problem indeterminate, or capable of innumerable solutions." W. G. PECK.

Pork [Fr. *porc;* Lat. *porcus*, a "swine"], the flesh of the domesticated swine, extensively used as an article of food. It is cured either by salting or smoking, and in the latter case is called bacon. The principal source of the commercial supply of pork is the U. S. Most other countries produce less pork than is required for home consumption. The valley of the Mississippi produces most of the swine. They are mostly transported alive to large commercial centres like St. Louis, Chicago, Cincinnati, Boston, and Buffalo, and are there killed. The pork is shipped principally to Great Britain, France, Germany, and the West Indies. Ireland exports great quantities of pork. Much has been written to show the unhealthiness of pork as an article of human food, but, while it must be admitted that in many countries it is too extensively used, it is certain that there is no cheaper article of flesh-food, nor any more acceptable to hard-working men, like lumbermen, sailors, and farm-laborers, than sound, healthy pork. Its use should, of course, be accompanied by suitable food, such as green vegetables, bread, and stewed fruits. It should be also well cooked, whether used by itself or in the form of sausage, as it is much subject to the attacks of the *trichina*.

Poros′ity [from the Gr. πόρος, "a passage"], a property of matter in consequence of which its molecules are not in absolute contact, but separated by intervals or pores filled with air. The porosity, for instance, of stone or wood is proved by immersing the object in water under the receiver of an air-pump; when the air is exhausted from the surface, that enclosed in the pores of the object will rise to the surface in the form of bubbles. The porosity, for instance, of cast iron has been proved by forcing water through the pores of a plate four inches thick.

Porphyr′ius, b. at Batanea, Syria, about 233 A. D.; received the instruction of Origen at Cæsarea; studied afterward at Athens under Longinus, and finally in Rome under Plotinus, of whom he became a passionate disciple; travelled in Sicily and other countries, but returned subsequently to Rome, where he d. about 305. Of his numerous works, the greater part is no longer extant. The most important of his lost productions was his work against Christianity, which was publicly burnt by order of Theodosius II. in 435. Among the works which have come down to us are biographies of Plotinus and Pythagoras; a commentary on Aristotle's *Categoriæ,* generally printed as an introduction to the *Organon;* a treatise on *Abstinence from Animal Food,* etc. There is no collected edition of his works.

Por′phyry [Gr. πορφυρίτης, from πορφύρα, "purple"], a name applied to various rocks, but correctly to red antique porphyry, a metamorphic mass of uncleavable feldspar, containing crystals of orthoclase or oligoclase, which when polished causes the purplish-gray surface to be spotted with paler patches. Much of the so-called porphyry is porphyry conglomerate, containing pebbles. Diabase porphyry is hornblendic. The name porphyry is often extended to other volcanic and basaltic rocks containing feldspar crystals.

Por′poise [It. *porco,* "hog," and *pesce,* "fish"], a name given to the small and slender species of the family Delphinidæ and sub-family Delphininæ. The name probably owes its origin to the snuffing noise which the animals make, simulating the grunt of the hog, and which has obtained upon our own coasts the name of "snuffer" and "puffing pig" for the *Phocæna Americana.* They are represented by numerous species and several genera—*e. g. Delphinus, Leucorhamphus, Tursiops, Lagenorhynchus,* and *Phocæna.* The species of some one or other of these genera, especially *Delphinus,* are found in almost all seas. The most common American species are the *Phocæna Americana, Lagenorhynchus leucopleurus, Tursiops erebennus,* and *Delphinus delphis* of the Atlantic, and the *Phocæna vomerina, Lagenorhynchus thicolea, Tursiops Gillii, Delphinus Bairdii,* and *Leucorhamphus borealis* of the Pacific coast of the U. S. THEODORE GILL.

Por′pora (NICOLÒ), b. at Naples Aug. 19, 1686; d. there in Feb., 1767; was one of the most celebrated singing-masters and composers of his time. Among his pupils were Farinelli and Cassarelli. His compositions, 50 operas, a number of masses, etc., are now forgotten, but in the history of music he is still remembered as the successful competitor of Handel during his visit to London in 1730, and as the master of Haydn during his visit to Vienna in 1746.

Porret′ta, town of Italy, province of Bologna, on the railway between Florence and Bologna, about 38 miles from the latter city. Porretta has only 3500 inhabitants, but is fast growing in population and in importance on account of its much-frequented hot sulphur springs, which are rendered more efficacious by the freshness and purity of the air, the town being about 1130 feet above the sea. This place is further noticeable for the jets of inflammable gas which issue forth near the springs, and which are used for lighting a part of the village.

Porsen′na, a king of the Etruscan city of Clusium, with whom the Tarquins, when expelled from Rome, sought refuge and aid; is believed to have conquered Rome and occupied it for some time—a fact which some Roman historians, such as Tacitus, hint at, while others, such as Livy, conceal the fact under the brilliant legends of Horatius Cocles, Mucius Scævola, etc. Pliny in his *Historia Naturalis* gives a description of the sepulchral monument of Porsenna.

Por′son (RICHARD), b. at East Ruston, Norfolk, England, Dec. 25, 1759, son of the parish clerk; was educated at Eton and at Trinity College, Cambridge, where he won the Craven scholarship, the chancellor's medal, and a fellowship 1782; began the publication of a series of critical labors upon the texts of classical authors; published in 1790 his famous *Letters* on the spuriousness of the text of the three witnesses; resigned his fellowship 1791 from conscientious scruples about subscribing the Thirty-nine Articles; became regius professor of Greek at Cambridge at £40 per annum, his friends subscribing a fund for his salary; became librarian of the London Institution 1806; published critical editions of several plays of Euripides, and corrected the text of Æschylus, Homer, Virgil, and Herodotus. D. at London Sept. 25, 1808. He was as noted for his marvellous memory as for his vast erudition. His *Notes* on Aristophanes (edited by Dobree) were published 1820, and the *Lexicon* of Photius 1822. (See his *Life* by J. S. Watson, 1861.)

Por′ta (CARLO), b. at Milan 1776; was an intimate friend of Alessandro Manzoni and of Tommaso Grossi. Of his poems in the Milanese dialect, which have passed through many editions, the most celebrated is the one entitled *Disgrazi de Giovanin Bongee.* Porta was an amiable

satirist, most true to nature and full of power and vigor; thus far, he stands unrivalled among writers *in dialetto.* D. 1821.

Por'ta, del'la (Giambattista), b. in Naples about 1540; studied natural science, especially optics; travelled much in Italy, Spain, and France; founded in his native city an academy, I Segreti, which held its meetings in his own house, and to which none was admitted unless he had made some discovery in natural philosophy; became very famous on account of certain predictions which turned true, and was eagerly sought by people who wished to know something of the future; was accused of magic, and compelled by the pope to dissolve his academy; wrote many volumes on natural magic, geometry, optics, the human physiognomy, etc.; invented the *camera obscura,* and was the first to demonstrate that visual perception is not effected by rays emanating from the eye, but by rays reflected from the objects. D. at Naples Feb. 4, 1615.

Portadown', town of Ireland, county of Armagh, on the Bann, has large distilleries and manufactures of linen and linen yarn, and an active trade in corn. It communicates by canal with the sea at Newry. P. 6658.

Portaels' (Jean François), b. at Vilvoorden, province of South Brabant, Belgium, in 1820; studied painting in the Academy of Brussels, at Paris under Paul Delaroche, and in Rome; travelled in Egypt and the Orient, and was appointed director of the Academy of Ghent in 1847. His most celebrated works are *A Drought in Egypt, The Story-teller of Cairo, A Funeral in the Desert of Suez,* and *A Caravan in Syria overtaken by a Simoom.*

Port'age, county of N. E. Ohio. Area, 500 sq. m. It is level, fertile, and is celebrated for its cattle, grain, wool, and dairy products. Cheese, lumber, carriages, leather, glass, machinery, saddlery, etc. are among the manufactured articles. Coal is found at some points. The county is traversed by Cleveland and Pittsburg, Cleveland and Mahoning, and Atlantic and Great Western R. Rs. Cap. Ravenna. P. 24,584.

Portage, county of Central Wisconsin. Area, 792 sq. m. It is undulating, and abounds in pine timber, which is extensively cut and sawn. The soil is good. Cattle, grain, and wool are staple products. The county is traversed by Wisconsin River and Wisconsin Central R. R. Cap. Stevens's Point. P. 10,634.

Portage, tp., Porter co., Ind., on Lake Michigan, Calumet River, and Michigan Central R. R. P. 728.

Portage, tp., St. Joseph co., Ind., on St. Joseph River, includes the village of South Bend, the county-seat. P. 777.

Portage, tp., Houghton co., Mich., on Sturgeon River. P. 1540.

Portage, p.-v. and tp., Kalamazoo co., Mich., on Kalamazoo division of Lake Shore and Michigan Southern R. R., and on Grand Rapids and Indiana R. R. P. 1050.

Portage, v., Portage des Sioux tp., St. Charles co., Mo., on Mississippi River at the point where the Sioux carried their canoes across the peninsula to Missouri River. P. 160.

Portage, tp., Livingston co., N. Y., on Genesee River, Genesee Valley Canal, and Buffalo division of Erie R. R., which here crosses Genesee River on a bridge 800 feet long. P. 1338.

Portage, tp., Hancock co., O., between Middle Portage and Auglaize rivers. P. 899.

Portage, tp., Ottawa co., O., on the peninsula between Sandusky Bay and Lake Erie. P. 1246.

Portage, tp., Summit co., O., between Cuyahoga and Tuscarawas rivers, includes the city of Akron, the county-seat. P. 1594.

Portage, p.-v. and tp., Wood co., O., on Middle Portage River. P. 1069.

Portage, tp., Cameron co., Pa., on Sinnemahoning River and Philadelphia and Erie division of Pennsylvania R. R., near Portage Creek, a tributary of the upper Allegheny River. P. 99.

Portage, city, Pacific tp., cap. of Columbia co., Wis., on the government canal between Fox and Wisconsin rivers, has a high school and an excellent system of common schools, 8 churches, 3 weekly newspapers, 2 banks, 1 foundry and machine-shop, a brewery, 1 flouring-mill, 1 tannery, and stores. It is the terminus of 2 railroads, and has a round-house and repair-shops. P. 3945.

E. W. Stevens, M. D., Ed. "Western Advance."

Portage des Sioux, p.-v. and tp., St. Charles co., Mo., on Mississippi River. P. 1861.

Portage Lake Plantation, tp., Aroostook co., Me. P. 124.

Portageville, p.-v., Genesee Falls tp., Wyoming co., N. Y., on Genesee River and Buffalo division of Erie R. R. P. 491.

Portale'gre, town of Portugal, province of Alemtejo, near the Spanish frontier, is surrounded with dilapidated fortifications, and has a fine cathedral and large cloth manufactures. P. 6000.

Port Allen, p.-v., Oakland tp., Louisa co., Ia., on Iowa River. P. 50.

Port-au-Prince, the capital of Hayti, situated on its western coast, on the Bay of Gonaives, is an ill-built, filthy, and unhealthy place. Mud islands, overgrown with mangrove shrubs, form in the harbor, and remain there; dunghills obstruct the passage in the streets, and, according to an account taken in 1840, more than half of the children of the city grow up without any school education. The senate-house is the only public building worth mentioning. Coffee, cocoa, mahogany, and Campeche-wood are exported. P. 23,000.

Port Aus'tin, p.-v. and tp., Huron co., Mich., on Lake Huron, has 3 churches, 1 newspaper, 3 salt manufactories, 2 grindstone-quarries, 2 hotels, and stores. P. 778.

William F. Clark, Ed. "Huron Co. News."

Port Bruce, a port of entry of Malahide tp., Elgin co., Ont., Canada, pleasantly situated at the mouth of Catfish Creek on Lake Erie. P. about 200.

Port Bur'well, a port of entry of Bayham tp., Elgin co., Ont., on Lake Erie at the mouth of Otter Creek. It has a good harbor, and has been of late years steadily increasing. P. about 1300.

Port By'ron, p.-v. and tp., Rock Island co., Ill., on Mississippi River and Western Union R. R., at head of Upper Rapids. P. of v. 576; of tp. 832.

Port Byron, p.-v., Mentz tp., Cayuga co., N. Y., on New York Central R. R. and Erie Canal, 26 miles W. of Syracuse, has 4 churches, 1 bank, paper and grist mills, 1 newspaper, 2 hotels, and stores. P. 1089.

C. E. Johnson, Ed. "Chronicle."

Port Car'bon, p.-b., East Norwegian tp., Schuylkill co., Pa., on Schuylkill River, Mahanoy and Broad Mountain R. R., and Schuylkill Valley branch of Philadelphia and Reading R. R., in the vicinity of rich coal-mines, 3 miles N. E. of Pottsville. P. 2251.

Port Ches'ter, p.-v., Rye tp., Westchester co., N. Y., on New York New Haven and Hartford R. R., 25 miles from New York City. It was incorporated in 1868; has 1 institute, a large public and a graded school, 5 churches, 2 banks, an iron-foundry, 2 shirt-factories, public halls, hotels, 1 weekly newspaper, a screw-bolt manufactory, 1 woollen-mill, and 1 carriage-coupling, etc. manufactory. P. 3797. B. F. Ashley, Ed. "Journal."

Port Clin'ton, p.-b., West Brunswick tp., Schuylkill co., Pa., on Schuylkill River and Canal and Philadelphia and Reading R. R. P. 578.

Port Clinton, p.-v., Portage tp., cap. of Ottawa co., O., on Lake Erie, at the mouth of Portage River and on Lake Shore and Michigan Southern R. R., 14 miles W. of Sandusky, has 1 weekly newspaper and some lake-trade. P. 543.

Port Col'borne, a thriving port of entry of Welland co., Ont., Canada, on Lake Erie where Welland Canal begins, and on Welland Railway and Buffalo branch of Grand Trunk, 20 miles from Buffalo. It has an elevator which can transfer 6000 bushels of grain per hour from vessels to the cars. It has 3 churches and a lighthouse. P. of sub-district, 988.

Port Dalhou'sie, port of entry, the terminus of Welland Canal and Railway, on Lake Ontario, is in Grantham tp., Lincoln co., 31 miles by water from Toronto. It has a lighthouse and some manufactures. P. of sub-district, 1081.

Port Depos'it, p.-v. and tp., Cecil co., Md., on E. bank of Susquehanna River, at head of navigation for heavily-laden boats, and on Port Deposit branch of Philadelphia Wilmington and Baltimore R. R., has 1 newspaper and large interests in the lumber-trade on the Susquehanna and in shipping granite to Baltimore. P. 1839.

Port Do'ver, port of entry of Norfolk co., Ont., Canada, at the mouth of Lynn River, on Lake Erie. It exports lumber and farm produce, has some manufactures and 1 weekly newspaper. P. about 1100.

Porte, Ottoman Porte, or **Sublime Porte** [the "lofty gate," or high gate of the imperial palace, among the Byzantines, as among other Orientals, was a favorite seat of justice; also the gates of cities are places for deliberative meetings], names which are applied to the central government of Turkey and the sultan's court at Constantinople.

Port El′gin (Normanton P. O.), a port on Lake Huron, in Bruce co., Ont., Canada, 55 miles N. by E. of Goderich, has some trade and manufactures and 1 weekly newspaper. P. about 750.

Port Eliz′abeth, in a commercial point of view the most important town of the eastern province of the English colony of the Cape of Good Hope. It was founded in 1820, and is situated on Algoa Bay in lat. 34° S., and its growth has been steady and rapid. In 1847 the value of its exports and imports amounted to £530,602; in 1867, to £4,000,000. The wool-trade of all the eastern districts of the colony is here concentrated, and splendid warehouses line the bay. P. 17,968, of whom most are of English descent.

Por′ter. See Beer, by Prof. C. F. Chandler, Ph. D., M. D., LL.D.

Porter, county of N. W. Indiana, bounded N. by Lake Michigan and S. by Kankakee River. Area, 450 sq. m. Its N. portion is sandy, the S. wet and marshy; the central part is productive and well timbered. Cattle, grain, and wool are leading products. The county is traversed by various railroads. It has important manufacturing interests. Cap. Valparaiso. P. 13,942.

Porter, tp., Porter co., Ind. P. 1006.

Porter, p.-v. and tp., Oxford co., Me., on Great Ossipee River. P. 1104.

Porter, tp., Cass co., Mich. P. 1933.

Porter, p.-v. and tp., Midland co., Mich., on Pine River. P. 82.

Porter, tp., Van Buren co., Mich. P. 1316.

Porter, tp., Christian co., Mo. P. 959.

Porter, tp., Richardson co., Neb. P. 219.

Porter, tp., Niagara co., N. Y., on Lake Ontario at mouth of Niagara River. Includes Fort Niagara and the village of Youngstown. P. 2042.

Porter, tp., Delaware co., O. P. 819.

Porter, tp., Scioto co., O., on Ohio and Little Scioto rivers and Marietta and Cincinnati R. R. P. 1965.

Porter, tp., Clarion co., Pa., on Red Bank Creek. P. 1546.

Porter, tp., Clinton co., Pa. P. 1101.

Porter, tp., Huntingdon co., Pa., on Juniata River and Pennsylvania R. R. P. 1253.

Porter, p.-v. and tp., Jefferson co., Pa. P. 525.

Porter, tp., Lycoming co., Pa. P. 650.

Porter, tp., Pike co., Pa. P. 102.

Porter, tp., Schuylkill co., Pa. P. 1167.

Porter, tp., Rock co., Wis. P. 1223.

Porter (Alexander J.), b. near Armagh, Ireland, in 1786; came to the U. S. 1801; engaged in mercantile pursuits at Nashville, Tenn.; studied law; was admitted to the bar 1807; settled at St. Martinsville, La., 1810; was a member of the convention which formed a State constitution 1811; gained prominence as a jurist and as a Whig politician; became a judge of the supreme court of Louisiana 1821; was U. S. Senator 1834–37; again elected in 1843, but declined to accept on account of ill-health. D. at Attakapas Jan. 13, 1844. The existing jurisprudence of Louisiana is largely due to the labors of Judge Porter.

Porter (Andrew), b. at Worcester, Pa., Sept. 24, 1743; taught a school at Philadelphia from 1767 till June, 1776, when he accepted from Congress a commission as captain of marines; was soon transferred to the artillery, in which he rendered good service, and was promoted to a colonelcy at the close of the war; was a commissioner to survey the boundary-lines of the State 1784–88; became brigadier-general of State militia 1800, soon afterward major-general; was appointed surveyor-general of Pennsylvania 1809; declined the post of secretary of war tendered him by Pres. Madison in 1812. D. at Harrisburg Nov. 16, 1813. Three of his sons filled high political posts.

Porter (Anna Maria), sister of Jane, b. at Durham, England, about 1780; educated at Edinburgh, where in her childhood she was a favorite of Sir Walter Scott; wrote many novels and tales, which once enjoyed considerable popularity, but are now forgotten. D. near Bristol, England, June 21, 1832.

Porter (Augustus S.), nephew of Peter B., b. at Canandaigua, N. Y., in 1798; graduated at Union College in 1818; studied law with the late Judge Howell at Canandaigua; settled first at Black Rock, N. Y., and afterward removed to Detroit, Mich., of which city he was for some years mayor; was afterward elected to the Senate of the U. S., in which he ranked as one of its most useful and upright members. D. at Niagara Falls in 1872.

Porter (Benjamin F.), b. at Charleston, S. C., in Sept., 1808; was self-educated; was admitted to the bar at an early age; afterward studied medicine, which he practised in Alabama until 1830, when he returned to the legal profession; was elected to the Alabama legislature 1832; became reporter of the State 1835; was elected to the bench 1840, but declined, doubting the constitutionality of his election; edited 14 vols. of the Alabama *Reports;* translated Heineccius's *Elements of the Institutes;* published a volume of *Poems* at Charleston, and was frequently an orator on public occasions and a contributor to periodicals.

Porter (David), b. at Boston, Mass., Feb. 1, 1780; served from boyhood on board a merchant vessel under his father, who was a sea-captain; entered the U. S. navy as midshipman Apr., 1798; was on board the Constellation during her engagement with a French frigate 1799; became a lieutenant Oct., 1799; was wounded in an action with pirates on the coast of Santo Domingo Jan., 1800; took part in the naval war upon Tripoli 1801–06; was captured in the Philadelphia Oct., 1803, and held for eighteen months a prisoner; was given command of the frigate Essex (32 guns) in 1812; captured H. B. M.'s ship Alert, the first man-of-war taken from the British; made several other prizes; sailed to the Pacific Jan., 1813; captured several whalers and trading vessels, but was himself captured in the harbor of Valparaiso Mar. 28, 1814, by two British vessels after a severe fight; published a *Journal of the Cruise of the Essex* (2 vols., 1815); was a navy commissioner 1815–23; commanded an expedition against West Indian pirates 1824; was court-martialed and suspended for six months in 1825 for disobedience to orders in a difficulty with the Spanish authorities of Puerto Rico; resigned his commission Aug. 18, 1826, and accepted the command of the Mexican navy; was sent as consul to Algiers 1829; was made chargé d'affaires to Turkey 1830; was afterward promoted to minister resident, and negotiated several treaties with the Porte. D. at Pera, near Constantinople, Mar. 28, 1843. His remains were brought to the U. S. and buried in the grounds of the U. S. Naval Asylum at Philadelphia. From his letters to a friend a work was compiled, *Constantinople and its Environs* (2 vols., 1835). A biographical sketch by Washington Irving appeared in vol. iv. of the *Analectic Magazine.* Porter C. Bliss.

Porter (David Dixon), b. June 8, 1814, in Pennsylvania. His father, the gallant Porter of Essex fame, having left our service and accepted the position of commander-in-chief of the naval forces of Mexico during her war with Spain, obtained an appointment for his son as a midshipman in the Mexican navy, and sent him to sea in the Guerrero, a 22-gun brig, having a complement of 180 officers and men, and commanded by his nephew, David H. Porter, an enterprising officer of but twenty-one years of age, who, like his uncle, had served in our navy. The Guerrero sailed from Vera Cruz on Apr. 17, 1827, and a few weeks thereafter fell in with the Spanish frigate La Lealtad, fully manned and carrying 64 guns. Finding it impossible to get away from the frigate, Capt. Porter resolutely gave battle, and absolutely maintained the unequal fight for nearly four hours, not striking his colors until the brig was filled with the dead and the dying and her spars and sails so torn to pieces as to make her utterly unmanageable. "As soon as the Spaniards saw the Mexican flag come down they put their helm up and ran down to the Guerrero, delivering two heavy broadsides when within 100 yards." During this cowardly firing Capt. Porter, "one of the bravest men that ever trod a ship's deck," was cut in two by a round shot, and his remains, instead of being interred with military honors, according to the usages of war, were barbarously thrown overboard by the victors in plain view of the land. Two years after this rough experience David D. Porter entered our navy as a midshipman, and as a lieutenant eighteen years later we find him actively engaged in all the operations of our navy on the E. coast of Mexico, and adding new lustre to a name already regarded in the U. S. as a synonym for valor. When the civil war broke out, Porter, then a commander, was despatched in the Powhatan to the relief of Fort Pickens, Fla., for whose beleaguered garrison the President felt great solicitude. This duty accomplished, he went vigorously to work fitting out a mortar flotilla for the reduction of the forts guarding the approaches to New Orleans by the lower Mississippi, which the government considered it of vital importance to get possession of. After the fall of New Orleans the mortar flotilla was actively engaged at Vicksburg, and in the fall of 1862, Porter was placed in command of all the naval forces on the Western rivers above New Orleans, with the rank of rear-admiral. His ability as a commander-in-chief was now conspicuously exhibited, not only in the battles which he fought, but also in the creation of a really formidable

fleet out of river-steamboats, which he covered with such plating as they could bear. Inspired by his example, his officers and men displayed a heroism which has never been surpassed, and wherever there was water enough to float a gunboat there the old flag was carried and respected. In 1864, Porter was transferred to the Atlantic coast to command the naval forces destined to operate against the defences of Wilmington, N. C., and on Jan. 15, 1865, the fall of Fort Fisher was hailed by the country as a glorious termination of his arduous war-service. In 1866 he was made vice-admiral, and appointed superintendent of the Naval Academy, which institution is still reaping the benefit of his able administration of four years; and on the death of Farragut (in 1870) he succeeded that illustrious man as the admiral of the navy. FOXHALL A. PARKER.

Porter (DAVID R.), son of Gen. Andrew, b. in Pennsylvania in 1788; became a lawyer; was frequently a member of both houses of the legislature; became an extensive iron manufacturer, and was governor of Pennsylvania for two successive terms (1839–45). D. at Harrisburg Aug. 6, 1867.

Porter (EBENEZER), D. D., son of Thomas, b. at Cornwall, Conn., Oct. 5, 1772; removed in 1779, with his father, to Tinmouth, Vt.; graduated at Dartmouth 1792; became in 1796 pastor of the Congregational church, Washington, Conn.; in 1812 professor of sacred rhetoric, and in 1827 president of Andover Theological Seminary. D. at Andover Apr. 8, 1834. Author of *Young Preacher's Manual* (1819) and a series of works on sacred rhetoric; and compiler of the *Rhetorical Reader* (1831), of which more than 300 editions were issued. Several volumes of his lectures and other discourses have been published in Great Britain and the U. S.

Porter (ELIPHALET), D. D., b. at North Bridgewater, Mass., June 11, 1758; graduated at Harvard College 1777; studied theology with his father, Rev. John Porter, who was minister at North Bridgewater from 1740 to 1802; was ordained pastor of the Congregational church at Roxbury Oct. 2, 1782, and filled that post until his death, Dec. 7, 1833. Author of a *Eulogy on Washington* (1800) and of a number of separately published sermons, and was one of the members of the American Academy of Arts and Sciences.

Porter (FITZ JOHN), b. at Portsmouth, N. H., in Sept., 1822; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of artillery July, 1845; served throughout the war with Mexico from Vera Cruz to the capture of the City of Mexico, being wounded at the assault of the capital, Sept. 13, 1847; brevet captain and major for gallantry at Molino del Rey and Chapultepec. From 1849 to 1855 he was stationed at West Point as instructor of artillery and cavalry, and was for a year adjutant of the post. Transferred to the adjutant-general's department, with the rank of brevet captain, June, 1856, he served in this capacity at various points, being (1857–60) assistant adjutant-general of the Utah expedition. He was appointed colonel of the 15th Infantry May 14, 1861, and three days later brigadier-general of volunteers, and served as chief of staff with Gen. Patterson and Gen. Banks until Aug., 1861, when he was assigned to the command of a division in the defences of Washington (Army of the Potomac). In the Virginia Peninsular campaign he was director of the siege of Yorktown, and upon the evacuation of that place was placed in command of the 5th corps, which formed the right wing of the army, and fought the battles of Mechanicsville and Gaines's Mill; at Malvern Hill his command held the left, which mainly resisted the assaults of that day. In the second battle of Bull Run his corps suffered severely on Aug. 30, but was not engaged on the 29th, although ordered into action by Gen. Pope. Continuing in command of his corps, he was present at Antietam, but in November was arraigned before a court-martial on the charge of disobedience of orders at Manassas, and on Jan. 21, 1863, was cashiered. In 1875 he was appointed commissioner of public works of New York City, but failed of confirmation Jan., 1876.

Porter (GEORGE B.), son of Gen. Andrew, b. at Lancaster, Pa., in 1790; was liberally educated; became a lawyer and a man of extensive business capacity; was appointed governor of Michigan Territory 1831, and while holding that office d. at Detroit July 6, 1834.

Porter (HORACE), son of Gov. David R., b. in Pennsylvania May, 1837; graduated at the U. S. Military Academy, and became brevet second lieutenant of ordnance July, 1860, major 1867; in Oct., 1861, accompanied the Port Royal expedition as assistant ordnance officer; engaged in the siege and reduction of Fort Pulaski, Ga.; on James Island expedition; chief of ordnance Army of the Potomac July–Sept., 1862; of the department of the Ohio Sept., 1862–Jan., 1863; of Army of the Cumberland Jan.–Nov., 1863; as A. D. C. on the staff of Lieut.-Gen. Grant Apr., 1864, participating in the battles of the campaign in Virginia of 1864–65, and at the close of the war was retained on the staff of Gen. Grant until the elevation of the latter to the Presidency, when he was selected by the President as his military secretary; resigned 1873 to become manager of the Pullman Palace-Car Co.

Porter (JAMES DAVIS), b. at Paris, Tenn., Dec. 7, 1828; educated at the University of Nashville, Tenn.; graduated in 1846; member of the legislature of Tennessee in 1859–60; adjutant-general of Cheatham's Confederate division; delegate from Henry co. in the constitutional convention of 1870; elected judge of the twelfth judicial circuit of Tennessee in 1871 for a term of eight years; resigned in Feb., 1874; nominated as Democratic candidate for governor in Aug., 1874; elected in the following November; inaugurated in Jan., 1875. JAMES D. PARK.

Porter (JAMES MADISON), son of Gen. Andrew, b. at Selma, Pa., Jan. 6, 1793; was educated for the bar; served as a volunteer in the war of 1812; was a member of the Pennsylvania constitutional convention of 1838; took an important part in its labors; was appointed secretary of war by Pres. Tyler 1843, but was rejected by the Senate; was one of the founders of Lafayette College at Easton; president of its board of trustees twenty-five years, and served, at different times, as president judge of two judicial districts. D. at Easton Nov. 11, 1862.

Porter (JANE), b. at Durham, England, in 1776, daughter of a surgeon in the 6th Dragoons, who died during her childhood; was educated at Edinburgh; afterward lived with her mother successively at London, at Ditton-on-Thames, and at Esher; published in 1803 her popular novel, *Thaddeus of Warsaw;* in 1809 the equally successful *Scottish Chiefs;* wrote, at the request of George IV., *Duke Christian of Luneburgh, or Traditions from the Hartz* (3 vols., 1824), and besides several other novels issued in 1831 a fictitious but highly circumstantial *Narrative of the Shipwreck of Sir Edward Seaward,* which by some reviewers was deemed a genuine narrative of facts. Most of Miss Porter's works were republished in the U. S., where they obtained a wide circulation. D. at Bristol May 24, 1850.

Porter (JOHN ADDISON), M. A., M. D., b. at Catskill, N. Y., Mar. 15, 1822; graduated at Yale in 1842; became professor of rhetoric and modern languages in Delaware College; went in 1847 to Giessen and studied chemistry with Liebig; professor of chemistry applied to the arts in Brown University 1850–52; held chemical professorships in Yale College 1852–64. D. at New Haven, Conn., Aug. 25, 1866. Author of two chemical textbooks and of several scientific papers; edited the *Connecticut War Record;* translated parts of the *Kalevala* (pub. 1868).

Porter (JOSHUA), M. D., b. at Lebanon, Conn., in 1730; d. at Salisbury, Conn., 1825; graduated at Yale College; was a representative in the general assembly and a member of the committee on the pay table; also colonel in the State militia, and agent to look after the first *home-made* cannon and balls used in the war and manufactured at Salisbury from its celebrated iron. Owing to a scarcity of officers at the battle of Saratoga, he voluntarily led a regiment through the engagement. That ended, he attended in the hospital those who had been wounded in the fight. For more than fifty years the soldier-doctor held important public trusts. GEORGE W. HOLLEY.

Porter (MOSES), b. at Danvers, Mass., in 1755; entered the Revolutionary army as lieutenant of artillery; was at Bunker's Hill; served through the war; remained in the regular army after its close; participated in Wayne's campaign of 1794 and other Indian wars; became colonel of light artillery Mar. 12, 1812; distinguished himself at the capture of Fort George, May 27, 1813; appointed brevet brigadier-general U. S. A. Sept. 10, 1813; took command at Norfolk, Va., 1814; became colonel 1st Artillery May, 1821. D. at Cambridge, Mass., Apr. 14, 1822.

Porter (NOAH), D. D., LL.D., b. at Farmington, Conn., Dec. 14, 1811, son of Rev. Noah Porter, D. D., minister of Farmington for fifty-five years (b. 1781; d. Sept. 24, 1866); graduated at Yale College 1831; taught school at New Haven 1831–33; was tutor at Yale 1833–35, pursuing theological studies at the same time; became pastor of the Congregational church at New Milford, Conn., Apr., 1836; settled at Springfield, Mass., 1843; was chosen Clark professor of metaphysics and moral philosophy at Yale College 1846; spent a year (1853–54) in Europe, chiefly in Germany, where he made a close study of modern German philosophy, and was elected president of Yale College on the resignation of Dr. Woolsey in 1871. Author of an *His-*

torical Discourse, delivered at Farmington Nov. 4, 1840, in commemoration of the 200th anniversary of the settlement of that town; a prize essay on *The Educational Systems of the Puritans and the Jesuits compared* (New York, 1851), *The Human Intellect, with an Introduction upon Psychology and the Soul* (New York, 1868), *Books and Reading* (1870), *American Colleges and the American Public* (1870), *Elements of Intellectual Philosophy* (1871), being an abridgment of the larger work, and *The Science of Nature versus the Science of Man* (1871). Dr. Porter was the principal editor of the revised edition of *Webster's Dictionary* (1864), and has sparingly contributed to religious and literary reviews and periodicals. He is admitted to be one of the ripest and most scholarly of American metaphysicians. PORTER C. BLISS.

Porter (PETER AUGUSTUS), only son of P. B. Porter, b. at Black Rock, N. Y., 1827; graduated at Cambridge, and afterward studied at the universities of Heidelberg and Berlin, Germany, intending to devote himself to literature. During the civil war he raised a regiment which was consolidated with the 8th New York heavy artillery and placed under his command. He was killed at Cold Harbor June 3, 1864, after having succeeded to the command of the brigade, which he was leading against the enemy's works. He had been a member of the legislature, but after entering the military service declined political preferment, on the ground that his neighbors—fathers and sons—had enlisted in the same service with the understanding that they were to be under his personal charge, and he would share their lot to the end. GEORGE W. HOLLEY.

Porter (PETER BUEL), second son of Joshua, b. at Salisbury, Conn., Aug. 14, 1773; d. at Niagara Falls, N. Y., 1844; graduated at Yale College 1791; obtained his professional education at the famous Litchfield Law School, and settled at Canandaigua, N. Y., but soon removed to Black Rock; where and at Niagara Falls he, in connection with his brother, the late Judge Augustus Porter, had acquired large possessions. He was elected to Congress in 1808, re-elected in 1810, and the year following, as chairman of the committee on foreign relations, prepared and introduced the celebrated report recommending war with Great Britain. Hostilities having begun, he resigned his seat in Congress, refused a general's commission in the regular army, was made quartermaster-general of New York, and not long afterward received the command of the Pennsylvania and New York volunteers and a body of Indians of the Six Nations. In June, 1813, after Buffalo and Black Rock (where he lived) had fallen into the hands of the British, his own house was made their head-quarters. Inspiring his neighbors with his own enthusiasm, he rallied a force and drove them back to Canada, their commander, Col. Bishop, having been mortally wounded in the affray. As one holding command in Smythe's unfortunate "army of invasion" he was twice permitted to embark to lead the van of the army into Canada, and each time recalled before reaching its shore. Some indignant remarks on this vacillating course ended in a duel with Gen. Smythe. In the summer of 1814, with his brigade of 3500 volunteers and Indians, he joined the army under Gen. Brown, which was again to undertake an advance into Canada. He "exhibited great personal gallantry" at Chippewa, and at Lundy's Lane, leading his brigade through the forest, he fell upon the right flank of the British at the critical moment when Morgan had carried the destructive battery on their left, thus securing victory in the most obstinate and sanguinary battle of the war. Besieged with the army under Gen. Gaines at Fort Erie, Gen. Brown being in Buffalo, wounded, he planned and led the famous sortie of Sept. 17, characterized by Napier (*Hist. of the War of the Peninsula*) as "a brilliant achievement—the only instance in history where a besieging army was entirely broken up and routed by a single sortie." Passing with part of his staff from one column to another, he suddenly came upon a party of about seventy British soldiers. Ordering them to surrender, he advanced boldly and disarmed them. A company of his own men fortunately came up just in time to save him from a hostile demonstration that, seeing him without escort, they had just begun against him. Preparatory to another campaign his private papers show that he was to have been appointed commander-in-chief of the army of the frontier. The Treaty of Ghent, however, by which peace was restored, put an end to further military operations on the frontier. In acknowledgment of his services in this war the city of New York presented Gen. Porter with the freedom of the city in a gold box; the State of New York voted him a sword; and the thanks of the Congress of the U. S., with a gold medal struck to commemorate the successful campaign of 1814, were presented to the five generals who had most distinguished themselves—Brown, Scott, Ripley, Gaines, and Porter. He was appointed in 1816 by Pres. Madison a commissioner under the treaty to settle the boundary-line between Canada and the U. S. An early projector of the Erie Canal, he with Morris and Clinton constituted the first board of commissioners for selecting its route. He married late in life Letitia Grayson, daughter of John Breckenridge, attorney-general under Pres. Jefferson. In 1828 he was appointed secretary of war, holding the office to the end of Mr. Adams's administration. His subsequent days were passed on his estate and among his numerous relations at Black Rock and Niagara Falls. G. W. HOLLEY.

Porter (ROBERT KER), brother of Jane, b. at Durham, England, about 1775; became distinguished as an historical painter and traveller; went to Spain with Sir John Moore 1808; was knighted in 1811; was consul in Venezuela 1826–41; lived many years in Russia, where he married the daughter of a prince. D. at St. Petersburg May 4, 1842. Author of *Travels in Russia and Sweden* (1808), *Letters from Portugal and Spain* (1809), *An Account of the Russian Campaign* (1813), and *Travels in Georgia, Persia, and Armenia* (1821–22).

Porter (ROBERT MASSINGALE), M. D., b. Apr. 12, 1818, in Nashville, Tenn.; d. there July 1, 1856; received the literary degree in 1836 from the University of Nashville; in 1838 that of law from Cambridge, Mass.; in 1843 that at Princeton for his theological course there; and in 1845 took M. D. at the University of Pennsylvania. At the organization of the medical department of the University of Nashville in 1852 he was made its first professor of anatomy, and four years afterward fell a victim to professional zeal by imbibition of blood-poisoning while teaching a summer class. Dr. Porter was a man of much promise, attested by his articles in the Nashville *Medical and Surgical Journal*, his zeal and interest in the profession, and the profound regret felt at his early loss. PAUL F. EVE.

Porter (THOMAS), b. at Cornwall, Conn., in May, 1734; served in the French war at Lake George 1755; became a prominent politician and member of the Connecticut legislature; took an active part in the public concerns of the Revolution; removed to Tinmouth, Vt., 1779; was for ten years a judge of the supreme and county courts of Vermont, and served thirty-five years in the legislatures of Connecticut and Vermont. D. at Granville, N. Y., in Aug., 1833. Father of Rev. Ebenezer Porter, president of Andover Theological Seminary.

Porter (THOMAS KENNEDY), M. D., b. in Franklin co., Ky., Feb., 1801; d. at Paris, Tenn., Feb., 1848; received the degree of M. D. from Transylvania University, Lexington, Ky., 1822; became one of the pioneer physicians of Western Tennessee, where his practice became so extensive that his life was shortened by excessive labor. His success in Henry co. was greater than any other of his day, and his generosity so conspicuous that, like Mr. Jefferson, in dying he left clean hands but an empty purse. He was the father of the present popular governor of Tennessee. PAUL F. EVE.

Porter (WILLIAM D.), son of Com. David, b. at New Orleans, La., in 1810; entered the U. S. navy as midshipman Jan. 1, 1823; became lieutenant Dec. 31, 1833; was the originator of the lighthouse system in use in the U. S.; served in the Gulf of Mexico during the Mexican war; was retired 1855; re-entered the navy 1859; built and commanded the iron-clad Essex in the Mississippi flotilla 1861–62; participated in the attacks on Forts Henry and Donelson; sailed down Mississippi River to New Orleans, forcing a passage by several Confederate batteries; took part in engagements at Vicksburg, Baton Rouge (where he effected the destruction of the Confederate iron-clad Arkansas), Natchez, and Port Hudson, and was made commodore July 16, 1862. From feeble health he took little part in subsequent naval service. D. in New York City May 1, 1864.

Porter (WILLIAM T.), b. in Vermont in 1806; was successively a teacher and a journeyman printer, which vocation he followed for some years in New York; established the *Constellation*, a weekly journal, afterward merged into the *Spirit of the Times*, a sporting journal, and in 1856 founded, in connection with George Wilkes, a new paper with a similar title, *Porter's Spirit of the Times*, which he conducted until his death at New York, July 19, 1858. He edited several volumes of stories upon sporting or humorous topics, and often wrote for other journals besides his own.

Porter's, tp., Montgomery co., Ala. P. 1564.

Portersville, p.-v., Muddy Creek tp., Butler co., Pa. P. 198.

Por'teus (BEILBY), D. D., b. in York, England, May 8, 1731; educated at Christ's College, Cambridge, where he obtained a fellowship and gained the Seatonian prize for

poetry: became chaplain to Archbishop Secker 1762, and to George III. 1769; was appointed bishop of Chester 1776, and of London 1787. D. in London May 14, 1808. Author of a *Review of the Life and Character of Archbishop Secker* (1797), *A Summary of the Evidences of Christianity*, and other works, of which a collective edition, preceded by a memoir, was published in 6 vols., 1811.

Port Ewen, p.-v., Hudsón River tp., Ulster co., N. Y., has a large trade in Pennsylvania coal. P. 1251.

Port Gib'son, p.-v., cap. of Claiborne co., Miss., on Bayou Pierre, 8 miles from Mississippi River, with which it is connected by rail, has 1 collegiate academy, 2 public schools, 6 churches, 1 newspaper, 1 carriage establishment, 2 grist-mills, 1 steam cotton-gin, several hotels, and stores. Large quantities of cotton are shipped from this place. P. 1088. FRANCIS MARSCHALK, ED. "STANDARD."

Port Glas'gow, town of Scotland, county of Renfrew, on the Clyde, has large quays, shipbuilding docks, extensive manufactures of sailcloth and ropes, and considerable importation of American timber. P. 10,805.

Port Glasgow, a small port of entry on Lake Erie, in Aldborough tp., Elgin co., Ont., Canada. P. about 100. (P. O. ALDBOROUGH.)

Port Has'tings, p.-v. of Inverness co., Cape Breton Island, has a good harbor called Plaister Cove, and is the landing place of cable telegraphs to Heart's Content, N. F., and to St. Pierre, Miquelon. It is a place of some trade. P. about 600.

Port Hawkes'bury, p.-v. of Inverness co., Cape Breton, has the best harbor on the Strait of Canso, and has a steam-ferry to Port Mulgrave, N. S. P. about 600.

Port Hood, the capital of Inverness co., Cape Breton (lat. 46° N., lon. 61° 34′ W.), has a good harbor, which is a great resort for fishing vessels in bad weather. Beds of coal are found near by. P. about 700.

Port Hen'ry, p.-v., Essex co., N. Y., on Lake Champlain and on Hudson and Delaware R. R., on the W. side of the lake, has good schools, 4 churches, 2 newspapers, 2 fire companies, 2 iron furnaces, and several superior iron-ore mines. P. about 5000. A. N. MERCHANT, ED. "RECORD."

Port Hope, a flourishing port of entry picturesquely situated on the N. shore of Lake Ontario, in Hope tp., Durham co., Ont., Canada, on Grand Trunk Railway, 63 miles E. of Toronto, and is the southern terminus of Midland Railway. It has a good harbor and a large fleet of vessels. A daily steamer visits Charlotte, N. Y., the port of Rochester. Lumber, flour, and grain are largely exported. The town is lighted with gas, is the seat of Trinity College School, and has 1 daily and 2 weekly newspapers. The town has a valuable water-power, afforded by Smith's Creek, which flows through the place. There are 5 flour-mills, 2 manufactories of ground plaster, lumber, buttons, woollen goods, leather, furniture, beer, and spirits. Port Hope has many tasteful public and private buildings. P. of sub-district, 5114.

Port Hud'son, p.-v., E. Feliciana parish, La., on Mississippi River, is the southern terminus of Clinton and Port Hudson R. R., and noted for important military events during the civil war.

Port Hu'ron, city, tp., and port of entry, cap. of St. Clair co., Mich., situated at the foot of Lake Huron, on Chicago and Lake Huron and Michigan division of Grand Trunk R. Rs., has a public library, excellent schools, 1 daily and 4 weekly newspapers, 2 horse railways, 8 churches, 2 dry docks, 5 shipyards, 5 saw, 2 flouring, and 3 planing mills, 3 foundries and machine-shops. It is engaged in the lumber-trade. P. of city, 5973; of tp. 832. JOHN F. TALBOT, ED. "SUNDAY COMMERCIAL."

Por'tici, town of Southern Italy, province of Naples, beautifully situated on the Bay of Naples, at the western foot of Vesuvius, about 5 miles from the city of Naples. Since 79 A. D. the volcano has poured its burning lava seven times over the spot on which Portici now stands, and as many times has it been rebuilt. The excavations in search of the treasures of Herculaneum were begun here in 1714. The ancient city occupied a portion of the present site of Portici, but also extended beyond it. The modern town consists chiefly of one long street, one fine square, a mole for the convenience of the shipping, a little fort which commands the roadstead, some respectable churches, and a royal palace, from the gardens and terraces of which may be had magnificent views of Naples, the sea, the islands, and the ever-threatening mountain. The chief industry of Portici, apart from the coral and other fishing, and from the small coasting-trade, consists in the manufacture of macaroni and of a variety of ribbons. P. in 1874, 11,792.

Portier' (MICHAEL), D. D., b. in France Sept. 7, 1795; was consecrated Roman Catholic bishop of Mobile in 1826, the first of that title. D. May 14, 1859.

Port Jack'son, p.-v., Florida tp., Montgomery co., N. Y., on Mohawk River and Erie Canal. P. 446.

Port Jef'ferson, p.-v., Suffolk co., N. Y., on the Long Island R. R., 63 miles E. of New York City, has a good school system, 3 churches, 2 steam saw-mills, 1 newspaper, and stores. Shipbuilding is the principal business. P. about 2500. S. A. TITUS, ED. "LONG ISLAND LEADER."

Port Jefferson, v., Clinton tp., Shelby co., O., on Great Miami River and Miami Canal (PRATT P. O.). P. 410.

Port Jer'vis, p.-v., Deer Park tp., Orange co., N. Y., on Erie R. R. and Delaware and Hudson Canal, at the confluence of the Neversink with the Delaware, and at the intersection of the boundary-lines of New York, New Jersey, and Pennsylvania, beautifully situated in the midst of picturesque scenery, has 6 churches, 1 daily, 1 tri-weekly, and 2 weekly newspapers, 3 banks, fine graded schools, several manufactories, and extensive repair-shops of Erie R. R. Port Jervis acquired considerable celebrity in the spring of 1875, when for several weeks it was threatened with destruction by an ice-gorge, but escaped with the loss of a railway bridge and a few buildings. P. 6377.

Port Ken'nedy, p.-v., Upper Merion tp., Montgomery co., Pa., on Schuylkill River and Philadelphia and Reading R. R. P. 516.

Port'land, a suburb of St. John, N. B., adjacent to that city, but having a separate government and police force. It extends from the harbor on the E. to St. John River on the W. It has many steam saw-mills, some shipyards, a street railway, a gas and water supply, and many handsome residences. A suspension bridge connects it with Lancaster. A rich graphite-mine is wrought here. P. of sub-district, 12,520.

Portland, p.-v., Dallas co., Ala. P. 1740.

Portland, p.-v. and tp., Ashley co., Ark. P. 984.

Portland, p.-v. and tp., Middlesex co., Conn., on the Connecticut River, nearly opposite Middletown, noted for the "Portland quarries" of brown sandstone. P. 4693.

Portland, p.-v. and tp., Whitesides co., Ill., on Rock River. P. 986.

Portland, p.-v., Wayne tp., cap. of Jay co., Ind., on Salamonie River and Cincinnati Richmond and Fort Wayne R. R., has 1 weekly newspaper and a considerable lumber-trade. P. 462.

Portland, p.-v. and tp., Cerro Gordo co., Ia., on Shell Rock River. P. 221.

Portland, cap. of Cumberland co., the largest city of Maine, and the fifth in size in New England, is situated in lat. 43° 39′ 52″ N., lon. 70° 13′ 34″ W., on a small peninsula jutting into Casco Bay. The peninsula occupied by the city proper comprises 1666 acres. The city is well drained, and is supplied with water and gas, a paid fire department with an alarm telegraph and 5 steam fire-engines, a board of trade, and possesses one of the best harbors on the Atlantic coast. The commercial interests of the city are extensive, and embrace in exportation quantities of lumber, sugar, and other commodities, while the importations include West Indian goods and articles of foreign manufacture. As the railroads began to affect the conditions of land-traffic, Portland became the gateway for the business of Maine, securing communication by rail with Boston in 1842, and with Montreal in 1853. A second road was opened to Boston, a direct line to New York *viâ* Worcester was completed in 1874, and a new road to the West through the Notch of the White Mountains and Northern Vermont will be opened in 1876. The gauge of the Grand Trunk R. R., from Portland to Montreal, and thence westward to Sarnia and Detroit, has been changed to correspond to the American gauge, thus permitting the shipment of grain from San Francisco to Portland without change. Portland is the winter port of the ocean-steamers connecting with Grand Trunk R. R. at Montreal in summer, and plying to Liverpool and Glasgow. There are 2 lines of steamers daily to New York, daily boats to Boston, and lines to Bangor, St. John, and Halifax. The value of imports at this port for 1872 was $22,523,232; of exports, $21,465,522. Portland has 2 public libraries, several scientific and literary societies, 6 musical clubs, numerous charitable associations, 25 churches, 3 lines of street-cars, 8 banks, besides private banking-houses, 3 daily and 9 weekly newspapers, a safe-deposit company, 2 iron-rolling mills, manufactories of locomotives and marine-engines, a dry dock deeper than any other in the U. S., and manufactories of carriages, furniture, varnishes, etc. P. 31,413. H. W. RICHARDSON, ED. "ADVERTISER."

Portland, p.-v. and tp., Ionia co., Mich., on Detroit Lansing and Lake Michigan and Coldwater Marshall and Mackinaw R. Rs., 110 miles W. of Detroit, has fine water-power, a union school, 5 churches, 2 banks, 1 newspaper, 2 flouring-mills, 2 foundries and machine-shops, 2 saw-mills, 3 hotels, and stores. P. of v. 1060; of tp. 2353.
J. W. Bailey, Ed. "Observer."

Portland, p.-v. and tp., Callaway co., Mo., on Missouri River. P. 121.

Portland, p.-v. and tp., Chautauqua co., N. Y., on Lake Erie, Lake Shore and Michigan Southern, and Buffalo Corry and Pittsburg R. Rs., includes the village of Centreville and Brocton. P. 1887.

Portland, tp., Erie co., O., includes the city of Sandusky. P. 681.

Portland, the chief city of Oregon, cap. of Multnomah co., on the W. bank of Willamette River, 12 miles above its confluence with the Columbia, at the head of ship-navigation, is well laid out, built, paved, lighted, and shaded; is the N. terminus of Oregon Central R. R., and connected by ferries with E. Portland, the N. terminus of Oregon and California R. R. By steamers on Willamette and Columbia rivers Portland is in daily connection with the S. terminus of Pacific division of Northern Pacific R. R. at Kalama, Wash. Ter., and has frequent communication with British Columbia and with San Francisco. The exportation of wheat and flour to Great Britain, New York, Japan, and China has developed largely since 1868. There was in 1873–74 a tonnage of nearly 200,000, with a registry of 61 vessels, in the coasting trade. The U. S. courts for Oregon are held here. There are 14 newspapers, 16 churches, 4 banks, numerous foundries, saw-mills, and factories, good graded schools, an Episcopalian grammar and divinity school, 2 Roman Catholic academies, a library association, and good public buildings. Laid out in 1845, Portland was incorporated as a city 1851. A large part of the city was burned Aug. 2, 1873, but has been rebuilt in better style. P. 8293.

Portland, p.-v., Upper Mt. Bethel tp., Northampton co., Pa., on Delaware Lackawanna and Western R. R.

Portland, p.-v. and tp., Preston co., West Va., on Baltimore and Ohio R. R. (Cranberry Summit Station). P. 1997.

Portland, tp., Dodge co., Wis. P. 1286.

Portland, tp., Monroe co., Wis. P. 630.

Portland Beds, in the British Upper Oolite, is the name (1) of a stratum resting on the Shotover sandstone, and (2) of a dirt-bed in the Lower Purbeck, lying over the former and associated with fresh-water marls. Fishes, mollusks, marsupials, and Insectivores have left their remains in these strata. The Portland stone, so famous for building purposes, is from these and the overlying strata. The best is from the lowest beds. It is a limestone, and is quarried in very large amounts.

Portland, Isle of, also called, from its shape, the **Bill of Portland,** a peninsula projecting into the English Channel from the coast of Dorsetshire, England, rises 458 feet, is connected with the mainland by a ridge of loose shingle, the Chesil Bank, and is noted for its quarries of excellent building-stone, the Portland stone of which St. Paul's cathedral in London is built; its fine breed of sheep, Portland mutton; the old castle, erected by Henry VIII.; the magnificent breakwater, with which are connected a naval station and a harbor of refuge; its prisons, capable of accommodating 1500 convicts, etc. (See Breakwater.)

Portland (or **Barberini**) **Vase,** a cinerary urn of blue glass covered with an enamel of white glass, and cut in cameo, so as to show a finely artistic group of the wedding of Thetis and Peleus. It once held the ashes of a relative of the emperor Alexander Severus, perhaps his mother, Mammæa, or those of the emperor himself. It dates from the third century A. D. It was found in the sixteenth century in a rich sarcophagus on the Monte del Grano, and was placed in the Barberini Palace. In 1770 it was bought by Sir W. Hamilton, and in 1810 was placed in the British Museum by the duke of Portland. In 1845 it was wantonly broken by one Lloyd, but the numerous pieces have been carefully united. It is ten inches high, and is one of the most valued relics of antiquity.

Port'landville, p.-v., Milford tp., Otsego co., N. Y., on Cooperstown and Susquehanna Valley R. R.

Port Lava'ca, p.-v., Calhoun co., Tex., on Matagorda Bay.

Port Ley'den, p.-v., Leyden tp., Lewis co., N. Y., on Black River and Utica and Black River R. R., has 1 newspaper, a fine water-power, and a large trade in lumber. P. 977.

Port Lou'is, capital of the English colony of Mauritius, on the north-western coast of the island. It is well built and strongly fortified, has a good harbor, barracks, a public library, a theatre, and a botanic garden, and forms the centre of the commerce of the colony. P. 30,000.

Port Loui'sa, p.-v. and tp., Louisa co., Ia., on Mississippi River. P. of v. 75; of tp. 774.

Port Lud'low, p.-v., Jefferson co., Wash. Ter., on Puget Sound. P. 259.

Port Mad'ison, p.-v., cap. of Kitsap co., Wash. Ter., on Puget Sound, 32 miles S. of Port Townsend. P. 249.

Port Mahon', town of Spain, capital of Minorca, situated on the southern coast of the island, has a spacious, safe, and strongly-fortified harbor, capable of accommodating a whole fleet of men-of-war. P. 12,600.

Portneuf', county of Quebec, Canada, extending N. W. from the St. Lawrence. Cap. Portneuf. P. 22,569.

Portneuf, p.-v., cap. of Portneuf co., Quebec, Canada, on the N. bank of the St. Lawrence, has manufactures of paper and a trade in flour and lumber. P. about 600.

Por'to Ale'gre, town of Brazil, capital of the province of São Pedro do Sul, on the shore of Lake Patos, through which it communicates with the sea. It is well built and progressing. P. 20,000.

Porto Empedocle, seaport-town of Sicily, province of Girgenti, about 5½ miles from the city of Girgenti. The mole was built by Charles III. of Naples, and, though the harbor is in many respects very deficient, yet it is the best on the S. coast of Sicily. The Italian government proposes extensive improvements in this port. P. in 1874, 7000.

Por'to Ferra'io, town in the island of Elba, embraced in the province of Leghorn. It stands on a considerable elevation, terminating in a double summit, commanded by two higher hills upon which strong castles were built by Cosimo I. It is sheltered by a promontory, and the port, opening to the N. N. E., is one of the safest and deepest found in the Italian islands. Nearly 1000 vessels annually take refuge here in bad weather, and the number entering for commercial purposes is about 1100. The town is surrounded by bastions, and the lower part extending to the mole is called the "Linguella." Seen from the water, the little city is almost imposing, but the streets are narrow and the buildings generally insignificant, except the palace and other constructions erected during the short stay of Napoleon I. on this island. Porto Ferraio is generally believed to be the *Ferraium* of the Romans, so named from the iron brought hither for transportation from the inexhaustible mines of the island. It sustained many sieges during the mediæval wars, and was the theatre of important military operations as late as 1799. The vine thrives in the neighborhood, but the town lives chiefly by fishing and by the manufacture of salt. P. in 1874, 5789.

Porto Maggio're, town of Italy, province of Ferrara, situated between two affluents of the lagoons of Comacchio, and so surrounded by water as to form an island accessible by six bridges. There is a tradition that it was once a seaport, though the Adriatic is now 22 miles distant. Porto Maggiore suffers greatly from malaria, but is the centre of an extensive trade in cattle and in agricultural produce. P. in 1874, 15,150.

Porto Mauri'zio [*Portus Mauritii*], seaport-town of Italy, province of the same name, about 14 miles from San Remo. It is strikingly situated on a hill overlooking the water, and was once well fortified and walled. The harbor is formed by two moles, and is entered from the S. S. W. Being quite unsheltered on the S., it is unsafe in heavy southern gales, but it is much frequented for the coast-trade. There are some fine churches here containing pictures worthy of notice. P. in 1874, 7000.

Por'to No'vo, town of British India, presidency of Madras, on the Coromandel coast, in lat. 11° 31′ N., has large iron-foundries. P. about 12,000.

Port Oram, p.-v., Morris co., N. J., on Morris and Essex and Chester R. Rs.

Por'to Ri'co, an island in the West Indies, one of the Greater Antilles, belongs to Spain, and comprises an area of 3530 sq. m., with 621,500 inhabitants, of whom one-half are white, one-third creoles, and the rest negroes. From W. to E. the island is traversed by a range of mountains whose average height is 1500 feet, but which in some peaks reach a height of above 3000 feet. In some places these mountains approach very near to the sea, but generally they leave a belt of low coast-land from 5 to 10 miles broad and consisting of rich alluvial soil. Numerous short rivers flow out from among the mountains and form lagoons along the coast, but most of them are navigable to the foot of the mountains, and the island is rich in good

harbors. The climate is hot, especially in the valleys and the coast-land, but not unhealthy. Water is abundant, and the vegetation is very rich. Forests of tropical density cover the mountains, and rice, maize, sugar, cotton, and coffee are extensively cultivated. The following table shows the exports for three consecutive years:

	1870.	1871.	1872.
Sugar, cwts.	2,025,966	2,162,666	1,885,241
Molasses, gallons	7,293,011	7,590,915	6,087,550
Coffee, cwts.	192,645	210,066	177,208
Tobacco, cwts.	86,105	55,240	61,761
Cotton, cwts.	7,066	7,800	5,139
Hides, cwts.	....	6,838	5,644
Rum, gallons	2,458	19,896	2,513

Many cattle are reared, and of a good breed. Copper, iron, lead, coal and saltworks are in operation; gold is found. The island is remarkably free from beasts of prey and serpents, but it is infested with rats, thousand-legs, mosquitoes, and other tormenting insects. Cap. Porto Rico.

Por'to Tol'le, or **San Nicolò,** town of Italy, province of Rovigo, situated on the Po at the point where the Tolle separates itself from the main stream. In 1860 a hurricane prostrated many of the houses, and swept away the cabins of the neighboring peasants. P. 5350.

Port Penn, p.-v., St. George's hundred, Newcastle co., Del., on Delaware River. P. 320.

Port Per'ry, p.-v. of Reach tp., Ontario co., Ont., Canada, on Whitby and Port Perry Railway, 47 miles from Toronto, and on Scugog Lake, has an extensive trade in grain and lumber by rail and steamboat, and has 1 weekly newspaper. A floating bridge three-fourths of a mile long extends to Scugog Island. Lumber is extensively sawed. P. about 1500.

Por'trait-Painting (or, that we may include sculpture, as well as painting, **Por'traiture**) is in human nature, and therefore it is vain to seek its origin in time and place. Vanity may have given it birth, but love was no doubt a more moving cause. The fable takes this side which says it began with the maiden who traced, with a coal from the hearth, the shadow of her lover's head on the wall. Yet, so little of what the oldest races did in this field remains to us that until Mariette's discovery in Lower Egypt of portrait-statues belonging to the third dynasty (B. C. 4449) we had a right to believe the art of portraiture to be of recent origin. Coming down to historic times, perhaps the earliest portraits of which we have any mention are those Apelles made of Alexander and Antigonus. We have but little record of the subsequent history of portraiture in Greece, for nearly all traces of Greek painting have disappeared, and no well-authenticated portrait-bust of antique Greek workmanship exists. The Romans had a great liking for portraits, and though we have little of their painting left, yet it may be that if more of it had been spared we should have seen that their painters were no less occupied with portraiture than their sculptors, since, of all the marbles left us from Roman times, a goodly share are busts or statues—portraits of their emperors, empresses, patricians, and notables.

The revival of painting in Italy in the thirteenth century was exclusively in the interests of the Church, but even Giotto introduced portraits of his contemporaries into his religious pictures, and his example was followed not only by his pupils, but by almost every succeeding Italian artist. An important exception is Michelangelo, who left no portraits. Even the statues of Lorenzo and Giuliano in the Medici chapel he declared he did not intend for portraits. The innovation made by Giotto led naturally to portrait-painting for its own sake, but it was late before portraits were painted as separate pictures. Raphael and his contemporaries, with their immediate successors, brought the art to its full perfection.

In Spain, Velasquez is the greatest name, but less skill than his, which was supreme, would have sufficed to give pre-eminence in a country where portrait-painting was so little practised as it was in the Peninsula. N. of the Alps, Van Eyck, Cranach, Dürer, Holbein, Rubens, Franz Hals, and Rembrandt distinguished themselves in portraiture. Holbein belongs, however, as much to England as to Germany; most of his finest portraits are in England. Since his time Germany has not produced any great portrait-painter.

In France no native-born portrait-painter of any distinction appeared until the eighteenth century. Francis I. invited several Italian artists into France, chief among them Leonardo da Vinci, from whose hand the king hoped he might get other portraits equal to that of Mona Lisa del Giocondo, now in the Louvre, on which Leonardo worked for four years, and which Francis bought of him for 4000 golden crowns. But, as is well known, Leonardo did not paint a single picture while he was in France.

In England, Holbein may be said to have created portrait-painting: he had many imitators, some of them most skilful, yet, though the country did not produce many portait-painters of consideration before the eighteenth century, she welcomed good painters from other lands. In Mary's time, Antonio Moro came from Utrecht, and in Elizabeth's reign Federigo Zucchero, an Italian, was in vogue. A Dutch painter, Lucas de Heere, also found employment. Later were the two Olivers, of French extraction; they were miniature-painters, and contemporary with them was Nicholas Hilliard, one of the first Englishmen by birth who gained distinction in the art. The brief visit of Rubens gave, after Holbein, the second great impetus to the art of portrait-painting in England. He remained in the island only one year, but he painted many portraits. He was followed by his great pupil, Van Dyck, who became for England a standard of excellence in portraiture. Contemporary with him was George Jameson, who had studied with Rubens, and who enjoyed in his own day a reputation second only to that of Van Dyck. The next name of repute is that of Samuel Cooper, a miniature-painter, born in England. He is reckoned a master in his own art. Peter Lely, a Westphalian, came to England and established himself as a portrait-painter. Besides Cromwell and many of his chiefs, he painted all the beauties of Charles II.'s harem. Cornelis Janssen of Leyden, a good painter, came over in 1618. While Lely was flourishing, Gottfried Kneller, a native of Lubeck, arrived; he had already gained some distinction in Europe. He had great success in England, and painted Dryden, Addison, and Pope, with nearly every notable man and woman of his time in the island. With the appearance of Sir Joshua Reynolds (1723–92) began a new and more fruitful period, the third important influence affecting the growth of painting, and particularly of portrait-painting, in England; and from his time to the present the history of English portraiture has never wanted for splendid names. Reynolds essayed historical painting, but his failures in this field cannot be seen for the splendid light that streams from his portraits. He painted men, women, and children with equal sympathy and delightfulness, and no artist that ever lived has left a work behind him richer in all that wins the love and admiration of mankind. If his times were not England's noblest, he makes them seem so; and all that England had of noble and beautiful in man or woman is illustrated by his canvases. Thomas Gainsborough, his contemporary (1727–88), would have been a dangerous rival if he had devoted himself as exclusively to portraiture as Reynolds did, but he preferred landscape-painting, and though his portraits are charming, yet he is widest known as one of the founders of landscape-painting in England. Another notable painter of this time was Romney (1734–1802), whose reputation has increased with time. John Opie (1761–1807) also gained considerable distinction.

The modern French school began with David (1748–1825), who was before all a so-called historical painter, but who made some excellent portraits. France has, however, never had a great artist whose name is identified exclusively with portrait-painting, or even to any considerable extent so identified. With those even who have excelled in it, it has always been held of secondary importance. Yet Gérard (1770–1837) made many interesting portraits, and those of Ingres (1781–1867) must surely outlive all but two or three of the imaginative compositions on which he thought to build his fame. Within a few years portrait-painting in France, as in England, has been taken up by some of the foremost men, and in the Royal Academy exhibitions the portraits by Holman Hunt, Watts, and Millais are looked for with the same interest that attends their other works.

Sculpture in England has been more successful in portraiture than in ideal work. It owed its modern impulsion to a Frenchman, Roubiliac (1695?–1762), who came to England in 1720, and by the very excess of his dramatic conception and the superfluous energy of his execution gave an impetus to his art in England which in a dull, pedantic time bore down everything before it. He was followed by a number of distinguished sculptors—Flaxman, Banks, Nollekens—Flaxman the greatest of all, but less known as a sculptor of portraits than the others. The line of statuaries has been unbroken in England from their time to our own, and the talent of Englishmen in this field has been for the most part directed to portraiture. The better-known names in English sculpture are Westmacott, Gibson, Foley, Bell, Marshall-Wood, Boehm, and Woolner. The portrait-busts of the last two are productions of singular merit, and future ages, no less than ours, will rejoice that such sculptors as Boehm and Woolner should have been found to preserve for us the features of Carlyle and Tennyson.

In America the art of portraiture properly begins with Copley, born in Boston in 1737, but who went to England

in 1774, when he was thirty-seven, and remained there the rest of his life, dying in 1815. He was an artist of native growth, and if Heaven had vouchsafed an atmosphere more genial to the arts than either America or England at that time afforded, he would doubtless have developed larger qualities than were perhaps possible under the circumstances in which he was educated. His manner of painting was somewhat cold and hard, but he drew well, his color is agreeable, and he gave a good deal of life and animation to his heads. He was followed by John Trumbull, who, though he failed as an historical painter, deserves to be remembered for his miniatures. Another excellent miniature-painter was Malbone. The next most distinguished name to Copley is, however, that of Gilbert Stuart (1756–1828), an artist who when at his best was one of the excellent painters of his time, whether at home or abroad. Other notable names, and bringing us down to our own time, are those of Leslie, Sully, Inman, Harding, Healy, Elliot, Baker, Huntington, and Page, not forgetting that of Furness, who died young, but left behind him work that gave promise of a brilliant future.

It may be remarked, in closing, that the world is unfortunate in that she has no portraits of the few greatest ones who have shaped her spiritual and intellectual life. Of Moses, of David, of Mohammed, of Confucius, of Booddha, of Aristotle, of Plato, of Socrates, of Jesus, we have no hint of any portrait. The so-called busts of Socrates, if meant for him at all, were probably made in later times from the descriptions of his contemporaries. The busts of Plato are now considered to be ideal heads of the Indian Bacchus. The pictures of Jesus are either formed directly on the antique types of Zeus or Apollo, or else upon the fictitious letter of Lentulus to the Roman senate. The discovery in our own day of the lost portrait of Dante by Giotto—thanks to stupid restorers and feeble copyists, lost again as soon as found—the discovery of a supposed death-mask of Shakspeare, and the bringing to light a forgotten bust of Milton, have shown at once how strongly the world desires to see how her great children looked when among men, and how far that desire is from being accomplished. For the most part, the antique world of men and women exists for us only in fancy; but the after-world, if it should care to know how the famous people of this age looked, will find abundant record, not only in the work of our painters and sculptors, but in the mechanic copies of the century's illustrations made by the photograph, an invention which is to the art of our day what the invention of printing was to literature in the fifteenth century. CLARENCE COOK.

Port Repub'lic, p.-v., Galloway tp., Atlantic co., N. J.

Port Republic, p.-v., Rockingham co., Va., on Shenandoah River, noted for the battle of June 8, 1862, won by Gen. "Stonewall" Jackson.

Port Rich'mond, v., Centre tp., Wapello co., Ia., on Des Moines River. P. 85.

Port Richmond, p.-v., Northfield tp., Richmond co., N. Y., on N. side of Staten Island and on Kill von Kull River, 8 miles S. W. of New York, with which it has hourly connection by steamer; was incorporated as a village 1866; has 1 newspaper, 4 churches, convenient docks for shipping, and some manufactures. P. 3028.

Port Row'an, a port of entry of Walsingham tp., Norfolk co., Ont., Canada, on Lake Erie, has a good harbor, and ships immense quantities of lumber and logs and considerable grain. P. about 900.

Port Roy'al (or, more properly, **Port Royal des Champs**), founded in 1204 by Matthieu de Montmorency at Chevreuse, near Versailles, as a monastery for Bernardine or Cistercian nuns. In the course of time it became noted as an educational institution, to which the French nobility sent their young daughters, but at the same time it lost to some degree its religious character, until in the beginning of the seventeenth century the abbess, Mère Marie Angélique, thoroughly reformed the establishment and revived the old religious discipline, with its rigid seclusion, poverty, and asceticism. She was a sister of Antoine Arnauld, "the great Arnauld," professor in theology at the Sorbonne and an ardent disciple of Jansen, and thus the monastery became Jansenistic. It flourished, and the number of nuns increased rapidly. In 1625, Hôtel de Clugny, in Faubourg de St. Jacques, Paris, was bought, and a branch institution was founded here under the title of Port Royal de Paris, and in 1626 a new and extended abbey was erected at Port Royal des Champs. Meanwhile, a number of pious and learned men had established themselves at a farm-house near Port Royal des Champs, called Les Granges, for the purpose of leading a secluded and ascetic life, devoted to studies and religious exercises; and when the nuns moved to the new abbey they were allowed to occupy the old place under the immediate jurisdiction of the archbishop of Paris. They were all Jansenists, and soon Port Royal became famous as the centre of the whole Jansenistic movement and the focus of the opposition to the Jesuits. Here the Jansenists founded a school and issued their celebrated handbooks in grammar, mathematics, logic, etc., and here were prepared those formidable attacks on the Society of Jesus which startled the whole world. But in 1664 the community was scattered by force; in 1669 the two monasteries, Port Royal des Champs and Port Royal de Paris, were separated, and the latter reorganized under the influence of the Jesuits; and when the nuns of Port Royal des Champs still refused to subscribe to the papal condemnation of Jansen, they were dispersed in 1709, and imprisoned in various other monasteries of France, and the buildings of their abbey levelled to the ground. (See Fontaine, *Mémoires pour servir à l'Histoire de Port Royal* (2 vols., 1736); Racine, *Histoire abrégée de Port Royal* (1742); Sainte-Beuve, *Port Royal* (5 vols., Paris, 1840–60), a most excellent work, sometimes overwhelming, and even exhausting, the receptive power of an ordinary reader, but giving a most valuable picture, at once sympathetic and impartial, of the scientific ideas, the moral character, and the social influence of the Jansenists.

Port Royal, P. O. name PERRYSVILLE (which see).

Port Royal, p.-v., Beaufort co., S. C., noted for one of the earliest settlements made by the Spaniards within the present limits of the U. S., for important events during the war of the rebellion, and as the present (1876) rendezvous of the North Atlantic squadron of the U. S. navy. The harbor is one of the finest in the world.

Port Royal, p.-v. and tp., Caroline co., Va., on Rappahannock River. P. 435; of tp. 3543.

Port Saeed', town of Egypt, at the junction of the Suez Canal with the Mediterranean, was in 1862 an insignificant village, but has now between 8000 and 9000 inhabitants, and its harbor, formed by two immense moles, is annually visited by over 1000 vessels.

Port San'ilac, p.-v., Sanilac tp., Sanilac co., Mich., on Lake Huron.

Port Sarnia. See SARNIA.

Ports'mouth, town of England, county of Hants, on the small island of Portsea, which is separated on the N. from the mainland by a narrow strait crossed by a bridge, is situated at the entrance of an inlet of the English Channel, 4 miles long, 5 miles broad, but only 220 yards across its entrance, and affording convenient and perfectly secure anchorage. Portsmouth, like Plymouth, is a triple town, consisting of Portsmouth proper, Portsea, adjoining on the N., and GOSPORT (which see), the latter on the opposite side of the harbor, communicating by a flying bridge. The dockyard is the most important establishment of that description in the United Kingdom, not only as regards its capability for building, repairing, and refitting ships of war, and the vast amount of stores of every denomination accumulated there for the service of the fleet, but also from its central position on the S. coast of England. It comprises an area of 293 acres of land, containing wet and dry docks, warehouses, anchor-forges, iron and copper mills, rope-houses, and every kind of establishment necessary for the construction and outfit of a ship-of-war. The royal Clarence victualling yard, formerly one of the large naval establishments of Portsmouth, is now removed to Gosport. Plymouth and Portsea are encircled by a fortified *enceinte* of the last century. As at Plymouth, the modern exigencies of defence have, under action of the defence commission appointed in 1859, removed the perimeter of defence to a chain of works built on modern types from 3 to 5 miles distant, and including in its length the crest of the commanding Portsdown Hill. Closely associated with Portsmouth as a naval dépôt, and with its defence from maritime attack, is the important anchorage of SPITHEAD (which see). P. 113,569.

Portsmouth, p.-v. of Frontenac co., Ont., Canada, has an excellent harbor, 2 miles W. of Kingston. It is the seat of Kingston penitentiary and of the Rockwood lunatic asylum, a beautiful structure. There is a marine railway, a tannery, a brewery, and a handsome town-hall. P. of sub-district, 1702.

Portsmouth, p.-v. and tp., Bay co., Mich., on Saginaw River and Flint and Père Marquette R. R. P. 1243; of tp. 1660.

Portsmouth, city and port of entry, cap. of Rockingham co., N. H., situated on the right bank of Piscataqua River, 3½ miles from the sea, in lat. 43° 04′ 35″ N., lon. 70° 45′ 08″ W. The climate is superior to that of any seaport N. of Cape Cod, the average temperature ranging higher in winter and lower in summer, with less fall of rain and more clearness. The first settlement was made at Little Harbor (now Rye) by the English in 1623, the most compact part of the city being known as Strawberry

Bank, from the abundance of this fruit that grew there. In 1653 the whole township was formally named Portsmouth, and in 1849 the town was incorporated as a city. Portsmouth contains 2 libraries of about 14,000 volumes, a mineralogical cabinet, 14 public schools, 10 religious societies, 7 banks, 2 military companies, a fire department, a cotton-mill, 2 breweries, several weaving establishments, 2 daily and 2 weekly newspapers, a fine custom-house, and many flourishing stores and elegant private residences. The U. S. navy-yard, situated about half a mile distant, is built upon two islands lying on the Kittery side of the river, and comprises 170 acres. Though in fact in another town and State, it is intimately connected with this city, and is commonly known as the Portsmouth navy-yard. The Eastern R. R. connects here with Portsmouth Saco and Portland R. R., while Portsmouth and Concord, Dover and Portsmouth, and Conway and Great Falls R. Rs. all terminate here. Portsmouth is the only seaport and customs entry in New Hampshire. Its harbor is capacious and one of the best in the U. S., having a depth of 40 feet at the entrance at low tide, with a mean rise and fall of 8½ feet, and never freezing. Commerce and shipbuilding are the chief industries, and have been from the earliest times. Two shipyards are still in active operation building for the merchant marine. Many celebrated war-vessels have been constructed here. In 1690 the Falkland of 54 guns was built by order of the British government, and she was followed by the America of 50 guns in 1749 for the same government. The famous Ranger of 18 guns was turned out in 1777 by order of the Continental Congress, and was commanded on her first cruise by John Paul Jones, the Farragut of the American Revolution. The ship was the first one to carry the Stars and Stripes and to receive a salute. These vessels were followed by many others, and to-day she ranks among the foremost of the shipbuilding-yards of the U. S. P. 9211. C. W. Tuttle.

Portsmouth, p.-v., Carteret co., N. C. P. 341.

Portsmouth, city, Clay tp., cap. of Scioto co., O., at the confluence of Scioto River with the Ohio, and at the S. terminus of Ohio and Erie Canal, on a branch of Marietta and Cincinnati R. R., is the shipping-point for the mineral regions of S. Ohio and N. E. Kentucky, and for the fertile valley of the Scioto, through which a railroad will shortly be built; has about 12 churches, 6 banks, 3 newspapers, 7 building associations, 2 rolling-mills, 3 foundries, several saw and planing-mills, numerous manufactories; has Holly waterworks, an opera-house, a Masonic temple, graded public schools, and a flourishing river-commerce. P. 10,592.

Portsmouth, p.-v. and tp., Newport co., R. I., embraces the northern half of the island of Rhode Island; has many villas and picturesque places of resort for summer visitors. It has coal-mines. P. 2003.

Portsmouth, city and port of entry, cap. of Norfolk co., Va., at the E. terminus of Seaboard and Roanoke R. R., on the E. bank of Elizabeth River, opposite Norfolk, with which it is connected by ferry, has one of the best harbors in the U. S., is the seat of Gosport navy-yard, of a dry dock, and naval hospital, and has lines of steamers to the principal Atlantic seaports. The exports are cotton, lumber, oak staves, naval stores, pig iron, and early vegetables for the Northern cities. There are 13 churches, 2 banks, 3 hotels, 1 daily newspaper, 2 academies, 12 public and 41 private schools, and several manufactories. P. 10,492.

Port Stan'ley, flourishing and beautiful port of entry in Elgin co., Ont., Canada, the S. terminus of London and Port Stanley Railway, 24 miles long. A steamer plies between this port and Cleveland, O., 85 miles distant. P. about 900.

Port Tobac'co, p.-v., Duffield tp., cap. of Charles co., Md., at the head of Port Tobacco Bay on Potomac River, has 1 newspaper, and was formerly an important shipping-point. P. 215.

Port Towns'end, p.-v., cap. of Jefferson co., Wash. Ter., on Port Townsend Bay and the Strait of Juan de Fuca, has a large lumber-trade and 1 weekly newspaper. P. 593.

Por'tugal [from *Portus Cale*, the ancient name of the city of Oporto], an independent kingdom of Europe, occupying the western part of the Iberian peninsula, between lat. 36° 57′ and 42° 8′ N. and lon. 6° 12′ and 9° 32′ W., and bounded N. and E. by Spain, S. and W. by the Atlantic, comprises an area of 34,500 sq. m., with a population of 3,990,570, and is divided into the following six provinces:

Provinces.	Area.	Pop.	Capital.
Minho	2807	971,001	Oporto.
Tras os Montes	4289	365,833	Bragança.
Beira	9244	1,294,282	Coimbra.
Estremadura	6872	839,691	Lisbon.
Alemtejo	9416	331,341	Evora.
Algarve	1872	188,422	Faro.

The Azores and the islands of Madeira and Porto Santo are directly connected with the kingdom with respect to their administration. The colonial possessions in Africa and Asia comprise an area of 639,000 sq. m., with 3,200,000 inhabitants, and consist—in Africa, of Cape Verd Islands, São Thomé, and Principe Islands, several points in Senegambia, Angola, and Benguela (250,000 sq. m.; pop. 2,000,000), Mozambique, and Sofala (380,000 sq. m.; pop. 300,000); and in Asia, of Goa, Salsette, Damaun, Macao, and Timor (5527 sq. m.; pop. 250,000). The surface is in all its principal features simply a continuation of Spain, and will be described there. The most prominent groups of mountains are that which enters the country between the Douro and the Tagus, traverses the provinces of Beira and Estremadura in several parallel chains, Serra da Estrella in the north-eastern part, Torres Vedras, Mafra, and Cintra in the south-western, and ends in Cabo da Roca, about 2000 feet high, on the Atlantic coast; and that which under the name of Serra de Monchique forms the boundary between the provinces of Algarve and Alemtejo, and ends in Cape St. Vincent. The coast is low between Cape St. Vincent and the mouth of the Tagus, in some places sandy, in others marshy; between the mouths of the Mondego and the Douro it presents the same aspect, but between Cabo da Roca and the Mondego it is high, rocky, and rough. It affords only a few good harbors—Oporto at the mouth of the Douro, Lisbon on the estuary of the Tagus, Setubal, Aveiro, Figuera, and Viana. The immense surf which from the Atlantic sets in on the coast has generally formed bars at the entrance of the harbors, and makes access to them difficult with certain winds. The soil is generally fertile, and the mountain-scenery often surpassingly fine. Large deposits of anthracite coal are found at Valongo, near Oporto; lead is mined in considerable quantities at Braçal; salt is produced at different places to the amount of 60,000,000 bushels annually; gold, silver, copper, and tin are also found, but mining is not carried on with any high degree of energy. The climate is milder than that of Spain, the summer heat being tempered by breezes from the sea, and severe cold with snow being unknown except in the northern mountain-districts. Algarve and the southern part of Alemtejo are the hottest parts of the country, and suffer often severely from droughts. Extensive forests of oak, elm, ash, pine, and chestnut, occupying an area of more than 300,000 acres, are found principally in the northern part; in the southern, large plantations of cork trees and date-palms; in the central, of olive and mulberry trees, the olive plantations occupying an area of more than 100,000 acres, and yielding an annual production of 5,500,000 gallons of oil. The orange, lemon, citron, fig, peach, walnut, and almond are raised throughout the whole country, and are of excellent quality. The principal cereals are wheat (5,500,000 bushels), rye (6,000,000), maize (14,000,000), and rice (400,000), but agriculture is in a very backward state, and the produce is barely enough to satisfy home demands. The cultivation of the olive tree and the vine is carried on with more care, and yields a considerable quantity for exportation. The vineyards of Portugal, of which the most important are situated in the valley of the Douro, cover an area of 473,517 acres, and produce annually about 132,500,000 gallons of wine. The finest breed of cattle is reared in the northern provinces, of sheep in Beira, of horses in Alemtejo. Mules and asses are generally used as beasts of burden. Goats and pigs are very numerous, especially in the mountain-districts; bees and silkworms are also extensively reared. Fish abound: the tunny and anchovy fisheries of Algarve are important. Some few wild animals, such as the wolf, the wild-boar, are found; small game is abundant.

The commerce and manufacturing industry, although steadily progressing, are still only little developed. Some cotton, wool, silk, paper, glass, and soap factories are in operation, and manufactures of earthenware, chemicals, hats, lace, copper, tin, and wicker ware are carried on. The foreign trade is principally with Great Britain, though also to a considerable extent with Brazil and France. The value of exports amounted in 1871 to $23,386,000; that of imports to $29,876,000; the principal articles of exportation are wine, olive oil, salt, chemicals, copper pyrites, dried fruit, pork, silver, cork, etc.: of importation, textile fabrics, coal, iron goods, timber, hides, tobacco, coffee, tea, etc. In 1873 the merchant navy consisted of 17 steamers, with a tonnage of 14,536, and 415 sailing vessels, with a tonnage of 93,815. But the internal means of communication—roads, canals, railways, etc.—are still insufficient, though large sums have been expended in the last few years for this purpose; and a still worse impediment to the rapid development of the material interests of the country is the confused state of the finances. In 1871–72 the revenues amounted to $20,310,832, the expenditures to $24,015,605, and for the last thirty years no budget has

been without a deficit. The national debt, which originated in 1796 by a loan of $4,500,000, amounted in 1873 to $364,165,000, with an annual interest of $11,080,000, which is sometimes paid, and sometimes not. The government is an hereditary monarchy, with a free constitution. The state religion is the Roman Catholic, but all religions are tolerated. There were 632 monasteries and 118 nunneries, with over 18,000 monks and nuns, and an annual income of about $5,000,000, dissolved in 1834, and their property confiscated. Primary instruction is compulsory, but in this, as in many other cases, the laws of the country would be very good if they were duly carried out.

Portugal was originally inhabited by Celtic and Iberian tribes. In the second century before our era it was conquered by the Romans and made a province under the name of *Lusitania*, after one of the principal tribes settled on the soil; in the fifth century after Christ it was overrun by the Visigoths, and in the eighth it was subjugated by the Moors. But at the close of the eleventh century Alfonso V., king of Leon and Castile, conquered the region between the Minho and the Douro from the Moors, and gave it to his son-in-law, Henry, about 1095; and from this point begins the national history of the Portuguese. Henry called himself count of Portugal, transferring the name from his capital, Porto Cale, to his whole dominion, and his son Alfonso assumed the title of king on the battlefield of Ourique in 1139, having defeated the Moors and extended his possessions to the Tagus. In 1253 the kingdom comprised nearly the same area as to-day. The most brilliant period of its history was in the fifteenth and sixteenth centuries, when the Portuguese occupied a prominent place among the European nations on account of their scientific knowledge, their practical enterprise, and their wealth. Prince Henry the Navigator (1394–1460) awakened that enthusiasm for the study of geography, astronomy, navigation, etc. and started the series of maritime explorations, which finally led to the discovery of America. In 1420, Porto Santo, and in 1421 Madeira, were discovered by Tristam Vaz, and soon after colonized. In 1445, Dinis Diaz passed Cape Verd; in 1486, Bartolomeu Diaz doubled the Cape of Good Hope; in 1497, Vasco da Gama found the way S. of Africa to India; Goa, Ceylon, the Moluccas, etc. were conquered, and all the riches of India began to flow into the harbors of Portugal. In 1500, Cabral discovered Brazil and took possession of it, and for more than half a century Portugal occupied the position of a grand power in the political system of Europe; Lisbon was at this time the centre of the commerce of the world. But under John III. (1521–57) the Jesuits came into the country with the Inquisition, and they soon succeeded in burying the energy of the people under dull superstition, and in training its passions for the cruelties of religious fanaticism. Aug., 1578, King Sebastian and his whole army, consisting of the flower of the nation, perished in the battle of Kassr-el-Kebir against the Moors, and thereby the military and pecuniary strength of the empire was broken. In 1580 the dynasty became extinct with Cardinal Henry, and Portugal now passed into the hands of Philip II. of Spain, during whose wars with the Netherlands it lost its commerce and its colonies. Impoverished and degraded, it still had strength enough left to reconquer its independence in 1640, when a general revolt against the Spanish dominion broke out, and the dynasty of Braganza was placed on the Portuguese throne with John IV. (1640–56). The country was once more rapidly advancing toward prosperity under the energetic government of Pombal, but under the long reign of Maria I. (1777–1816) the Jesuits again succeeded in plunging it into misery. Its close alliance with England implicated it in the wars with Napoleon, and Nov. 24, 1807, the royal family fled to Brazil. The English succeeded in re-establishing the dynasty by the Treaty of Cintra, Aug. 30, 1808, but the country had to pay very dear; its finances were loaded down with debt, and its commerce and industry were much impeded by monopolies held by London merchants. John VI. (1816–26) returned in 1821 from Brazil, but before he landed in Portugal he was compelled to sign a liberal constitution, July 3. In 1822, Brazil was separated from Portugal and acknowledged as an independent state, under his son Dom Pedro. He was succeeded by Maria II. (1826–53; see MIGUEL, DOM), Pedro V. (1853–61), and Louis I., the present king. CLEMENS PETERSEN.

Por'tuguese Language and Literature. The Portuguese language is a branch of the *lingua Romana rustica*, with a strong infusion of Arabic terms, derived from the time of Moorish domination, and a considerable admixture of Teutonic, brought by the early Suevian and Burgundian conquerors, and is closely connected with the Galician dialect of Spanish, with which it was, in fact, originally identical. It is less energetic, but more fluent, than the Castilian, and native grammarians claim for it the title of "eldest daughter of the Latin." It has no gutturals or harsh aspirates, but possesses five nasal vowels (pronounced nearly *ang, eng, ing, oung, oong*) and five double vowels or *prolaçoes*—namely, *ch, lh, nh, ph*, and *rr*—corresponding nearly to their French analogues. Many Latin words are preserved more exactly than in the sister languages (*e. g. ferro, filho*), while in others the phonetic decay has been strongly marked, chiefly by the omission of the consonants *l* and *n* between vowels (*e. g. dôr = dolor, pôr = ponere, povo = populus*).

The national literature of Portugal has suffered from the constant tendency of native writers on important subjects not merely to imitate, but to employ, the Spanish (and more recently the French) language; and had the subjection of Portugal to Spain by Philip II. (1580–1640) been permanent, Portuguese would doubtless have ceased to exist as a literary language, and become a mere dialect of Spanish, like the Gallego. The inveterate political enmity of the Portuguese to the Spaniard has, however, not only preserved the national language, but has been instrumental in endowing it with a poetical and historical literature of considerable interest. The Portuguese language assumed a distinct form in the eleventh century, but the earliest existing specimens, chiefly translations from Provençal songs, date from the beginning of the thirteenth century. The Portuguese kings of the Burgundian dynasty fostered the beginnings of the national poetry, several of them being themselves poets, especially Dionysius or Diniz (1279–1325), the founder of the University of Coimbra, by whom a *cancioneiro* or songbook was compiled, which, after being lost for several centuries, was discovered in the Vatican Library and published in 1847. The celebrated romance *Amadis de Gaul*, by Vasco de Lobeira, was among the first prose compositions. In the fifteenth century history in the form of chronicle began to flourish, the most eminent author being Fernão Lopes, called the "Portuguese Froissart," whose royal chronicles were continued by Gomes Eannes de Azurara. In the sixteenth century Damião de Goes wrote a learned *Chronicle of King Emanuel;* João de Barros produced his classic *Asia Portugueza;* Alfonso d'Albuquerque his *Commentarios;* Lopes de Castanheda wrote his valuable history of the discovery of the Indies; and the traveller Fernão Mendes-Pinto produced the celebrated *Peregrinaçao*, which gave him (justly or unjustly) so high a rank among imaginative writers. During the same century, which is the golden age of Portuguese literature, Bernardino Ribeiro wrote his famous romance, *Menina e Moça*, and founded the pastoral and romantic school of poetry, which was soon adorned by the writings of Christovão Falcão, Sa de Miranda, Pedro de Caminha, Diego Bernardes, Rodrigues Lobo, and Jeronimo Cortereal. About the middle of the century Antonio Ferreira, a successful imitator of Horace and Petrarch, was the leading ornament of the classical school of poetry, and in his *Ines de Castro* produced a tragedy before any theatre existed in Spain. He was quickly followed by Gil Vicente. The greatest name in Portuguese literature is Luiz de Camoens (1524–79), author of the immortal epic *Os Lusiadas*, which has for ever determined the literary form of the language. The close of the sixteenth and beginning of the seventeenth century was a period of literary as well as political eclipse, illustrated only by the names of Pereira de Castro, Sa y Menezes, Faria e Sousa, Barbosa Bacellar, and Jacinto Freire de Andrada, author of the admired *Vida de João de Castro*. Toward the close of the seventeenth century Father Antonio Vieyra produced his remarkable sermons, considered as models of pulpit eloquence, and literature exhibited some signs of prodigious activity, which soon filled the libraries of Portugal with imitations of the prevailing taste in France. The *Bibliotheca Lusitana* of Diego Barbosa Machado gave the literary history, bibliography, and biography down to 1750, and commemorated many hundreds of authors whose works rarely passed the limits of the little kingdom. The greatest names of the latter half of the eighteenth century were the lyric poets Francisco Manoel do Nascimento and Manoel Barbosa de Boccage, and the distinctively modern school of Portuguese literature dates from the epic and romantic poet Agostinho de Macedo. The leading recent writers of Portugal are the historian and novelist Alexandro Herculano and the viscount Almeida Garrett, a versatile poet and essayist, the dramatist Mendes Leal, and the novelist Rebello de Silva.

Portuguese literature in Brazil produced toward the close of the eighteenth century the epic poems *Uruguay*, by José Basilio da Gama, and *Caramurú*, by Fray Durão; and lyric poetry was creditably cultivated by some writers who constituted the so-called Minas school. In the present century the most noted Brazilian writers have been the moralist Fonseca, marquis of Maricá, the lexicographer Moraes e Silva, the dramatist and poet D. J. G. de Ma-

galhães, the historian F. A. de Varnhagen, and the novelists and poets Gonçalves Dias, Joaquim Manoel de Macedo, and Norberto de Souza e Silva. PORTER C. BLISS.

Portuguese Man-of-War, the popular name of the *Physalia arethusa*. See ACALEPHÆ.

Portulaca'ceæ [from *Portulaca*, one of the genera], a natural order of succulent exogenous herbs and shrubs, all harmless and many of them with gay flowers. The purslanes (*Portulaca*), the calandrinias, and the claytonias, include a few ornamental species.

Port Whit'by, Canada. See WHITBY.

Port Wine. See WINE.

Port'ville, p.-v. and tp., Cattaraugus co., N. Y., on Allegheny River, Genesee Valley Canal, and Buffalo New York and Philadelphia R. R. P. 450; of tp. 1814.

Port Wash'ington, p.-v., N. Hempstead tp., Queens co., N. Y., on Manhasset Bay, Long Island Sound. P. 804.

Port Washington, p.-v., Salem tp., Tuscarawas co., O., on Tuscarawas River, Ohio and Erie Canal, and Pittsburg Cincinnati and St. Louis R. R. P. 425.

Port Washington, v. and tp., Ozaukee co., Wis. (OZAUKEE P. O.), on Lake Michigan and Milwaukee Lake Shore and Western R. R. P. 2390.

Port Wil'liam, p.-v., Liberty tp., Clinton co., O., on Cæsar's Creek. P. 184.

Po'rus, a king of India, ruling E. of the Hydaspes; attacked Alexander when he tried to cross this river, but was defeated, wounded, and captured. He was treated with great kindness, however, by Alexander, and restored to his kingdom, which was much enlarged. As an ally of the Macedonians he afterward supported them on their further expedition into India, but after the departure of Alexander he was put to death by Eudemus, who was left in command of the Greek army of occupation.

Por'y (JOHN), b. in England about 1570; studied at Gonvil and Caius College; translated the *Geographical History of Africa* by Leo Africanus (folio, 1600; republished by Purchas); resided at Paris 1612; was secretary to the Virginia colony at Jamestown 1619–21; visited Plymouth, Mass., on his voyage to England, shortly after its settlement by the Leyden Pilgrims; returned to Virginia as a commissioner deputed by the privy council 1623, and d. probably in Virginia before 1635. He was one of the assistants of Hakluyt in his great geographical enterprise, a man of considerable learning, and a well-wisher both of the Virginia and the Plymouth colonies.

Poseidon. See NEPTUNE.

Po'sen, province of Prussia, bounded by Silesia, Brandenburg, Pomerania, East Prussia, and Poland, comprises an area of 11,260 sq. m., with 1,583,843 inhabitants, of whom more than two-thirds are Poles, using the Polish language and adhering to Roman Catholicism. The land is a low and level plain around the Warta, an affluent of the Vistula. It is dotted all over with small lakes and covered to a great extent with fine forests. The soil is fruitful and well cultivated. Many swamps and marshes have of late been drained and transformed into good meadows or arable land. Cattle of superior quality are reared, and large crops of wheat, rye, barley, and oats are raised. Manufactures, especially of linen and lace, are carried on. Posen formed a part of Poland until the first partition of that country, when Prussia took the largest part of the present province. The robbery was enlarged at the two following partitions, and solemnly sanctioned at the Congress of Vienna in 1815. But setting aside the manner in which the province was acquired, it has been well governed and is steadily progressing under Prussian rule.

Posen, town of Prussia, capital of the province of Posen, on the Warta, is an old but handsome city. The Russian government has made it one of its great fortified places, and surrounded it by a modern enceinte with citadel and outworks at a cost of 114,000,000 reals. It contains many elegant buildings, both public and private, many fine promenades and public squares, many good educational and benevolent institutions, and extensive manufactures of tobacco, sealing-wax, wax candles, leather, furs, liqueurs, gold and silver ware, woollen and linen fabrics, arms and carriages. P. 56,374.

Po'sey, county of S. W. Indiana, separated from Kentucky on the S. and Illinois on the W. by Ohio and Wabash rivers. It has a very fertile soil. The wide bottom-lands are flat and low, the uplands hilly. Corn, grain, tobacco, and wool are important products. Carriages, ploughs, etc. are among the manufactured articles. Cap. Mount Vernon. P. 19,185.

Posey, tp., Clay co., Ind., on St. Louis Vandalia Terre Haute and Indianapolis R. R. P. 2132.

Posey, tp., Fayette co., Ind., on a branch of Jeffersonville Madison and Indianapolis R. R. (BENTONVILLE STATION). P. 947.

Posey, tp., Franklin co., Ind. P. 974.

Posey, tp., Harrison co., Ind., on Ohio River. P. 1774.

Posey, tp., Rush co., Ind., on Cincinnati Hamilton and Dayton R. R. P. 1763.

Posey, tp., Switzerland co., Ind., on Ohio River. P. 2183.

Posey, tp., Washington co., Ind., on Great Blue River. P. 1349.

Posey (THOMAS), b. in Virginia July 9, 1750; received an ordinary common-school education; removed to Western Virginia in 1769; was quartermaster to Lewis's division of Lord Dunmore's expedition against the Ohio Indians, and took part in the memorable battle of Point Pleasant, Oct. 10, 1774; was in the following year a member of the Virginia committee of correspondence, and captain of a company which he raised for the 7th Virginia regiment; participated in the defeat of Lord Dunmore at Gwyn's Island, July 8, 1776; joined the Continental army at Middlebrook, N. J., early in 1777; was transferred to Morgan's famous rifle regiment; distinguished himself in an action at Piscataway, N. J., and in the battles of Bemis Heights and Stillwater under Gen. Gates; commanded the regiment with the rank of major in an expedition against the Indians Oct., 1778; commanded the 11th Virginia regiment 1779, distinguishing himself at the head of a battery at Stony Point; was present at Yorktown; served under Wayne in Georgia; defeated the Indians June 23, 1782; resided in Spotsylvania co., Va., many years after the war; was appointed brigadier-general Feb. 14, 1793; removed soon afterward to Kentucky, where he became lieutenant-governor and major-general, 1809; was U. S. Senator from Louisiana 1812–13; succeeded Harrison as governor of Indiana Territory 1813, and became agent for Indian affairs 1816. D. at Shawneetown, Ill., Mar. 19, 1818. His *Life* was published in Sparks's *American Biography*.

Poseyville, p.-v., Robb tp., Posey co., Ind. P. 213.

Posido'nius, b. at Apamea in Syria about 135 B. C.; studied at Athens under Panætius; settled in Rhodes; became the head of the Stoic school of philosophy, whose doctrines, however, he softened and toned down in harmony with those of the Peripatetics; went in 86 B. C. to Rome as ambassador; was the teacher of Cicero and Pompey. D. at Rome about 51 B. C. Some fragments of his works are still extant, collected and edited by Janus Bake (Leyden, 1810) under the title *Posidonii Rhodii Reliquiæ Doctrinæ*.

Posi'lipo [Gr. Παυσίλυπον, "an end to care"], the name of a villa of the notorious epicure Vedius Pollio, afterward extended to the entire eminence which bounds the city of Naples on the W. It is pierced by a tunnel called the Grotto of Posilipo, 2244 feet long, 21½ wide, 69 feet high at the eastern extremity, and 25 in the middle, through which runs the road to Puzzuoli. Above the eastern archway of the grotto is the so-called Tomb of Virgil, who had a villa near by. The whole eminence is now covered with charming villas.

Pos'itivism [Lat. *positivus*]. In the opinion of its adherents the system of thought known as positivism or the positive philosophy is a universal system, which is destined to be accepted by the whole human race, and in comparison with which all other systems must appear as insignificant and local, as, for example, the opinions of Socinus or Manichæus must appear when contrasted with all-embracing Christianity. To those, however, who not being disciples of Comte, do not share these views, the positive philosophy not only seems to be as much a temporary and local phenomenon as the philosophy of Anaxagoras or of Hegel; but it appears so deeply impregnated with the purely individual idiosyncrasies of its founder that without a biographical notice its real character cannot be fully understood.

Isidore Auguste Marie François Xavier Comte was born at Montpellier, in the S. of France, on Jan. 19, 1798. His parents were rigid Catholics and legitimists—a fact of some interest, since the later career of their son shows that, however pronounced may have been his dissent from the doctrines of theological and political orthodoxy, the character of his social and religious speculations was to a great extent determined by the mental symbols with which his earliest education must have furnished him. Throughout his life, indeed, though he attained to views of scientific method which in profundity few modern writers have surpassed, and though he succeeded in taking a survey of human history in many respects more comprehensive and suggestive than any which had been previously achieved, yet he never seems to have framed even the most rudi-

mentary conception of that purely free and critical temper of mind which is essential to the attainment of truth in scientific matters, or of that unhampered but legitimate freedom of action which human history shows to be at each moment the goal of all preceding social progress and the indispensable condition of further social progress in the future. Comte's ideal of society, from first to last, was one in which the beliefs and actions of the great mass of mankind, even in their minutest and most trivial details, should be inexorably prescribed by a small governing class; and the most extreme result of his religious and political radicalism was to alter the superficial appearance of this small governing class by substituting a "high priest of humanity" and a board of positive philosophers for the pope and the imperial council of the Middle Ages. Hence, with all his wide historic sympathies, he never succeeded in understanding the fundamental principle of Protestantism, the most important acquisition of modern times; nor, in spite of his profound insight into certain aspects of scientific thinking, did he ever comprehend or value that critical spirit which questions all things in order that it may hold fast to that which is verified—a spirit in the absence of which all the discoveries of Newton and Faraday would be of no more real use to us than the cosmological dogmas of the priests who burned Vanini and imprisoned Galileo. To ascribe these grave philosophical defects to Comte's early training would be to make far too extensive an inference; but the facts are none the less interesting in view of the thorough consistency of aim which, in spite of superficial changes, characterized his whole career.

Comte early exhibited remarkable mathematical ability, and at the age of seventeen was admitted to the École Polytechnique at Paris, from which he was, however, soon expelled for participating in a complaint against one of the masters on the part of the younger students. But after having tasted of the intellectual life of the great capital he naturally found it impossible to content himself with Montpellier; and so, after a few months of intense study at home, he returned to Paris, penniless and in defiance of the wishes of his parents; and having been befriended by two scientific men of the highest eminence—Poinsot the mathematician and Blainville the biologist—he set about earning a livelihood by private teaching in mathematics. From 1818 to 1824 he was associated as secretary and pupil with St. Simon, the celebrated founder of a sect of world-menders; and it appears to have been during this period that he began to conceive his great scheme for the reorganization of society by philosophy. By 1824, Comte's views had so far outgrown those of his master that their friendly co-operation was brought to an end. The plans then conceived by Comte show the vast sweep of his mind. Dreamers or crotchety speculators of the type of St. Simon and Fourier, deeply impressed with the defects of human society as actually existing, have sought to remodel the relations which men sustain to one another in such a way as to eliminate these defects. But as a rule such attempts have been based upon *a priori* theories as to the constitution of human nature in the abstract. It was Comte's peculiarity that he saw that any such attempt, to be legitimate, must be based upon a thorough study of the conditions of social existence and of the tendencies of human nature as concretely exemplified in history. Before artistic practice must come scientific theory; before the polity must come a sociology. It was in connection with these views that Comte maintained in 1824 that the phenomena of society conform to fixed and ascertainable laws, no less than the phenomena of chemical combination or planetary rotation. It would perhaps be wrong to give Comte the credit of having originated this view, which had been growing in the minds of advanced thinkers since the time of Adam Smith; but the clearness with which he conceived it and the emphasis with which he set it forth constitute one of his chief philosophic merits. To discover the laws or most general aspects of the succession of social events was therefore the great task which Comte set before himself. But from his commanding standpoint such a task as this required a systematic and elaborate preparation on the most immense scale. For the phenomena of human society are by far the most complicated and irregular phenomena with which investigation has to deal. In two ways the successful study of them involves a previous study of the most general aspects of all other phenomena. For, in the first place, the human units of society conform to physical, chemical, and biological laws, so that these must be known before we can give a complete account of the actions of social units. And, in the second place, each science has devices for getting at the truth about things which are to some extent peculiar to itself, so that we must look over the whole field in order to equip ourselves adequately for a research which will call into play all the devices we can bring to bear. One science, for example, succeeds pre-eminently by the use of experiment, while another, in which experiment is less likely to return finally satisfactory answers, gets along best by using the comparative method. Let us, therefore, study each method in that science which best illustrates the proper use of it, and then we shall be the better prepared to investigate the excessively complex questions presented by the phenomena of human society.

Thus, in the attempt to inaugurate a scientific theory of social phenomena Comte was led incidentally to work up the elements of a grander theory of scientific method than any which had yet been laid before the world. As his acquaintance with physical science was wholly at second-hand, he fell into many errors in the details of his scheme, as has been forcibly pointed out by Prof. Huxley and others, but he nevertheless accomplished so much as fairly to entitle him to a place beside Bacon or Descartes as a writer on method. Our present space allows us only to give brief hints at some of his most significant views. The first task to be accomplished was to classify the various sciences in the order of their logical dependence. Having made a division between abstract and concrete sciences, corresponding nearly to the old division between natural philosophy and natural history, Comte arranged his so-called abstract sciences in a linear series, determined by the decreasing generality and simplicity of the phenomena with which the respective sciences are concerned. He began with the most simple and general phenomena, to proceed step by step to those which are most complex and special. Upon this principle the inorganic sciences, as a group, were manifestly to come before those which deal with organic phenomena. For example, we can study thermal radiations and chemical reactions without taking vital forces into the account, but we cannot study living organisms without appealing to physics and chemistry at every step. In the region of inorganic science Comte placed astronomy first, as dealing (in his time) only with gravitative force as manifested in the relatively simple phenomena of the mutual attractions of the heavenly bodies; whereas physics, which he placed next, treats not only of gravitative force as manifested throughout relatively complex terrestrial phenomena, but also of such modes of forces as cohesion and capillarity, and of the varieties of wave-motion known as sound, heat, light, magnetism, and electricity. Chemistry, dealing with the still more complex phenomena in which the relative positions of molecules are altered heterogeneously, resulting in new compounds with new properties, was ranked third in order. Passing then to organic science, Comte grouped together, under the head of biology, the most general aspects of nutrition and reproduction, of muscular contractility and nervous sensibility; under the last-named head he included all the phenomena of mind, leaving no place for psychology as an independent science, and setting aside altogether the study of the subjective phenomena of consciousness by introspective observation. Last in the series, as obviously the most complex and specialized of all, was ranked the science of sociology. Mathematics, on the other hand, was placed before all these sciences, the phenomena of number, form, and magnitude being universal, and capable of generalization without reference to other phenomena. The "hierarchy of the positive sciences" thus came out in the following order: (1) mathematics; (2) astronomy; (3) physics; (4) chemistry; (5) biology; (6) sociology. According to Comte, this arrangement represented not only the logical order in which the sciences depend one upon another, but also the historical order in which they have been successively developed and in which they have aided each other's advance. Thus, astronomy, according to Comte, was truly a science in the days of Hipparchus, while physics became a science, in the true sense of the word, only when Galileo discovered the increment of velocity in falling bodies; chemistry was not scientific until the time of Lavoisier; biology was first organized into a coherent body of doctrine by Bichat; and sociology had to wait until all these lines of inquiry were gathered together in the hands of the founder of positivism. The sharp-sighted reader will not fail to note that in setting forth some of these results the philosopher is reasoning upon the words rather than upon the things. It was only the geometrical part of astronomy, for instance, which had been generalized in the time of Hipparchus, and it is needless to say that the geometrical data employed in these generalizations had all been originally obtained from the study of terrestrial phenomena. On the other hand, the dynamical part of astronomy, the part in which physical conceptions of force and motion are involved, did not get scientifically treated until sundry generalizations of terrestrial physics, made by Galileo and Huyghens, had furnished Newton with the necessary data. The order of dependence as between astronomy and physics was, there-

fore, wrongly stated by Comte; and this error is only one among many. Indeed, fascinating as the Comtist classification of the sciences has appeared to many minds, it is not at the present day accepted by scientific thinkers, being in many fundamental aspects not merely inadequate, but positively misleading. An article like the present is not the proper place for the discussion of this subject, for which the reader may be referred to Mr. Herbert Spencer's two essays on the *Classification of the Sciences*, and the *Genesis of Science*, and to Part I. ch. viii. of *Outlines of Cosmic Philosophy*, by the present writer. It is there shown, by arguments which no one has as yet succeeded in answering, that while the Comtean classification may freely be allowed to be more profound than any which had preceded it, it nevertheless does not represent either the historical or the logical order of dependence among the sciences, and is not in any sense a tenable classification.

Inadequate and untrustworthy, however, as this classification turns out to be if regarded as an attempt to describe the true relations between the different sciences, it was not a bad classification for the practical ends which Comte had in view. He cared much less about organizing a coherent body of doctrine concerning the various provinces of nature than about co-ordinating the methods of research which the sciences severally best illustrate. To this point, already briefly alluded to, a few words of explanation must be given. His most important step consisted in assigning to each class of phenomena its appropriate method of investigation, and in clearly marking out the limits within which each method is applicable. It is this which makes it still interesting and profitable to read his great work, even in those chapters on physics, chemistry, and biology which in nearly all other respects the recent revolutions in science have rendered thoroughly antiquated. According to Comte, the resources at our disposal for the inductive investigation of phenomena may be classified as Observation, Experiment, and Comparison. In simple observation we merely collate the phenomena as they are presented to us; in experiment, we artificially vary the circumstances; in comparison, we watch the circumstances as they are varied for us on a great scale by nature. The conditions of successful observation are best studied in astronomy, where experiment is out of the question, owing to the magnitude and inaccessibility of the phenomena, and where the comparative method is only beginning to be applied. Physics and chemistry, on the other hand, are, *par excellence*, the sciences of experiment, since we can vary the phenomena almost indefinitely. In biology, experiment is also indispensable, nearly all our knowledge of the more important organic functions having been gained through vivisection and other forms of experiment; but experiment is far more complicated and difficult to interpret in biology than in physics, partly owing to the subtlety of the causes in operation, partly because the experiment itself sets in motion a new series of phenomena which are liable to mask and obscure those which we wish to observe. Hence, the practical study of experimentation should not begin in biology, but in physics or chemistry, where the conditions are simpler. On the other hand, it is in biology that we can best learn the use of the comparative method, since here we have a vast hierarchy of organisms, in which various organs and their corresponding functions appear in all stages of development. It was in biology that the method of comparison was first employed upon a great scale, and since the time of Cuvier its extension over all departments of sociological inquiry, including linguistics, mythology, and jurisprudence, is perhaps the most striking event in the history of science.

Perhaps no better illustration of the use of the comparative method could be found than is furnished by Comte's first wide generalization from the facts of history. When, after the elaborate preparatory discussion of scientific methods here pointed out, Comte endeavored to sum up the most prominent aspects of social progress, both intellectual and material, his first achievement was his celebrated theory of the "three stages" through which men's conceptions must pass. In his opinion this evolution of human thought through three stages is not only the fundamental phenomenon in history, but also affords the norm for testing the validity of philosophic systems. And unquestionably the theory constitutes the most essential part of the structure of positivism. He who intelligently accepts the so-called "law of the three stages" may well be regarded as a Positivist; he who rejects the so-called "law," as an inadequate and misleading description of the phenomena which it seeks to generalize, must be ranked among the antagonists of the positive philosophy. With these preliminaries the theory may be thus stated: "There are three modes of philosophizing—the theological, the metaphysical, and the positive. The first two modes are characterized by the attempt to formulate the unknowable Cause or causes of phenomena; but positivism, recognizing the futility of all such attempts, ignores the unknowable Cause or causes of phenomena. Positivism limits itself to ascertaining uniformities of coexistence and sequence among phenomena. Metaphysics and theology superadd investigations concerning the nature of the hidden efficient cause of the phenomena; but metaphysics regards this cause as a mere abstract entity, while theology regards it as endowed with volition and intelligence. There are three successive stages of theology—fetishism, in which phenomena, not being generalized, are regarded as endowed each with a volition of its own; polytheism, in which generalized groups of phenomena are regarded each as under the control of a presiding deity endowed with volition; and monotheism, which arises when men have gained the conception of a universe, and have generalized the causes of phenomena until they have arrived at the notion of a single First Cause. According to Comte, philosophy began in fetishism; as science progressively arranged phenomena in groups of wider and wider generality, philosophy passed through polytheism into monotheism; and as with its increasing generality the primitive anthropomorphic conception of cause faded away, becoming replaced by the conception of an unknowable Cause manifested in phenomena, philosophy became metaphysical; finally, when the unknowable Cause is ignored, and no account is taken of anything beyond the immediate content of observed facts, philosophy becomes positive." This statement, cited from the chapter in the *Outlines of Cosmic Philosophy* in which it is sought to refute the positivist theory, may fitly be supplemented by a statement from Comte himself. At the beginning of his great work he tells us that "the mind employs successively in each of its researches three methods of philosophizing, of which the character is essentially different and even radically opposed—first, the theological method, then the metaphysical, lastly the positive. The theological system arrives at the highest perfection of which it is susceptible when it has substituted the providential action of a single Being for the capricious play of the innumerable independent deities which were primitively imagined. Likewise, the perfection of the metaphysical system consists in conceiving, instead of many particular entities, one grand entity, Nature, as the source of all phenomena. Finally, the perfection of the positive system would be to represent all observable phenomena as particular cases of a single general fact." In accordance with this general view, Comte maintains that in every department of inquiry whatever, human speculation has passed through, or is passing through, these three stages; and, by way of welding firmly together the different parts of his system, he affirms that the order in which the respective sciences have advanced toward the positive stage is truly represented by the order in which they are ranked in his linear classification. Obviously, we have here a very important theorem. For if this view of intellectual progress could be demonstrated, it would follow that the conceptions of mankind must eventually become "positive" with reference to all questions, and Comte's claim to be regarded as the philosophic lawgiver for the whole future of the human race might not seem extravagant.

It is primarily the business of a sketch like the present article to describe rather than to criticise or seek to overthrow the system of philosophy of which it treats. Yet it is through a few words of criticism, in which dissent must unavoidably be expressed, that we shall best succeed in characterizing this central theory of positivism. That there is a strong appearance of truth in the Comtist theory when superficially considered can hardly be denied. Nay more, we need not be chary in admitting that as an historical generalization it really contains a considerable amount of truth; and the way in which Comte has worked it out, more especially in that part of his work which deals with the philosophy of history, is such as to call forth and justify the warmest admiration for his great power of historical generalization. That science which consists in following out the mental processes of uncivilized races by means of their mythology, superstitions, and customs—that science of which Mr. Tylor is the great representative—leaves it quite beyond question that the most primitive speculations of men who know enough to speculate at all are such speculations as Comte would have called fetishistic. By men in such a stage of culture the wind which blows down a hut is a person endowed with conscious volition; it blows down the hut on purpose, perhaps because the owner has offended it; and to prevent a recurrence of the disaster there is no better way than to cajole the irritable Wind. Savages may continue indefinitely to think thus; but obviously among progressive races, as generalization goes on, so that causes at first thought of as multitudinous

and local come to be thought of as few and general, these causes get detached in thought from their phenomenal effects, and men do not imagine them in such concrete shape as formerly. Instead of an angry Wind we have a half-spiritual Wodan, who manifests his wrath through many other agents besides the howling tempest; and in place of a definitely imaginable volition in the agent itself, we have some occult property, such as momentum, through which the act is effected. After a while it comes to be further perceived that, for purposes of scientific research, even this occult property need not be postulated, such a term as momentum being merely a convenient symbol for denoting certain relations, actual or possible, between one body and another. In the recognition of this fact Comte would say that we reach the positive stage of thought with reference to the phenomenon in question. A further illustration will assist us in comprehending this point, upon which it is needful to be very explicit. In his inquiry into the movements of the planets Newton very carefully abstained from making any hypothesis as to the nature of gravitative force. For the purposes of his scientific calculation it was not only not necessary to appeal to any such thing as attraction, but the calculation could indeed get along much better without making such an appeal. All that the scientific process required was that, a given quantity of matter being present in a given position, a certain other portion of matter should proceed to occupy a series of sequent positions in a certain specified order. When it was found that in the presence of such a portion of matter as the earth, another portion of matter known as the moon keeps on occupying such successive positions as were indicated by the Newtonian hypothesis, then the hypothesis was duly verified. And it remains to this day an adequate description of the facts with which it professes to deal, no matter whether the occult cause of the facts be really attraction, as has generally been supposed, or a differential result of pressures, as some physicists now imagine. For the immediate purposes of the astronomical theorem the content of the observed facts is all that is required. Obviously, the principle involved in this simple case remains the same in the most complicated cases of causation with which science can deal; and so the "positive" stage of thought, of which Comte believed himself to be the herald, would be a stage in which this Newtonian way of considering things would become universally regarded as finally sufficient for the interpretation of nature. From the positivist point of view, therefore, the world in all its actual complexity, man and his loftiest attributes included, is but a variegated succession of groups of events between which there obtain divers relations of coexistence and sequence; and the detection and description of these relations is the sole legitimate business of philosophy, which has nothing whatever to do with Cause, and knows nothing of any ultimate Existence as the source of phenomenal events. This, it will be seen, is at bottom identical with the skeptical nihilism of Hume, the chief difference between the two philosophers being that Comte sought to construct an elaborate dogmatic system upon a basis which to Hume seemed only to afford a ground for skepticism. That the positive mode of philosophizing, as thus described by Comte, bears a strong resemblance to the mode of philosophizing habitually adopted by modern scientific thinkers, cannot be denied. And this is, I believe, because Comte's description of the scientific process is correct as far as it goes. It is true that in such scientific operations as the undulatory theory in physics, or the theory of definite proportions in chemistry, or the hypothesis of physiological units in biology, we do turn our attention away from metaphysical conceptions of force and cause and concentrate our attention upon the mere sequent grouping of phenomena. But the anti-positivist school, of which Mr. Herbert Spencer is the great representative, maintains that in this scientific restriction of inquiry to mere phenomenal sequence we have simply the most extensive application of an artifice to which science has hitherto owed most of its triumphs—namely, the artifice of abstracting from Things those aspects of them with which we can most securely deal. Thus, the lines and circles of geometry are fictions, in the sense that no such things are to be found in nature; and so the "attraction" of the physicist and the "atoms" of the chemist are as likely as not fictions in the same sense: whether they are or not is all one to the scientific inquirer, so long as they are of service in bringing his ideal constructions into agreement with observation. But in saying this we do not say that there is no basis in nature for lines and circles, nor do we imply that there is no such thing as an intimate constitution of matter, even though our attracting atoms may not be the sort of things of which matter is made up. In short, we recognize that in disregarding the ontological side of any problem, and confining our attention to the phenomenal side, we are only employing a scientific artifice due to the limitation of our faculties; we do not for a moment imply that the problem has no ontological side. On the contrary, we hold that beneath every physical problem there lies a metaphysical problem, which doubtless we can neither solve nor elude, yet in default of an answer to which our vaunted physical solution remains merely symbolic. And in similar wise, with reference to the interpretation of the world as a whole, we hold that Cause cannot be ignored save as a temporary artifice of thinking, and that phenomenal existence cannot be rationally conceived without positing an Absolute Existence of which the former is the manifestation.

In the light of this statement of dissent it seems that the real character of what Comte meant by positivism is more fully brought out than it could be in any other way. To know what anything is, we must know what it is not. And we now can see clearly that in the Comtist scheme the "positive" stage does not mean merely the scientific stage of thought on all manner of subjects, toward which every one must admit that society is progressing. It means more than this, for it means a stage of thought the very possibility of which may well be denied by truly scientific thinkers, and is in fact denied by some whose names rank second to none. It is Prof. Huxley who says of the word "positive" that "in its specially philosophical sense, as implying a system of thought which assumes nothing beyond the content of observed facts, it implies that which never did exist, and never will."

With regard to this fundamental doctrine of the "three stages," therefore, Mr. Spencer and his school hold a position diametrically opposed to that held by the Positivists. Between the three terminal conceptions—of God, of Nature, and of Law—as above described by Comte, we deny that there is any incongruity, or that the latter supersedes the former; and we maintain, on the contrary, that science, when properly understood, remains quite at one with metaphysics and theology in the assertion of Unconditional Existence as the source of Conditioned Existence. While in Comte's system, therefore, the assumed conflict between science and religion is emphasized and perpetuated, in Mr. Spencer's system it disappears entirely. The system of Mr. Spencer has by many persons been supposed to be akin to positivism, because, like the latter, it rejects as illegitimate sundry *a priori* methods of arriving at truth which have hitherto been more customarily associated with the processes of metaphysics and theology than with those of science. But this surface resemblance only shows that all modern philosophy, following out a tendency which has been apparent for two centuries, is becoming more and more thoroughly permeated by the scientific spirit of skeptical wariness in its method of reaching conclusions. Though Comtists and Spencerians alike claim to be scientific, yet they differ so fundamentally as to what science means that their systems may be more truly described as the two opposite extremes of scientific philosophizing. The difference between them is the difference between a system that is radically revolutionary and quasi-atheistical, and a system that is conservatively progressive and in the deepest sense theistic.

This difference is further eludidated by Comte's theory of sociology, and it serves in turn to elucidate that theory. To give even a sketch of Comte's brilliant contributions to the philosophic study of history would be out of the question in the limited space at our disposal. We can only hint at the character of his fundamental position. The so-called "law of the three stages," just criticised, is regarded by Comte as the law of the intellectual progress of society; and the fifth volume of his great work is a splendid survey of European history, in which this theory is applied and illustrated with admirable ingenuity. It should be read in connection with the *History of Civilization* by Guizot, which in many respects it strongly resembles, though the latter writer, while inferior to Comte in depth of thought, yet far surpasses him in philosophic appreciation of the democratic and Protestant aspects of modern society. Along with the progress from theological to positive habits of thought, Comte joins the progress from military to industrial modes of life, and maintains—incorrectly, as we should hold—that the latter change is determined by the former. This brings us to his fundamental point. He passes over the history of moral progress, and while admitting as a fact the growth of the sympathetic and social feelings at the expense of the selfish and unsocial, he yet fails to take this into the account as the pre-eminent factor in social changes, and always argues as if social amelioration were the product of a reformation of speculative beliefs. Instead of recognizing that the framework of society is based ultimately upon *character*, he regards it as based ultimately upon *opinion*. To this, as to nearly all the theorems of positivism, the Evolutionists of Mr. Spencer's school oppose a di-

rectly contrary theorem. Without forgetting that man is a complex phenomenon, wherein opinion and character are facts inextricably mixed together, we hold that the latter is a more fundamental fact than the former in determining social progress. We hold that men's opinions depend more on their characters than their characters upon their opinions, and that, in order to improve society, it is not enough to effect a change of beliefs, but it is further necessary that there should be a gradual change in men's dispositions and prevalent motives. Now, improvement in character is a slow result of countless influences summed up in what has been called social discipline, and accordingly we do not suppose it possible to effect a radical reformation of society—to bring in the millennium, for example—by any such movement, taken separately, as can be carried out by one man or a single generation of men; least of all, do we believe it possible to reform society by means of philosophy. The whole structure of positivism, the whole lifework of Comte, is founded on the precisely contrary belief, that society can be reorganized by means of philosophy—that in order to ensure a more harmonious co-operation of human interests it is sufficient to effect a unification of men's beliefs. The evil which Comte always regarded as the grand fundamental evil to be remedied, and which is always thus alluded to by his followers, is what they are fond of calling "the intellectual anarchy of the Western World." Note how profoundly in accordance with the general temper of Comte's mind is the belief that individuality, as involving variety in opinion and behavior, is equivalent to "anarchy," and that "order" means uniformity. It was to put an end to this "anarchy," and to inaugurate an era of uniformity in belief and conduct, that Comte entered upon his long series of philosophical labors; and from first to last he kept this end steadily in view. All his profound studies in the philosophy of method, and all his elaborate historical generalizations, were merely as incidents in the accomplishment of this great central task. And perhaps he is not alone among famous thinkers in that his incidental labors were mainly successes, while his central task turned out to be an utter and, as we shall presently see, a ludicrous and contemptible failure.

To appreciate the form which Comte's practical application of his sociological theories finally assumed, it is necessary to recur for a moment to the circumstances of his private life, and to observe what happened after his rupture with St. Simon in 1824. In the year following this event he was married to Caroline Massin, bookseller; and in 1826 he had sufficiently matured the scheme of his positive philosophy to begin the systematic exposition of it in a course of seventy-two lectures, under the auspices, as Mr. Lewes tells us, of such men as Poinsot, Blainville, Carnot, and A. von Humboldt. But the cerebral excitement attendant upon the preparation of these lectures had been extreme, and after some three or four had been delivered the course was brought to an end by an attack of acute mania, which made it necessary for a time to place the young philosopher under the care of Esquirol. Comte was soon, however, taken from the asylum, and, with his mother and wife for nurses, so far recovered as to be able in 1828 to proceed with his work. In 1830 the first volume was published, and in 1842, after twelve years of unremitting labor, the sixth and concluding volume appeared. In this same year he was separated from his wife, with whom his relations seem never to have been pleasant, and about this time he lost an office in the École Polytechnique which he had held since 1833, so that he was once more without means of supporting himself. "To mitigate the blow," says Mr. Lewes, "three Englishmen—Mr. Grote, Mr. Raikes Currie, and Sir W. Molesworth—through the intervention of Mr. Stuart Mill, offered to replace the official salary for one year, understanding that at the end of the year Comte would be either reinstated or would have resolved on some other career." The position was not regained, and the subsidy was not renewed, though Mr. Grote sent 600 francs additional; and Comte's indignation was great at the refusal of his wealthy English friends to keep up a contribution to his support, to which he considered himself as legitimately entitled in virtue of his services to philosophy. In this aberration of moral sentiment one can see that the unbalanced or quasi-insane period of his life was beginning. In 1845 he conceived an intense affection for Madame Clotilde de Vaux, a lady who had been "separated from her husband by a crime which had condemned him to the galleys for life." Comte's relations with this lady (who died the next year) seem to have been entirely of the kind that are in polite slang termed "platonic," but they gave a color to all his after life and speculation. However the fact is to be explained, certain arrogant pontifical moods of feeling, which had at times been apparent in the earlier part of his life, now took entire possession of him. His old project, of inaugurating a new philosophy which should renovate human society, now assumed the form of an attempt to institute a new religion, which Prof. Huxley has happily and tersely described as "Catholicism *minus* Christianity," and in which Comte, instead of the pope, was to be sovereign pontiff. In one of his works, published some seven years after this time, he alludes to it as the era in his life when to the career of Aristotle, which he had hitherto followed, he added the career of St. Paul! Yet the philosophic germs of this later career, as above hinted, are apparent enough in his earlier work. There was no such break between his earlier and his later speculations as one would infer from reading Mr. Mill's little book on *Auguste Comte and Positivism*. The early philosophic project for reorganizing society came to be transfigured into a quasi-religious project, but its general outlines underwent no further change than was necessarily implied in such a transfiguration of external aspect. The end in view still was to ensure a fixed and uniform standard of social action by establishing a fixed and uniform standard of belief; but the attainment of such a standard by means of scientific methods was no longer deemed sufficient: in addition to this there must be a uniform religious impulse and a uniform cultus. But as the assumed outgrowing of the theological stage of thought involved the ignoring of Deity, and as even Comte was not able to imagine a religion without some sort of a god, it became necessary to furnish some new kind of deity as the source of this new religious impulse and the object of this new cultus. This new kind of deity, according to Comte, is Humanity, and the religious impulse of the future is to be the impulse to serve Humanity and to deserve well of it. It must be admitted that the ethical side of this conception of religion is lofty enough, but the speculative side of it may well seem too grotesque to be seriously entertained by any one endowed with the slightest modicum of that sense of humor which, next to religious faith, is the most desirable possession of a human being. Comte spent the later years of his life in rearing upon this basis a system of practical philosophy astonishingly minute in detail, which in complicated absurdity has probably never been matched by the productions of any other human mind. To describe the details of such a scheme would be out of place in an article like the present one, our duty in this regard being sufficiently discharged by referring the reader to the books in which the scheme is elaborately expounded. It may suffice to note that the ideal of society, as described by Comte, is a state in which everything—even to the minutest details of life—is to be prescribed by unquestioned authority, in which the New Pope or "high priest of Humanity" is to decide upon the age at which each man shall be married, what profession he shall choose, upon what scientific researches he shall enter, and when he shall become *emeritus* as to the general work of life. No caliph, in his wildest dreams of absolutism, ever imagined such a state of things as Comte sought to work out for his ideal society. The main features of this scheme were shaped in curious accordance with the Roman Catholic ideal as conceived by the mediæval popes. There was to be a class of philosophers corresponding to the class of priests under the old régime, with unlimited control over opinions. The arch-philosopher, or "high priest of Humanity," was to supersede the pope; and Paris was to be the holy city of the Positivist as Rome had been the holy city of the Roman Catholic. A new calendar was to be instituted, beginning with the French Revolution of 1789, and like the old one was to be made up of saints' days, save that philosophers, poets, legislators, inventors, and pre-eminently deserving men of all sorts, and from all ages and countries, were to be substituted for the saints of the old calendar. And for the Virgin Mother an antitype was to be found in the ideal of Humanity, symbolized as "a woman of thirty with a child in her arms." And so on throughout a host of dreary and arbitrary details.

This, it will no doubt be thought, was a sorry outcome for an attempt which had begun with a profound classification of the doctrines and methods of science, and with an elaborate survey of human history. And such frivolity seems too puerile to have come from a man who, with all his shortcomings, must always hold a high place among the solid thinkers of the first half of the present century. It seems to me that the true explanation of these aberrations is to be found in the theory that during the later years of his life Comte was really insane. Many profound and sensible thoughts are to be found in the *Positive Polity* and in the *Catechism of Positive Religion;* and this fact has been urged in defence of the essential sanity of Comte's mind. But even madmen may often be wise and reasonable; and we need not suppose that the insanity of a powerful and learned thinker like Comte must necessarily resemble that of a weak and uncultured mind. The phe-

nomena of mental alienation may be as diversified as those of mental health; and there are so many degrees of insanity that it is not unfrequently difficult to define it sharply. Certainly, I would not be understood as attributing an ordinary form of insanity to the founder of positivism. His first great work shows no sign of mental unsoundness, though it had been preceded by a cerebral attack. But long before this work was concluded Comte had entered upon a course of life which was not only a symptom of mental eccentricity, but was quite well calculated to bring on a mental one-sidedness hard to distinguish from monomania. He kept entirely aloof from society, and even from the reading of contemporary literature, and buried himself in seclusion, with no company save his own meditations and a few mystic writers of the Middle Ages. This he called "cerebral hygiene," but, as elsewhere argued, such a course is always likely to beget eccentricity, and most of all in the case of so impatient and egotistical a thinker as Comte. And when such eccentricity has been carried to a certain length it becomes a mere question of words whether we are to call it insanity or not.

In the very last years of Comte's life this mental aberration became even more unmistakable. After finishing the *Positive Polity* he began a new work, called *Subjective Synthesis*, in which it is recommended that decimal numeration should be abandoned in favor of a septimal system, because seven is a sacred number, and, moreover, being a prime number, is better fitted to inspire the human intellect with a sense of its necessary limitations! Every volume, moreover, constituting a distinct treatise, should consist of "seven chapters, besides the introduction and the conclusion; and each of these should be composed of three parts. Each third part of a chapter should be divided into seven sections, each composed of seven groups of sentences, separated by the usual break of line," etc. etc. "These rules of composition make prose approach to the regularity of poetry, when combined with my previous reduction of the maximum length of a sentence to two manuscript or five printed lines—that is, 250 letters." The author did not live to complete these fearful and wonderful speculations, but died soon after the publication of his first volume, on Sept. 5, 1857.

At his death Comte left behind him one great disciple, M. Émile Littré, one of the wisest thinkers and most consummate scholars that France has produced—inferior, perhaps, to his master in scientific depth, but vastly superior to him in learning and in practical sagacity. But M. Littré is regarded as half a heretic by the thorough-going disciples of Comte, as he refused to follow his teacher through his later vagaries. M. Robinet, the eminent physiologist, is also a follower of Comte; and besides this, a small number of Positivists, under the leadership of M. Laffitte, continue at Paris to profess the "religion of humanity." In Germany, positivism has never gained any footing at all; in England, only a slender and precarious one. Among eminent English thinkers Comte exercised considerable influence over Mr. Mill, and made a partial conquest of Mr. Lewes. Among the declared followers of Comte in England are Mr. Congreve, Prof. E. S. Beesly, Mr. Harrison, and Dr. Bridges; and Mr. John Morley, editor of the *Fortnightly Review*, has been considerably influenced by him. Mr. Congreve is at the head of a so-called "positivist church" in London; and an attempt to get up a similar society has been made in New York. But while it has furnished many valuable suggestions, the influence of positivism as a whole upon the philosophic thought of the present generation has been slight; and that influence is visibly waning. The most eminent English thinkers, such as Prof. Huxley and Mr. Spencer, have shown toward it, from the outset, the most determined hostility. As a rule, the positivist school of the present day is characterized by a sympathy with Communists and belligerent workmen, a partiality for the short and sharp despotic method of settling social questions, a tendency to regard politics from the sentimentalist point of view, a dislike to individuality of thought, an obtuseness to the requirements of scientific method, and (in the speculative region) a more or less open hostility to the theory of evolution, the doctrine of the correlation of forces, and other theories which have assumed prominence since the time when their master Comte stigmatized such kinds of theorizing as "metaphysical" and "chimerical."

Bibliography.—The works of Auguste Comte are as follows: *Cours de Philosophie positive* (6 vols., Paris, 1830–42; since republished with preface by Littré, 1864); *Traité élémentaire de Géometrie analytique* (1843); *Traité philosophique d'Astronomie populaire* (1844); *Discours sur l'Esprit positif* (1844); *Discours sur l'Ensemble du Positivisme* (1848; afterwards included in the *Politique positive*); *Calendrier positiviste* (1849); *Culte systématique de l'Humanité* (1850); *Catéchisme positiviste* (16mo, 1852); *Système de Politique positive, ou Traité de Sociologie, instituant la Religion de l'Humanité* (4 vols., 1852–54); *Appel aux Conservateurs* (1855); *Synthèse subjective* (tom. i., 1856);—all at Paris, and, except the *Catechisme*, in 8vo. *English translations: The Positive Philosophy*, by Miss Harriet Martineau, very much abridged (2 vols. 8vo, Lond., 1853; New York, 1858); *Catéchism of Positive Religion*, by Richard Congreve (12mo, 1858); *A General View of Positivism* (*Discours sur l'Ensemble*, etc.), by J. H. Bridges (8vo, 1865);—all at London. A translation of the *Politique positive* is announced as about to appear in London. Part of the 1st vol. of the *Philosophie positive*, translated by W. M. Gillespie, was published (New York, 1858) under the title *Philosophy of Mathematics*. A review entitled *La Philosophie positive*, conducted by Littré and Wyrouboff, has been published six times a year in Paris, since July, 1867. As auxiliary expositions and discussions of the positive philosophy, the student should consult Littré, *Auguste Comte et la Philosophie positive* (Paris, 1864); *Paroles de Philosophie positive* (1863); *Auguste Comte et Stuart Mill* (1866); Pellarin, *Essai critique sur la Philosophie positive* (Paris, 1864); Robinet, *Notice sur l'Œuvre et sur la Vie d'Auguste Comte* (Paris, 1864); Blignières, *Exposition de la Religion et de la Philosophie positive* (Paris, 1857); Mill, *Auguste Comte and Positivism* (London and Boston, 1866); Bridges, *The Unity of Comte's Life and Doctrine* (London, 1866); C. G. David (*pseudon.*), *A Positivist Primer* (New York, 1871); Lewes, *Comte's Philosophy of the Sciences* (London, 1853); *History of Philosophy* (3d ed., 2 vols., London, 1867; the edition republished in this country by D. Appleton & Co., New York, is the 2d ed. of 1857, in which the subject is much less thoroughly treated). These are the principal works out of a considerable body of literature which has accumulated about the subject. For hostile criticisms see Huxley, *The Scientific Aspects of Positivism*, in his *Lay Sermons* (London, 1870; reprinted in New York); Spencer, *Recent Discussions in Science, Philosophy, and Morals* (New York, 1873); and *Outlines of Cosmic Philosophy* (2 vols., London, 1874, and Boston, 1875), by the present writer. JOHN FISKE.

Pos'se Comita'tus [Lat.], literally, "the power of the county." By the common law the sheriff while engaged in executing process, especially when it was criminal, or in pursuing and arresting felons, or in exercising his functions generally as the chief administrative officer charged with the duty of keeping the peace, was authorized to summon to his aid if necessary all the men above the age of fifteen years within the county, with a few exceptions, and they constituted, in the ancient technical nomenclature, "the power of the county." The same authority is given to the sheriff in this country, although its exercise is often regulated by statute. The ordinary cases in which such a resort is had to the active assistance of private citizens are the quelling of riots, the overcoming of forcible seizures or detainers of land, the subduing of forcible rescues made or attempted of persons arrested pursuant to the command of a proper writ, and the resistance to any forcible measures in opposition to the execution of public justice; in short, wherever a breach of the peace has attained, or threatens to attain, such magnitude that the officials themselves are unable to suppress it. Since the sheriff may call out the entire power of the county, he may, at his discretion, under the circumstances above described, summon one or more individuals, or any number less than the whole, when their help is necessary to enable him to accomplish his public duty. Certain classes, however, who are incompetent to render any valuable aid, are exempt—namely, the sick and infirm, those under the age of fifteen, and women. JOHN NORTON POMEROY.

Possibil'ity [Lat. *possibilitas*], in law. This term is used to denote both a future uncertain event, and a future contingent interest in land or personalty depending upon such an event. Possibilities are either "bare" or "coupled with an interest," and also "near" or "remote." A bare possibility is the mere chance or hope of succeeding to an estate, without any present right or interest; as, for example, the expectation of the heir during the life of his ancestor; it is in no sense property, and cannot be transferred nor released. A possibility is said to be coupled with an interest when an estate or right has been given to a person upon the happening of some future and uncertain event, as in the case of many contingent estates. A possibility is near when the contingency is single; as, for example, an estate given to A upon the death of B; it is remote, where two or more doubtful events must take place in succession, and an estate is given upon the happening of the last in order. JOHN NORTON POMEROY.

Post and **Post-Office.** See POST-OFFICE, by G. G. HUBBARD.

Post, tp., Allamakee co., Ia. (POSTVILLE P. O.), on Milwaukee and St. Paul R. R. P. 1223.

Post (ALFRED CHARLES), M. D., LL.D., b. in New York City Jan. 3, 1806; graduated at Columbia College, N. Y., 1822; has been attending and consulting surgeon to various hospitals and institutions in New York City (among them St. Luke's Hospital), and professor of general surgery in the medical department of the University of New York from 1851 to the present time.

Post (MINTURN), M. D., b. in New York June 28, 1808; graduated at Columbia College 1827; took his medical degree at the University of Pennsylvania 1832; studied in Paris under Louis and other eminent instructors; practised for many years with success in New York, giving special attention to diseases of the chest. D. in New York Apr. 26, 1869; translated Raciborski on *Auscultation and Percussion.*

Post (TRUMAN MARCELLUS), D. D., b. at Middlebury, Vt., June 3, 1810; graduated at Middlebury College 1829; was principal of an academy at Castleton, Vt., 1829–30; tutor at Middlebury 1830–32, during which time he studied law; spent the winter of 1832–33 at Washington, D. C., hearing the debates in Congress and the Supreme Court; was a short time at St. Louis, Mo.; settled at Jacksonville, Ill., and was admitted to the bar, but in the same year (1833) accepted the professorship of languages in Illinois College at that place; subsequently became professor of history; was ordained to the ministry and installed pastor of the Congregational church at Jacksonville 1840; became in 1847 pastor of the Third Presbyterian church at St. Louis, Mo., and in 1851 of the First Congregational church, then formed in the same city, which position he still (1876) holds. During his pastorate in St. Louis, Dr. Post has also officiated as professor of history in Washington University in that city, professor of ecclesiastical history in the theological seminary at Chicago, Ill., and lecturer on Congregationalism in the seminary at Andover, Mass. He has contributed to the *Biblical Repository* and other periodicals, has printed a number of pamphlets, addresses, and sermons, and is author of *The Skeptical Era in Modern History* (New York, 1856).

Post (WRIGHT), M. D., b. at North Hempstead, L. I., Feb. 19, 1766; studied medicine in New York and Europe; became a practitioner in New York 1786; received in 1792 the professorship of surgery, and later that of anatomy and physiology in Columbia College; became professor of anatomy in the College of Physicians and Surgeons 1813, its president 1821–26; author of various professional papers and lectures. D. at Throg's Neck, N. Y., June 14, 1828.

Postel (KARL). See SEALSFIELD (CHARLES).

Post'humous [Lat. *postumus*, sometimes *posthumus*, "the last"] **Child** (law), a child born after his father's death; and the term is also applied to the very exceptional case of a child taken from the dead body of its mother. It is a general doctrine of the law that for all purposes of succession, either from an intestate or by a will or marriage settlement, a legitimate posthumous child is regarded as though born at the death of its father, so that it is able to inherit the land or succeed to the personal estate, or take the property given by the testament or deed, provided that it would have done so if it were born before the father's decease. JOHN NORTON POMEROY.

Post Liminium. See POSTLIMINY.

Postlim'iny [Lat. *postliminium*], a Roman law-term, literally denoting "return behind one's own threshold" or "into one's own house;" then, especially, return from a state of capture and its consequences, or restoration to former political and other rights. Capture in war, as well of a Roman as of any one else, was held to make him a slave; and as a slave could make no will nor have any civil rights, the captured Roman's rights of property, citizenship, even of family, would be by this calamity not merely suspended, but brought to an end. The right of testament was saved from the effect of capture by the fiction of the Cornelian law, according to which the soldier was conceived of as having been killed in battle while yet a free Roman. The rights of citizenship, family, and property were saved by the *jus postliminii*, by which, if he had freed himself during war or had been restored by treaty, it was assumed that he had never been away. This right of postliminy has been applied in international law to recapture; but as capture in Christian nations does not involve slavery, it is unnecessary as far as persons are concerned; and as far as the rights of an original owner of recaptured property are concerned, there is no need of applying to them the principles of Roman postliminy, nor can it well be done.

T. D. WOOLSEY.

Post Oak, tp., Johnson co., Mo. P. 2631.

Post'-Office, The. Couriers for the conveyance of letters and despatches for kings and princes are as old as empires and kingdoms. The vast extent of territory and the great number of kings and satraps subject to the emperors of Persia and Assyria required them to maintain regular couriers to bear their commands and bring reports from their distant provinces. The first system of posts seems to have been established by the Romans, and from the Latin the word *post* is derived. It was the policy of the Romans to maintain constant communication with all the countries that became subject to them, and for this purpose they constructed "royal ways" from Rome through all the countries of Europe, and their route is to-day easily traced through Italy, France, England, and Germany. At intervals were greater and lesser posts; the first, at the termination of a day's journey, was a camp with a small band of soldiers and a large equipment of men, carriages, horses, and supplies, and whatever was necessary for expediting couriers or travellers on their way; at the other were the relays of horses, and over all was the Roman eagle. Along these ways the couriers bore public and private letters, while passengers and merchandise were carried by slower conveyances. On one occasion it is said that a courier travelled nearly across the continent of Europe at the rate of 160 miles a day. As the power of Rome declined the posts were gradually abandoned, the ways neglected and deserted, until the Dark Ages removed these vestiges of civilization. The Renaissance of the thirteenth and fourteenth centuries led to a renewal of intercourse between different parts of the same country and with foreign states, and by slow degrees the highways were renewed and posts were again seen travelling through the land—at first on horseback, afterward by carriage. On the Continent the postal service was established for the convenience of the sovereigns and nobles, but subsequently the carriage of passengers, freight, and the letters of private individuals was permitted. The service was generally performed by the sovereigns, who owned and maintained the equipment, that they might retain the power of inspecting all correspondence; sometimes the monopoly was given to private individuals. The posts of the counts of Thurn and Taxis were maintained for many generations, and their stamps are found in all large collections of stamps. The carriage of the mails in England was generally left to private parties, although even there it was repeatedly farmed out as a monopoly to favorites of the Crown. The introduction of stage-coaches at the close of the last century gave despatch and regularity to the postal service of Great Britain, and about 1800 the mails were carried with as great rapidity as the posts of the Romans.

The post-office abroad was established for the use of the rulers, and the cost was defrayed by regular taxes; but when the people were permitted to use it they were charged for the privilege a postage high enough to pay all expenses and yield a large revenue to the state. In America a different system has always prevailed: here it was established for the benefit of the people, and as public intelligence contained in newspapers was for the public benefit, they have been carried free or for a very small postage, and private intelligence or letters have been carried at a higher rate, the revenue derived from these two classes of mail-matter being high enough nearly to cover the expense of the service. The post-office existed in America from its earliest settlement. Originally, it was merely a receptacle in the coffee-house, where letters arriving from abroad were deposited, and taken by those to whom they were addressed or carried to them by their neighbors. The first legislation on the subject is found in the records of the general court of Massachusetts for 1639, and the next in the colonial law of Virginia in 1657; these illustrate the character of the service. That of Massachusetts provides "that notice be given that Richard Fairbanks his house in Boston is the place appointed for all letters which are brought beyond the seas or are to be sent thither, to be left with him; and he is to take care that they are to be delivered or sent according to the directions; and he is allowed for every letter a penny, and must answer all miscarriages through his own neglect in this kind." The colonial law of Virginia required "every planter to provide a messenger to convey the despatches, as they arrived, to the next plantation, and so on, on pain of forfeiting a hogshead of tobacco for default." Gradually, a postal service was established between the several colonies, and in 1672 there was "a post to goe monthly from New York to Boston." In 1710 the postal service of the British empire was consolidated into one establishment, the chief offices at Edinburgh, Dublin, and New York. One of the earliest acts of the Continental Congress was the establishment of a post-office and post-routes from Falmouth, Me., to Savannah, Ga., "for conveying intelligence and letters throughout this continent," and to spread knowledge of the acts of Congress and the progress of the

Revolution among the different colonies. Benjamin Franklin was the first postmaster-general, and under his practical management it was soon extended through all the colonies. Franklin's connection with the post-office began early in life—in 1737 as postmaster at Philadelphia —and continued for over forty years. Newspapers were generally published by the postmasters of the several cities, and their papers were not only sent free through the mails, but all others were excluded. Franklin was the first to give equal privilege to all publishers; subsequently, a small sum was charged as postage, which seems to have been a perquisite of the postmaster, but no regular postage on newspapers was established by law until 1792. For some years subsequently to 1776 the postage was paid in currency, and was increased as the value of the currency depreciated until it became impossible to keep up with the decreasing value, when the rate was reduced and made payable in specie. The rates of postage fixed in 1792 were continued, with a few unimportant changes, for more than fifty years. There were nine different rates: for 30 miles and under, 6 cents; over 30 and not exceeding 60 miles, 8; between 60 and 100 miles, 10; between 100 and 150 miles, 12; between 150 and 200 miles, 15; between 200 and 250 miles, 17; between 250 and 350 miles, 20; between 350 and 450 miles, 22; over 450 miles, 25. These high and various rates amounted almost to a prohibition of correspondence. Few letters were sent, and from 1800 to 1830 the increase scarcely kept pace with the growth of the population. Many letters were sent by private hand, and after the express companies were started a great many were sent by them at less than the postage, and though the post-office department endeavored to prevent it at different times, was unable to do so. But the post-office for the use of the people and as the agency of the government, in which they are more immediately interested than in any other department, is the product of the present generation. In 1845 the number of letters and transient matter mailed throughout the U. S. was about 29,000,000; in 1875 the number of letters and transient matter mailed in the city of Boston alone was about 39,000,000, or one-third more than was mailed in the whole country by the preceding generation. The entire expenditures of the department during fifty years ending in 1833 were $34,700,000; revenue, $36,400,000. During the year 1875 the expenditures were $33,611,000, the revenue, $27,441,000. The number of letters and transient matter mailed in fifty years was less than 100,000,000, while during the year 1875 nearly 900,000,000 letters and transient matter, besides newspapers, were transmitted—nine times as many letters in one year as in fifty, at about the same cost. Prior to 1851 the department was self-sustaining, although in some years the receipts were less than the expenditures; since then the expenses, with the exception of one year during the war, have invariably exceeded the income. In the year 1851 the postage on newspapers and magazines was greatly reduced, and bound books were first carried by mail at less than letter-postage; subsequently, seeds, clothing for soldiers, ores, minerals, and merchandise generally were made mailable matter. The weight of these parcels was at first limited to 12 ounces, but subsequently increased to 4 pounds. The weight of the mails and their cost have been greatly increased by the carriage of newspapers and parcels. It appears, from a statement prepared by the department in 1875, that letters pay an annual profit of $4,000,000, and that all other mail-matter yields $11,000,000 less than it costs, as will appear by reference to the table at the end of this article.

The rapid growth of the postal service has not been confined to America, but has extended to all civilized countries. It commenced in Great Britain in 1840, five years earlier than in this country, when penny postage was introduced after a contest of many years, and in three years the correspondence was quadrupled. In all the countries of the Continent a similar result has taken place. This increase is due to four causes: first, the reduction of letter-postage from an average of 12½ to 3 cents in this country, and from 15 to 2 cents in Great Britain; second, the introduction and extension of railroads, by which intercourse with different places is facilitated, more frequent mails are sent, and much greater despatch made than by the old methods of travel; third, by the extension of the mail-routes to the dwellings of the inhabitants of large cities through the letter-carrier system; and fourth, by increased efficiency in the management of the department, and by the greater activity and stimulus in the habits of men and in the business of the country.

In Great Britain a postage of 2 cents on letters and 1 cent on newspapers yields a net revenue of $13,710,000. In America a postage of 3 cents on letters and 2 cents a pound on newspapers, equal to about 4 mills on a single newspaper and of 8 cents a pound on third-class matter,† costs $6,000,000 over and above the receipts. This is due to the low postage on newspapers and third-class matter, and to the extent of our mail service. Long mail-routes are maintained at an enormous expense through territories where there are but few inhabitants, while two out of every three of the post-offices do not pay even their office-expenses. In six States the profits in 1875 exceeded the expenses by a sum sufficient to cover the loss in twenty-two other States, leaving nine States and Territories from which this large annual deficit arises.

General Postal Statistics.

Year.	Country.	Population.	Number of letters.	Journals and printed matter.	Letters, average number to each person.	Receipts.	Expenditures.
1874	Great Britain.	31,847,000	967,000,000	259,000,000	30	$18,758,000	$15,047,000
1874	Germany.......	41,070,000	697,000,000	350,000,000	17	23,077,000	21,053,000
1874	Austria.........	20,394,000	245,000,000	82,000,000	12	8,250,000	7,640,000
1874	Hungary.......	15,510,000	68,000,000	23,000,000	5		
1874	France...........	36,102,000	334,000,000	331,000,000	9	*22,083,000	*14,600,000
1874	Russia...........	65,704,000	63,000,000	24,000,000	1		
1873	Italy..............	26,871,000	104,000,000	94,000,000	4	4,562,000	4,440,000
1871	Spain............	16,835,000	78,000,000	....	4½		
1874	Sweden.........	4,341,000	15,000,000	....	3¾		
1874	Belgium.........	5,253,000	58,000,000	59,000,000	12		
1874	Switzerland...	2,669,000	63,000,000	39,000,000	24	2,893,000	2,586,000
1874	United States.	41,000,000	973,000,000	....	23½	27,441,000	33,611,000
1873	Canada..........	3,718,000	34,000,000	25,000,000	9	1,139,000	1,387,000

Our mails in 1875 were transported 75,000,000 miles by railroad over 70,000 miles of post-roads, and 58,000,000 miles by other modes of transportation over 208,000 miles of post-roads; total transportation, 133,000,000 miles over 278,000 miles of post-routes, at an annual cost of $15,353,000; 755,000,000 letters and unsealed circulars, besides newspapers and magazines, were distributed by 51,177 officers and employés through 35,547 post-offices. About one-third of the whole business originated in seven cities—Baltimore, Boston, Chicago, Cincinnati, New York, Philadelphia, and St. Louis—and one-fifth in New York alone. The system of free delivery has been extended to 88 cities and towns, and is self-sustaining, the amount of local postage exceeding its entire expense. The ratio of increase of the whole service in 1875 was 9 per cent.; in the free-delivery cities, 13½ per cent. Many of the railroads of the U. S. have placed upon them postal cars, attended by several clerks, which receive and deliver mails at the stations, the mails received being assorted while the cars are in motion. This system has been further extended by the improved facility of receiving the mails from hanging-posts by a crane or scoop, by the necessary adaptation of the car, without stopping at the stations, the mails being also delivered by being thrown from the car at the stations. In 1875 two fast-mail trains were put in operation between New York and Chicago and between New York and St. Louis, by which the time of delivery of mails is much lessened between the eastern and western portions of the U. S.

A system of registration for letters has been adopted. The fee is uniform at 10 cents for all parts of the world. Its use is increasing slowly, but the registration of letters will not be made generally available until some further improvements have been made and a prompt delivery of the package guarantied by the department, as is now done in some countries of Europe. The money-order system was introduced a few years ago, and is coming into general use; over 5,000,000 orders are annually issued, amounting in the aggregate to about $80,000,000. The rates were

* The rate on all third-class matter was fixed at 1 cent an ounce in Mar., 1875.

† 1873.

slightly increased by the act of Mar., 1875, and vary with the value of the order—from 10 cents for $15 to 25 cents for orders over $40 and under $50. These orders are issued payable in Great Britain, Switzerland, Germany, Italy, Canada, and Newfoundland. They illustrate the tendency of capital toward the centres of trade, and from the West to the East. Smaller offices issue more orders than they pay—larger ones pay more than they issue. The West issues nearly twice as many as it pays, and America issues nearly six times as many on Great Britain as it pays.

Postal-cards, a recent extension of the service, were first adopted by Germany. Their use has increased much more rapidly here than abroad. The number of letters mailed in Great Britain is 50 per cent. greater than with us, but the number of postal-cards mailed is one quarter less. This difference can be accounted for only by the fact that

Statistics relating to the Business of the Post-Office Department of the U. S.

For five years ending July 1.	Revenue.	Expenditures.	Profit and loss.	Cost of transportation.	Number of letters * and transient papers.	Average number to each person in five years.	Per cent. of increase.	Population.
1794	$384,000	$285,000	+ $99,000	$175,000	2,688,000			
1799	1,066,000	767,000	+ 299,000	463,000	7,462,000	$1\frac{4}{10}$	...	5,308,000
1804	1,964,000	1,415,000	+ 554,000	866,000	13,783,000	$2\frac{2}{10}$	80	6,311,000
1809	2,313,000	2,219,000	+ 94,000	1,439,000	17,191,000	$2\frac{4}{10}$	25	7,239,000
1814	3,476,000	2,786,000	+ 690,000	1,890,000	24,332,000	$2\frac{9}{10}$	40	8,435,000
1819	5,344,000	4,779,000	+ 565,000	2,980,000	35,538,000	$3\frac{7}{10}$	46	9,633,000
1824	5,652,000	5,852,000	— 200,000	3,896,000	37,364,000	$3\frac{7}{10}$	5	10,299,000
1829	7,420,000	7,295,000	+ 125,000	4,853,000	47,860,000	$3\frac{8}{10}$	28	12,866,000
1834	11,547,000	11,976,000	— 429,000	7,826,000	74,329,000	5	58	14,967,000
1839	19,215,000	18,178,000	+ 1,037,000	11,872,000	121,374,000	$7\frac{1}{10}$	64	17,069,000
1844	22,031,000	22,516,000	— 485,000	16,335,000	136,717,000	7	13	19,630,000
1849	21,358,000	21,208,000	+ 150,000	12,911,000	269,028,000	$11\frac{6}{10}$	95	23,191,000
1854	†31,731,000	35,139,000	— 3,408,000	20,707,000	457,024,000	$16\frac{6}{10}$	90	27,312,000
1859	39,171,000	59,568,000	—20,397,000	35,267,000	851,607,000	27	75	31,443,000
1864	50,902,000	63,565,000	—12,663,000	31,530,000	1,488,168,000	$42\frac{7}{10}$	50	34,748,000
1869	79,717,000	94,711,000	—14,994,000	43,878,000	2,194,659,000	$57\frac{5}{10}$	45	38,115,000
1874	111,393,000	136,258,000	—24,865,000	64,547,000	3,482,159,000	$82\frac{7}{10}$	56	41,000,000
Totals...	$414,689,000	$488,617,000	—$73,928,000	$261,535,000				
Year ending 1875	$27,441,360	$33,611,309	— $6,054,000	$15,353,369	973,275,000	$23\frac{1}{2}$	...	41,000,000

the postage on letters is 50 per cent. higher here than in Great Britain. The increase of postal-cards in 1875 was 18 per cent.; of ordinary postage-stamps, 6 per cent. Great Britain has the largest correspondence in proportion to population, but the ratio of increase is much less rapid than that of the U. S.; the average number of letters to each person for the year 1874 was 33 in England, 14 in Ireland, 30 in the United Kingdom of Great Britain. In Switzerland the average number is 24 to each person; next is the U. S., 23½ to each person; next Germany, Austria, and the Netherlands; France and Canada have about half as many as the U. S., and twice as many as Spain and Norway; Greece one-fourth as many as Norway, and four times as many as Russia. Belgium has the greatest number of post-offices in proportion to population, Great Britain the next, Spain one-tenth as many as Great Britain, while Japan leads Greece and Norway.

America has always had an interest in the interchange and development of its correspondence with Europe; the high postage formerly limited this correspondence. In 1865 the postage to England was 24 cents, to the Continent higher; only 6,000,000 letters were then exchanged with Europe. Our post-office was the first to propose a reduction of ocean-postage, and now 20,000,000 letters a year are exchanged.

At the invitation of Germany, in the year 1874 a postal congress of all the states of Europe, the U. S., and Egypt was held at Berne, and a postal convention was agreed upon, which was signed by the delegates from the countries of Europe and the U. S., and has been ratified by the several governments. A postal-union was organized, with a central office at Berne, under the supervision of the post-office department of Switzerland, for the purpose of considering and working out all questions in the interests of the union. It is expected that hereafter these conventions will be held every three years. Instead of the varying rates theretofore prevalent, a uniform postage was adopted of 5 cents on prepaid, and 10 cents on unpaid letters, weighing not over ½ an ounce, between all members of the union; newspapers, not over 4 ounces in weight, 2 cents; books and other printed matter and patterns of merchandise, not exceeding 8¾ ounces, 2 cents for each 2 ounces; postal-cards, 2 cents; prepayment invariably required except on letters.

England has taken the lead in almost every reform of the postal service. It was the first to adopt a penny postage; it has the best free-delivery system extending over both town and country, and issues postal money-orders payable in almost every part of the world. It receives and pays out deposits as a savings bank, allowing interest on deposits

Postal Statistics of Great Britain.

		Total number of letters.	Increase per cent. per annum.	Average number to each person.	Gross revenue.	Expenditure.	Net revenue.
Estimated number in	1839	76,000,000	......	3	$11,950,000	$3,730,000	$8,165,000
" " "	1840	169,000,000	122½	7	6,795,000	4,290,000	2,500,000
Average of five years.	1841–45	227,000,000	10	8	8,290,000	5,005,000	3,280,000
	1846–50	327,000,000	5	12	10,715,000	6,512,000	4,190,000
	1851–55	410,000,000	5¾	15	12,845,000	7,205,000	5,640,000
	1856–60	523,000,000	4½	18	15,675,000	8,925,000	6,745,000
	1861–65	648,000,000	5½	22	19,455,000	10,370,000	9,085,000
	1866–70	800,000,000	4	26	23,090,000	12,095,000	10,990,000
Year	1871	867,000,000	2⅓	27	24,500,000	12,795,000	11,700,000
"	1872	885,000,000	2	28	26,040,000	13,770,000	12,270,000
"	1873	907,000,000	2½	29	26,740,000	14,230,000	12,505,000
"	1874	967,000,000	$6\frac{7}{10}$	30	28,755,000	15,045,000	13,710,000

of small amounts, and has absorbed almost all the old savings banks; 1,670,000 individuals have on deposit $115,000,000. It issues licenses for dogs, horses, carriages, servants, guns, and game, from which it derives an income of over $2,600,000. It grants annuities and effects insurance on lives, and has in existence about 10,000 of these contracts. The post-office pays annually to the treasury nearly $14,000,000, net profits; it operates the postal telegraph, and transmitted in 1874 over 19,000,000 messages, at a net profit of $550,000, without including interest on the cost of the property. The letter-delivery in the city of London is unequalled. It begins early in the morning and continues till 7 or 8 o'clock in the evening, the last delivery being made after the arrival of the continental, Irish, and Scotch mails. It is their boast to find the residence of the addressee of every letter.

In all the countries of Europe the telegraph has been adopted as one of the postal agencies for the transmission of correspondence. The rates are generally low and uni-

* The number of letters prior to 1858 is ascertained by multiplying the yearly postage received on letters by the average postage; since then, by the number of stamps issued; these include stamps on transient newspapers, magazines, and other third-class matter, and parcels having more than one stamp, which amount to about 20 per cent.; newspapers and periodicals issued to regular subscribers are not included. There are no means of ascertaining how many of this class are mailed, as they are weighed, and the postage paid by the weight of the parcel.

† Including permanent appropriation of $700,000 a year for franked matter.

form, the business large, and a source of profit in almost every country. Switzerland takes the lead in this correspondence, and transmits 81 telegrams a year for each 100 of its inhabitants; Great Britain, 54; Belgium, 52; Germany, 32; the U. S. one-half as many as Switzerland; and France one-half as many as the U. S.

In Great Britain the postage on letters not exceeding 1 ounce is 2 cents; on registered newspapers, 1 cent; on books and printed matter, 1 cent for each 2 ounces; prepayment invariable. The size is limited to 18 in. $\times$ 9 in. $\times$ 6 in., and the weight to 5 pounds. No other kinds of parcels are mailable, unless at letter-postage, excepting samples for foreign countries. In France the postage is 3 cents for drop-letters, 5 cents for others; double rates if not prepaid. Journals and periodicals treating of politics and social economy, 4 centimes, or 8 mills; other journals, 8 centimes = 16 mills; other printed matter, 4 mills a gramme,* increasing 2 mills for each added gramme; samples of merchandise, 3 cents for 50 grammes, adding 1 cent for each additional 50 grammes to 300, the extreme limit; other parcels are not mailable except at letter-rates. In almost all the other countries of Europe merchandise is mailable, but in these countries it is not received, transmitted, or delivered with letters, but through separate bureaus and by other conveyances: the rates vary with the weight, distance, and speed of transmission. In America all mail-matter is divided into three classes—letters, 3 cents $\frac{1}{2}$ ounce; newspapers and journals issued to regular subscribers, at 2 and 3 cents a pound; and all other matter, not weighing over 4 pounds, that can be sent without injury to the employés or mail, 1 cent an ounce.

The United States Official Postal Guide, published by Messrs. H. O. Houghton & Co. of Boston, at the Riverside Press, "is revised and published by authority of the post-office department." It is a very useful manual, containing the regulations of the department and full instructions to the public, and information required by those who have any transactions with the department.

Tabular Statement of the Cost, Revenues, and Comparative Profit and Loss of carrying the different Classes of Mail-matter for the period of one year, in the United States.

Class of mail-matter.	Total number pieces of mail-matter of each class originating in U. S.	Per cent. of the number of each class to total of all classes.	Total weight of each class of mail-matter originating in U. S.	Per cent. of the weight of each class to total of all classes.	Number pieces each class of mail-matter to each pound.	Revenue from each class of mail-matter in the U. S.	Per cent. of revenue from each class to revenue from all classes.	Revenue from each piece of mail-matter.	Revenue from each pound of mail-matter.	Cost of transportation, handling, etc. each class of mail-matter.	Per cent. of cost each class to whole cost.	Cost of each piece.	Cost of each pound.	Total profit or loss on each class.	Profit or loss on each piece.	Profit or loss on each pound.
	Pieces.		Pounds.		Pieces.	$		Cts.	$	$		Cts.	$	Profit.	Cts.	Cts.
1st class..	629,185,386	61.5	13,502,762	12.1	46.6	19,597,204.90	77.6	3.11	1.45	15,384,614.20	47.7	2.445	1 13.937	$4,212,390.70	.665	31.063
														Loss.	Loss.	Loss.
2d class..	155,399,019	15.2	55,783,832	50	2.785	976,217.06	3.9	.628	.175	7,969,240.97	24.7	5.128	14.28	6,993,023.91	4.5	12.53
3d class..	237,081,046	22.3	42,351,308	37.9	5.59	4,658,643.88	18.5	1.96	.11	8,772,559.41	27.6	3.7	20.7	4,113,915.53	1.74	9.7
Total....	1,021,665,451	....	111,637,902	....	......	25,213,865.84	....	....	....	32,126,414.58						

NOTE.—It is not claimed that this table is exactly accurate in all its figures. It is, however, as nearly so as it is possible to make it, and the comparisons as to the different classes of mail-matter are doubtless very nearly absolutely correct. This is clearly shown by the following facts: The information upon which the table is based was gathered from 258 fairly representative post-offices, from which about 50 per cent. of the entire revenue of the post-office department is collected. The estimates from these actual examinations, compared with the actual facts so far as reported by the proper bureaus of the department, are found to be approximately correct. Thus, the total number of pieces of first and third class matter is shown by the table to have been 866,266,432, while by the official report the number of stamps, stamped envelopes, and postal-cards issued for the same period was 905,451,305, leaving 39,184,873 pieces for packages upon which more than one stamp was used; which is believed to be about in accordance with the actual fact. The figures as to the weight of the matter are based upon actual weighing, and are almost exactly correct. For the figures showing the comparative cost and revenue of the different kinds of matter long and searching examinations were made, and the deductions therefrom for the year, being compared with official reports so far as they exist, were found to be correct. The table, therefore, forms a proper and just basis for any deductions that may be made.

GARDINER G. HUBBARD.

Post Town, v., Madison tp., Montgomery co., O. P. 37.

Post'ulate, in geometry, differs from *axiom* by being simply a position on which mathematicians agree, but which it would not be impossible to deny; while an axiom denotes a self-evident position. Thus, the position, "A circle may be described from a given centre with a given radius," is a postulate, while the position, "Things equal to the same thing are equal to one another," is an axiom. In philosophy this distinction between postulate and axiom has been obliterated, and both words are used synonymously to denote such positions as cannot be denied without denying consciousness itself. Thus, in the Kantian philosophy the existence of God and the immortality of the soul are treated as postulates of the practical reason, forming the very basis of the moral consciousness, needing no theoretical evidence, and even incapable of any.

Post'ville, p.-v. and p.-tp., Allamakee co., Ia., at the junction of the main line with Milwaukee division of Milwaukee and St. Paul R. R., has 1 newspaper.

Potamogal'idæ [from *Potamogalæ*; Gr. ποταμός, "river," and γαλῆ, "a weasel"], a family of insectivorous mammals represented by a single species which inhabits certain African rivers. The form is somewhat otter-like; the head elongated, and with the snout produced; the tail very much compressed; the digits not connected by webs; the skull is cylindro-conic, with a suboptic foramen, but no lachrymal one; the teeth forty—viz. I. $\frac{3}{3}$, C. $\frac{1}{1}$, P. M. $\frac{3}{3}$, M. $\frac{3}{3}\times 2$; the upper molars present, each incompletely divided, triangular prisms, two principal internal cusps being developed; the lower molars have each a narrow triangular, transverse crown, behind which is a quite large posterior lobe or area; the scapula has no metacromion; the clavicles are atrophied; the tibia and fibula ankylosed together at their distal extremities. The family is distinguished by these characters from the Centelidæ, with which it is most nearly allied. The single species (*Potamogale velox*) is an inhabitant of some equatorial West African streams.

THEODORE GILL.

Pot'ash [Fr. *potasse*; Ger. *Kali, Kaliumoxyd, Pflanzenlaugensalz*], **Vegetable Alkali**, or **Pearlash**; chemically, hydrate of the oxide of the metal *potassium*, $K_2O.H_2O$; by many chemists written KHO or KOH, on the hypothesis that it has a molecular structure similar to that of water, HHO or HOH, or is built upon the "water-type." Potash and pearlash of commerce are obtained by the lixiviation of wood-ashes mixed with lime, and boiling down the ley. Pearlash is merely a somewhat purer form, produced by calcination. During the burning of wood to form ashes, organic salts of potash, which exist in it, are converted into carbonate of potash; and in the lixiviation the lime converts the carbonate into hydrate of potash. Ashes vary greatly in their content of potash according to their source, ashes of *wheat-stems*, for example, containing 47 per cent., of *oak-leaves* 24 per cent., of *corn-stalks* (Indian corn) 17.5 per cent., of *grape-vines* 12.73 per cent., of *flax* 5 per cent., of *willow-wood* 2.85 per cent., and of *pine-wood* but half of 1 per cent. The U. S., being one of the countries in which wood is abundant, is one of the largest potash-producing countries, and the State of New York, particularly, is said to furnish 75 per cent. of the whole of the large American export of potash. Russia is another very productive potash country. As the forests disappear, however, mineral sources of potash must come into application, and the most available of these at present are the minerals *carnallite* and *sylvite*, containing chloride of potassium, found abundantly at the Stassfurt mines. The greatest natural treasuries of potash are the common mineral *feldspars*, in which, however, it is combined by such powerful affinities that no sufficiently cheap method has yet been discovered for its extraction. In America we have another mineral, even cheaper and more readily obtainable than feldspars, the *glauconite* of the Cretaceous or *greensand* formation, chiefly developed in New Jersey, which constitutes a large geological formation, often nearly pure glauconite, and containing the equivalent of 10 or 12 per cent. of commercial potash. This mineral—which constitutes a large and abundant article of commerce for fertilizing purposes—is far more easily decomposable than the feldspars, and will be in the future an immensely valuable source of potash in illimitable quantities.

The commercial varieties of potash are by no means pure. The French chemist Vauquelin made the following analyses of some of them:

*1000 grammes = 35 ounces.

In 100 parts.	Equivalent in pure hydrate of potash.	Sulphate of potash.	Chloride of potassium.	Insoluble residue.	Carbonic acid and water.
American	74.4	13.37	1.74	0.18	10.33
Russian	67.0	5.64	0.43	4.86	22.05
Pearlash	65.45	6.95	0.35	0.52	26.74
Dantzic	52.34	13.19	1.21	6.85	26.39

The strength of commercial potash, which it is an essential matter to know, is determined by processes of alkalimetry. (See ALKALIMETER; also VOLUMETRIC ANALYSIS.) But it is also important to know whether the potash may not be adulterated with the cheaper alkali, *soda.* There are several tests for this, one of the best probably being that of Frémy—a solution of the *metantimoniate* of potash—which is applied after converting the potash into neutral chloride, and will precipitate, with proper care, 1 per cent. of soda. *Pure hydrate of potash*, an important reagent in the laboratory, is prepared from the crystallized bicarbonate, the most available commercial potash compound that is obtainable in a state approaching purity. A moderate heat converts this into carbonate, which is then decomposed by boiling its rather dilute solution with hydrate of lime. The solution of hydrate of potash thus obtained, on being boiled to dryness and treated with alcohol, will yield a solution of potash pure enough for most uses. The alcohol is distilled off and used over again. Hydrate of potash, approximately pure, cast into the form of sticks or pencils, is abundant in commerce, being used sometimes in this form as a cauterizing agent. Hydrate of potash is very deliquescent, and must be kept from contact with the air. It dissolves in a little over its own weight of water, forming a solution which, according to Dalton, may have a density of 2.4, containing about 47.5 per cent. of hydrate. As the hydrate itself has a density of but 2.1, a great molecular condensation is indicated in this solution. HENRY WURTZ.

Potas′sium [Ger. *Kalium*], a metallic element which forms the basis of the bodies known as potash-compounds. Anhydrous *potash* (K_2O) is one oxide of this metal, and common *caustic potash* ($K_2H_2O_2$) is engendered by its contact with water in proper proportions.

History.—The earlier chemists held that the two "mineral alkalies," *potash* and *soda*—called also by them "fixed alkalies," to distinguish them from *ammonia*—were elementary in their nature. Lavoisier suspected them to be of the nature of metallic oxides, and there were several current statements of their having been found by different chemists to yield, on intense ignition with charcoal, metallic matters, which were, however, generally recognized as iron, derived from impurities in the materials. It was reserved for H. Davy in 1807, while experimenting with a voltaic battery of great power upon potash, to isolate and obtain the wonderful new metal potassium—a discovery which at that time created an interest and excitement throughout the chemical world such as has seldom been equalled. His experiment was repeated by all chemists who possessed the means, and other modes were discovered of decomposing potash. Gay-Lussac and Thénard, who discovered another mode, for some time maintained that potassium was a *compound* substance, composed of potash and hydrogen—a conclusion which arose legitimately and directly from the phlogistic views then still quite prevalent. (See PHLOGISTON.) Gay-Lussac and Thénard also at first claimed that Davy's new body was a *liquid metal*, like mercury. (See below.) Berzelius and other chemists quickly came to the rescue, and the hypothesis of Lavoisier, as demonstrated by Davy's astounding discovery, was soon established, and the mineral alkalies, together with the alkaline earths soon after, took their true places as metallic oxides in our chemical classification.

Occurrence and Functions in Nature.—Potassium is very widely, though not so very abundantly, diffused throughout the earth. In the older rocks of the continents almost its sole matrices are *orthoclase* or potash-feldspar, and the potash-micas *muscovite*, *biotite*, and *phlogopite*. Its minerals or ores are therefore not numerous, though often very abundant locally in amount. Like all the other soluble constituents of the rocks, potash is continually being leached out from these as well as from soils composed of their débris, and being carried down into the ocean, where, however, it has not accumulated to so great an extent as the other alkali-metal sodium, chiefly for two reasons, one of which is that rivers carry down a very far smaller proportion of potassium than of sodium; and another reason, still stronger, being the fact that certain mineral bodies containing potassium appear to separate or to be precipitated, in some manner not at all as yet understood, from the waters of the ocean. One such body is the mineral *glauconite* (greensand). Potash was called, in the early days of the science, the "vegetable alkali," from the fact that it peculiarly abounds in the plant kingdom, the ashes of which are indeed as yet the most abundant source of this alkali. In the mineral kingdom SODIUM (which see) is a much more prevalent element than potassium. A highly-productive source of potassium compounds of late years has been found in certain layers of the great saline deposits at Stassfurt, as the chlorides *carnallite* and *sylvite*, and the double sulphate with magnesia, *picromerite*.

Preparation of the Metal.—H. Davy's original method was to expose slightly-moistened caustic potash to the current of a voltaic battery of 200 couples. The potash was placed in a platinum dish, which was connected with the negative pole—that is, made the cathode—while the positive pole, or anode, was a platinum wire. The heat of the current caused fusion of the mass, and globules of the metallic potassium in a fused state appeared in the dish, which were quickly transferred to petroleum to prevent their taking fire and burning up in the air. The method next discovered, that of Gay-Lussac and Thénard, consisted in allowing fused caustic potash to flow into an iron tube filled with iron borings and heated to whiteness. Their first potassium, as before stated, was permanently liquid, which they themselves found afterward to be due to the fact that their potash contained soda, and their product was an alloy with sodium, which is a permanently liquid alloy at ordinary temperatures. A third method is that now in general use for making potassium, which was suggested by Curaudau, but carried successfully into practice by Brunner, and is hence known as "Brunner's method." It consists in distilling in an iron retort, at a very elevated temperature, an intimate mixture of dipotassium-carbonate and charcoal, the whole mass being (theoretically) convertible into potassium and gaseous dioxide of carbon: $O_3CK_2 + C_2 = (CO)_3 + K_2$. Under the head SODIUM will be found some details of Brunner's method, generally applicable also to potassium; but the latter metal is much more difficult to obtain by this method than sodium, and is hence always much more costly. This is, however, of the less importance since sodium is applicable generally to the same uses as potassium, is much more easily handled and managed, and, having a smaller equivalent (23, while that of potassium is 39), goes further, weight for weight. In the manufacture of potassium by the method of Brunner there is a great tendency to the formation of an *explosive body*, not well understood, but supposed to be a compound of potassium and carbonic oxide, which often gives rise to dangerous accidents. The potassium produced must always be redistilled once or twice to rid it of all admixture with secondary products, which either contain or in time engender the explosive body referred to. Matthiessen proposed to return, in a measure, to the original method of obtaining potassium of Davy, by electrolysis. He used, however, instead of caustic potash, the *chloride of potassium*; and, to render this more fusible, he combined it with chloride calcium in equivalent proportions to a double chloride. A Bunsen battery of six cells furnished him with voltaic power sufficient to procure considerable quantities of potassium in a perfectly pure state, and of course without any trouble from the explosive body above referred to. It can scarcely be doubted that the application of electrolytic currents obtained by mechanical means—from magneto-electric engines—would be found practically available in the preparation of potassium if Matthiessen's ideas should be employed.

Nature and Properties.—Potassium is a very soft metal, cutting like wax, having a rather dark lead-blue color, with brilliant lustre; becoming brittle and crystalline at zero Centigrade. Two density-determinations only are on record, which do not differ much:

Gay-Lussac and Thénard (at 15° C.)	.865
Sementini (temperature not stated)	.87

These two preparations, therefore, belonged, in all probability, to the same allotropic modification. Indeed, a definite and simple potassium-molecule, computed from the newly-discovered geometric law of molecular condensation of the present writer (explained under head of VOLUMES, MOLECULAR), requires the density *at zero* .871. Potassium is therefore lighter than water, and, next to LITHIUM (which see), it is the lightest solid body yet known when in its elemental form. When it combines with oxygen, however, to form K_2O (whose density at zero is 2.714), it condenses, as the writer has discovered, to a density of about 2.65, or about that of *wrought aluminium*. This same *heavy* molecule of potassium exists also in its sulphates, chromates, permanganate, sulphocyanide, and some other compounds. Potassium is so soft at the mean temperature of 60° F. that two pieces pressed and kneaded together will coalesce like pieces of soft wax. It is commonly said to be susceptible, therefore, of being *welded* at ordinary

temperatures, as iron is at a white heat. At about 145° F. it melts, and at a red heat boils, and may be distilled, yielding a vapor of a beautiful green color. It combines with the oxygen of the air with great avidity, so that a freshly-cut surface tarnishes instantly in the air; and in order to preserve it, it must remain immersed in a bottle under the surface of some hydrocarbon liquid free from oxygen. Rectified petroleum may be used for this purpose, but the rectified oils of coal-tar are preferable. C. E. Long obtained potassium, by pouring off the liquid part during its solidification, in bright octahedral crystals of the tetragonal (dimetric) system. SODIUM (which see) forms similar crystals upon similar treatment. Potassium burns when heated with a large flame of very intense temperature and a peculiar violet color, which resolves itself in the spectroscope into the characteristic spectrum of potassium. When thrown on water, the reaction which occurs between the metal (whose levity, as above stated, causes it to float) and the water is so violent, and so much heat is developed, that the potassium and the hydrogen produced by the decomposition of the water both take fire spontaneously, and burn together with a rich rose-red colored flame, constituting one of the most beautiful, interesting, and instructive experiments of the chemical classroom. The melted globule of potassium runs about over the surface of the water eccentrically, propelled by the torrent of hydrogen gas evolved around it, the motion becoming more and more rapid until there remains at last only a fused globule of caustic potash; which is also supported out of contact with the water by the atmosphere of steam around it, until finally, on cooling sufficiently, this globule suddenly unites with the water below with a slight sharp explosion. Potassium unites with mercury with great and explosive violence to form potassium-amalgam, whose properties are so similar to those of the much more important compound *Sodium Amalgam* (see SODIUM, COMPOUNDS OF) that a reference to this latter head will be appropriate. H. WURTZ.

Potas′sium Compounds, Medicinal Uses of. *Potassa*, from its strong chemical affinities, is powerfully caustic to living tissues. It unites with water and with albuminous substances, and from its deliquescence and high diffusive power rapidly penetrates the tissues, and thus carries its destructive effects very deeply. The slough is black, slimy, and pultaceous. Taken internally, potassa or a strong solution thereof is a violent corrosive poison. The antidote is some organic acid, such as acetic (vinegar), citric, or tartaric. In weaker solution potassa swells and softens epithelium, producing a slippery feel to the fingers. Potassa is used in surgery as a caustic, being fused and run into cylindrical moulds about the size of a goosequill, so as to form conveniently-shaped sticks. A solution of potassa of specific gravity 1.065 is officinal in the *U. S. Pharmacopœia*, and may be used for the general purposes of alkaline medication. But alkaline salts of the same base are preferable, and this solution is therefore employed more in pharmacy than in medicine. *Potassium carbonate* and *bicarbonate* are strongly alkaline, and have essentially the physiological properties of solution of potassa. They are used externally in weak solution as lotions in skin diseases to remove dried epithelial crusts and scabs and control the excessive secretion of such diseases as eczema. Like other alkaline lotions, they often allay the itching of skin disease. They are not much given internally, sodium salts and other alkalies being preferable for alkalizing the contents of the alimentary canal, and salts of potassium with organic acids for producing the effects of potassa on the system at large. They are sufficiently alkaline to be poisonous in large dose. *Potassium acetate* and *citrate*, though of neutral reaction, become converted into carbonates in the blood through decomposition of the organic acids. They thus tend to increase the alkalinity of the blood, to alkalize the urine, and especially to diminish the quantity of uric acid present in the system. They may also prove diuretic, increasing the quantity of the solid elements as well as the water of the urine, but this effect is very uncertain, and frequently does not occur at all in health. These salts are used medicinally in rheumatism, gout, and uric-acid gravel to diminish the excess of acidity characteristic of those diseases, and in dropsy and deficient secretion of urine to produce diuresis. Solution of the citrate, freshly made by saturating lemon-juice by potassium carbonate and drunk during effervescence, is a favorite mode of giving the salt for the above purposes, and is also a very refreshing fever-draught, for allaying nausea, and for reducing over-action of the heart in acute febrile states. *Potassium and sodium tartrate* (Rochelle or Seignette salt) is of low diffusion power, and in large dose is purgative simply, producing, like other cathartic salts, watery stools. In smaller quantities, as a drachm, given considerably diluted, it is absorbed, its acid decomposed, and then under the form of carbonate it produces the effects and may be used for the purposes just enumerated. It is also employed as a purgative, and is most commonly given in the form of the *Seidlitz powder* (*pulveres effervescentes aperientes* of the *U. S. Pharmacopœia*). A Seidlitz powder consists of a blue paper containing two drachms of the Rochelle salt and forty grains of sodium bicarbonate, and a smaller white paper containing thirty-five grains of tartaric acid. The contents of the two papers are to be separately dissolved in about two fluid-ounces of water, the solutions mixed and drunk during the effervescence that immediately takes place. *Acid potassium tartrate* (bitartrate = cream of tartar) is purgative like Rochelle salt, and is considerably used as a saline cathartic. In small dose, again like the Rochelle salt, it is absorbed and may prove diuretic, but apparently in the case of this salt the acid is not decomposed, or at least the salt does not act as an alkali in the blood. It cannot be used, therefore, for alkaline internal medication, like the acetate or citrate. *Neutral potassium tartrate* is also purgative, but from its disagreeable taste the acid tartrate is medicinally preferable. *Potassium sulphate* is again purgative, but is harsh and may be poisonous, and is therefore little used. *Potassium nitrate* (nitre = saltpetre) is irritant and in large dose poisonous, inflaming the stomach, causing vomiting and purging, and also having an effect, common to many of the stronger potassium compounds, of affecting the heart, enfeebling its power, and even causing death by syncope. Nitre is used in medicine as an ingredient of cooling saline draughts in fever, to reduce over-action of the heart, and was at one time largely employed in acute rheumatism. Nitre has nothing to do with the so-called *sweet spirit of nitre*, which is a peculiar ethereal compound containing nitrous ether and alcohol. *Potassium chlorate*, though of high diffusion power like nitre, is less freely soluble, and is hence not so strongly irritant and poisonous; yet an inordinate dose can inflame the stomach, and in one case proved fatal. This salt is peculiar in being largely excreted by the salivary glands and increasing their secretion. Medicinally, its use is almost confined to inflammatory and ulcerative diseases of the mouth and throat, over which it often has a remarkable power. A saturated solution may be gargled, and a little swallowed from time to time, or a few of the crystals may be held in the mouth and allowed slowly to dissolve.

The other potassium salts used in medicine derive peculiar powers from their several acidifying principles. *Potassium cyanide* is intensely poisonous, and has essentially the properties of HYDROCYANIC ACID (which see). *Potassium ferrocyanide* has but feeble physiological action, and is practically used only in pharmacy and the arts. The properties of *potassium iodide* will be found described under IODINE, MEDICINAL USES OF. *Potassium bromide* has peculiar powers over the nervous system, in addition to possessing the properties of potassium salts in general of enfeebling the heart and tending to cause diuresis. The nervous influence is first a mere blunting of reflex excitability, cerebral and spinal, passing to complete paralysis if the drug be administered too long in inordinate quantities. The production of an eruption on the face like acne, and moderate salivation with a fœtid breath, are minor effects following the continued use of the drug. This salt is largely used in medicine to allay morbid nervous irritability, and is of special curative power in epilepsy, for the treatment of which it is perhaps the best remedy yet found. *Potassium sulphide* is used in medicine for the sulphur it contains. (See SULPHUR, MEDICINAL USES OF.) *Potassium bichromate* is irritant and caustic, and internally a corrosive poison. It is officinal in the *Pharmacopœia* only for pharmaceutical use, being employed for the preparation of sodium valerianate. *Potassium permanganate* in concentrated solution is slowly caustic, but the medicinal use of the salt is as a disinfectant. It acts by oxidation through giving up of some of its own oxygen, and in weak solution is an excellent disinfectant application to wounds, foul sores, and ulcers. EDWARD CURTIS.

Potassium, Compounds of. Of *oxides* of the metal potassium *three* exist, all of which have been obtainable only since Davy's discovery of the metal POTASSIUM (which see), as they are derivable only from the metal. To obtain the lowest oxide, K_2O, the best method is to heat together two equivalents of potassium with one of potash: $K_2 + K_2H_2O_2 = 2K_2O + H_2$. Its true density at zero is 2.714; Karsten found (at normal temperature) 2.656. It melts at a red heat, but is not so volatile as potash. When mixed with water, it combines to form potash with such energy as to give rise to incandescence, as is also the case with quicklime and some other oxides; this notwithstanding the fact that an important *expansion* takes place in the combination; the mean density of equal equivalents of K_2O and water being about 2.44, while pot-

ash has the true density at zero 2.048 (Filhol found 2.044). In the case of quicklime the expansion is even greater in proportion. (See VOLUMES, MOLECULAR.) The other two oxides of potassium, K_2O_2 and K_2O_4, *dioxide* and *tetroxide*, are formed in the rapid combustion of potassium in dry air or oxygen. To obtain either of them in a pure state special precautions are necessary. The dioxide is white, but the tetroxide has a chrome-yellow color.

Chloride of Potassium (KCl).—This salt occurs native as the mineral *sylvine* (*sylvite* of Dana). The early chemists had for it the name *sal digestivum sylvii*, whence the name of the mineral. Its principal localities are Mount Vesuvius, where it condenses from fumaroles in cubical crystals, and Leopoldshall in Anhalt. It also occurs in solution in many mineral waters and in the ocean. Chloride of potassium is not abundant as the mineral sylvine, but there is another mineral, containing this chloride as a constituent, that is found so abundantly at the Stassfurth mines in Magdeburg as to be a large article of commerce of late years as a material for making fertilizers. This is *carnallite*, which is a double chloride of potassium and magnesium. It forms at Stassfurth the greater part of a stratum from 60 to 70 feet in thickness. Its composition is $KCl.MgCl_2.6H_2O$. Chloride of potassium is more soluble than common salt, dissolving in three times its weight of water at normal temperature.

Bromide of Potassium (KBr).—This salt, so largely used of late years in medicine, is found in solution in mineral springs, but is prepared for commerce by artificial methods, one of which is the decomposition by carbonate of potash of *bromide of iron*, previously prepared by the action of bromine on iron. It is very soluble in water.

Iodide of Potassium (KI).—Also an exceedingly valuable medicinal salt. It is prepared by various methods, one of which is similar to that referred to under the bromides, using *iodide of iron* instead of bromide. It dissolves in seven-tenths of its weight of water and in six times its weight of alcohol. Its solutions have the power to dissolve iodine itself largely, forming deep-brown liquids. In these the iodine does not appear to be combined, but merely dissolved, since disulphide of carbon will dissolve it out. Iodide of potassium produces cold when dissolving in water, the depression under favorable circumstances being as much as 43° F.

Sulphides of Potassium.—Five of these are known—K_2S, K_2S_2, K_2S_3, K_2S_4, and K_2S_5. The preparation called *liver of sulphur*, prepared by fusing together sulphur and carbonate of potash, contains several of these sulphides. The modes of separation and of preparation in a state of purity will be found described in the chemical textbooks. Many of the other potassium-compounds will be found described elsewhere under appropriate heads.

HENRY WURTZ.

Pota'to, the most widely-cultivated and valuable of esculent tubers, is the *Solanum tuberosum*, and being the typical species of a typical family, both of vast extent and widely-differing characteristics (see SOLANACEÆ), it is thus allied to several powerful narcotics, such as tobacco, henbane, and belladonna, as well as to other esculents, such as the tomato, egg-plant, and capsicum. The name, which is applied indifferently to the plant and to the tuber, is directly derived from the Spanish *batatas*, a word undoubtedly from the Carib or some other American Indian language, and first applied to the sweet potato, to which the name was exclusively given by English writers before the middle of the seventeenth century. The potato is a native of the elevated tropical valleys of Mexico, Peru, and Chili; and was probably carried to Spain from Peru early in the sixteenth century. It was probably introduced into Virginia from Florida by the Spanish explorers, and into Great Britain from Virginia by Sir John Hawkins in 1565, though the credit is usually assigned to Sir Walter Raleigh, who was never in Virginia. At the present day it is found in several varieties in a wild state in Peru, Chili, and the island of Chiloe, the wild plant bearing still a close resemblance to the cultivated, except in the abnormal development of the tuber in the latter. The common potato was described in 1597 under the name of *Batata Virginiana* by Gerard in his *Herball*, and in the following century it was cultivated on a small scale in the Netherlands, Burgundy, and Italy, and on account of its great yield was recommended by the British Royal Society in 1663 for introduction into Ireland as a safeguard against famines (!); but it was not until near the middle of the eighteenth century that it acquired any real importance in Europe outside of Ireland. It was little regarded in Virginia, and seems to have been unknown in New England until the eighteenth century, when it was carried thither from Ireland. The potato is not mentioned in *The Complete Gardiner*, a work published in 1719, and as late as 1771 only two varieties, a white and a red, were mentioned in the most important English work on gardening, and they were considered chiefly as food for swine and cattle. The potato is usually spoken of as a *root*, but this is an inaccuracy, the roots being quite distinct from the tuber, which is in reality an underground stem, naturally of considerable size, and abnormally developed by cultivation, through the accumulation of starch for the use of the plants growing from the *eyes* or buds. Under proper trimming and management the branches above ground may be made to assume several of the characteristics of the tubers.

The potato may be described as a perennial plant, with smooth herbaceous stems, from one to three feet in height, pinnate leaves, flowers varying in breadth from an inch to two inches, and in color from bluish-white to purple, and consisting of a wheel-shaped corolla, more or less veined, bearing a globular purplish fruit or seed-ball of the size of a gooseberry, and an herbage characterized by a narcotic smell, and practically useless, though it may be eaten like spinach, both by man and by cattle. One of the leading qualities of the potato is an extraordinary productiveness, far exceeding that of any esculent with which it can be placed in competition, an equal amount of ground yielding, according to Humboldt, thirty times greater weight of potatoes than of wheat. Potatoes consist almost wholly of starch, and are accordingly deficient in nitrogen, and ill-adapted for an exclusive article of diet. They are hardy, and grow well in poor land throughout a vast extent of the earth's surface. Though, as already mentioned, indigenous to tropical America, they do not grow there in the lowlands, but only in the high valleys several thousand feet above the level of the sea. In the U. S. they yield best in the extreme Northern States, especially New York and New England, and also in Canada; and in Europe are successfully cultivated up to 60° N. lat. in Sweden. Formerly planted exclusively by hand in hills three or four feet apart, they are now sown extensively in drills, and flourish without that minute care once given them. Where large quantities of potatoes are grown, various mechanical devices are in use for dividing the drills and throwing up the tubers, ready to be gathered by hand. They have natural affinities to moisture and antipathy to light, to which they should never be exposed. There is a bitter principle subsisting in the potato which may be considered as more or less poisonous, and which is aggravated by the action of light to such a degree as to turn green; this principle must be removed by cooking before the tuber is fit for food; hence the water in which potatoes have been boiled should never be employed in the preparation of other food. The particular variety of potato can be secured only by raising the tubers. The seed of a single ball will often produce many varieties of potatoes, and cannot be depended upon to propagate the parent stock. Dr. Hexamer of New Castle, N. Y., a high authority on potato-culture, keeps constantly on hand, as a standard of comparison, above 300 varieties of potatoes, and new varieties might be produced apparently without limit by the necessary effort. The varieties most esteemed in the first half of the nineteenth century seemed to receive a complete check by the potato-rot of 1845, and they have now (1876) practically fallen into disesteem, and are replaced by others. The best of the old favorites was probably the mercer of Neshannock (so called from having originated on Neshannock Creek, Mercer co., Pa.); its place in point of popularity seems to be filled by the early rose, Jackson, white garnet, Chili, peach-blow, and early Goodrich, most of which were originated by the late Rev. Chauncey E. Goodrich of Utica, N. Y., to whom the world is largely indebted for the preservation and improvement of this important article of diet. The annual crop of potatoes in the U. S. in 1870 was 143,337,473 bushels, of which New York produced 28,500,000, Pennsylvania nearly 13,000,000, and Ohio and Illinois each about 10,000,000. (For an account of the ravages of the most recent enemy to the potato, the Colorado potato-bug, see the ensuing article.)

REVISED BY ASA GRAY.

Pota'to-Bug. This term is applied indiscriminately by farmers to a great many different insects that attack the potato, the habits of which are in many cases as different as those of a horse and a hog. Of the principal insect enemies of the potato, the following may be enumerated: *Boring in the stalk*—the stalk-borer (*Gortyna nitela*): the potato-stalk weevil (*Baridius trinotatus*). *Feeding upon the leaves*—the potato-worm (*Sphinx 5-maculata*); the three-lined leaf-beetle (*Lema trilineata*); the cucumber flea-beetle (*Haltica cucumeris*); over half a dozen species of blister-beetles, belonging to the genera *Lytta* and *Epicauta*; and finally the Colorado potato-beetle (*Doryphora 10-lineata*), a hemispherical yellow beetle about one-third of an inch long, with ten black stripes on the elytra. This last, on account of its singular history and great destruc-

FIG. 1.

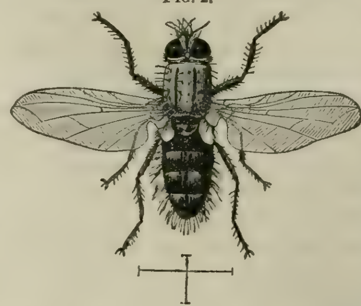
Colorado Potato-beetle: *a*, eggs; *b*, *b*, *b*, larvæ; *c*, pupa; *d*, *d*, beetle from side and back. Colors, *a*, orange; *b*, Venetian red; *c*, pale orange; *d*, black and yellow.

tive power, has come to be known as "the potato-bug," and it is to it that we shall confine our attention under that title.

Few insects have attracted greater attention than has this species since 1860. First described by Thomas Say, who found it tolerably common on the upper Missouri in 1824, it was afterward scarcely heard of till 1859. Feeding originally on the sand-burr (*Solanum rostratum*), a wild plant belonging to the same genus as the potato, the insect was at first doubtless confined to the more fertile country just E. of the Rocky Mountains, ranging from the Black Hills down into Mexico, but being most common and extending farthest E. to the N., or in the Black Hills region. Its wild food-plant is easily dispersed by adhering to animals and vehicles, and has for many years, like the beetle, been extending its range eastward. We are therefore warranted in concluding that by its dispersion, and perhaps by other aid given by man, directly or indirectly, the beetle was enabled to cross the stretches of plain and prairie that intervene between its native home and the more fertile country to the E. It would naturally be most assisted along the line of greatest travel, and we consequently find it first falling in large numbers on the cultivated potato, which it found to its liking, about 100 miles W. of Omaha, Neb., in 1859. With extensive fields of cultivated potatoes instead of scattering plants of *Solanum rostratum* to feed on, the insect began to multiply and to spread at a marvellous rate. In 1861 it invaded Iowa; in 1862, S. W. Wisconsin; in 1864 and 1865 it crossed the Mississippi to the western part of Illinois: along the Iowa line, and from N. E. Missouri in 1866, it occupied most of the country W. of a line drawn between Chicago and St. Louis; in 1867 it reached S. W. Michigan and W. Indiana; in 1868 many parts of Ohio, and from that time on kept spreading from year to year, until in 1874 it touched the Atlantic seaboard at numerous places, and in 1875 was common from Virginia to Maine, and even abounded in the streets of the larger cities, as Philadelphia and New York. It may thus be said to have travelled over 1500 miles in a direct line within sixteen years, and to have spread over an area of something like 1,500,000 sq. m., including most of the territory in Nebraska, Kansas, Missouri, Iowa, Minnesota, Wisconsin, Illinois, Indiana, Kentucky, Michigan, Ohio, Ontario (Canada), New York, Vermont, New Hampshire, Connecticut, Massachusetts, Rhode Island, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia. Though the insect is generally said to have travelled E., in so far as the language implies that the species is migratory or itinerant it is incorrect. The insect simply spreads, and, though most injurious during the first few years of its advent, it never leaves one section for another, but always remains where it has once obtained a foothold, its destructive power varying according as the season is favorable to its development or otherwise, or according as its enemies multiply or decrease.

Natural History.—The insect hibernates in the perfect or beetle state under old rubbish or in sheltered situations of whatever kind, but normally in the ground, generally but a few inches beneath the surface, but exceptionally at a depth of three feet. As vegetation starts in spring the insect issues from the ground, and long before potatoes are up, or even planted, it may be seen flying on genial days in search of food and company, the rose-red under-wings contrasting prettily with the yellow and black of the elytra. It will frequently work into a sprouting hill of potatoes as these are raising the soil, and feed upon the

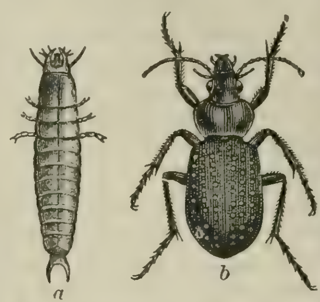
FIG. 2.



Lydella doryphoræ: Colors, black and silvery-gray.

tender sprouts and tubers; and as soon as the plant shows itself the female begins to lay her oval orange eggs in clusters of from 10 to 40, each attached by one end to the under side of a leaf or to a stem. With favorable weather there hatches, in the course of a week, from each egg a small, dark Venetian red, hunchbacked larva, which becomes paler and acquires a double row of lateral black spots as it advances toward full growth. This period arrives in about three weeks from hatching, and the larva finally burrows into the ground, where, within a simple earthen cavity, it becomes a pupa, and finally a beetle in from seven to ten days, the whole cycle of its transformations from the egg to the beetle requiring rarely more than a month.

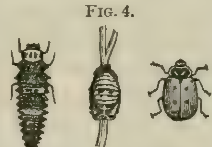
FIG. 3.



Fiery ground-beetle: *a*, larva; *b*, beetle. Colors, *a*, black; *b*, black and golden.

The illustrations in our figure will convey a correct idea of its different stages. In the latitude of St. Louis there are three broods annually, the last brood of beetles issuing from the ground early in the fall, and, as we have already seen, entering it again to pass the winter. The migratory habit is often very noticeable in this last brood of the beetles, and for weeks they may be seen flying in bevies or travelling on foot in immense armies wherever they are unusually numerous. The beetle feeds less than the larva, but is nevertheless very tenacious of life. The period of oviposition covers about a month for each female, and the number of eggs produced by each averages about 500. While the species feeds by preference on plants belonging to the genus *Solanum*, and it is doubtful whether it could thrive for any length of time on other plants than those of the family

FIG. 4.



Convergent Ladybird: larva, pupa, and beetle. Colors, black and orange.

FIG. 5.

15-spotted Ladybird: *a*, larva; *b*, pupa; *d*, beetle. Colors, *a*, black and yellow; *b*, black and orange; *d*, black, cream-yellow, and chocolate.

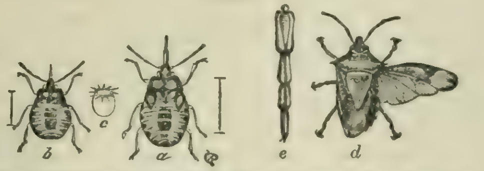
Solanaceæ, yet in its march across the country it has adapted itself, in an emergency, to other kinds, among which may be mentioned the cabbage, hedge mustard (*Sisymbrium officinale*), smart-weed (*Polygonum hydropiper*), pig-weed (*Amarantus retroflexus*), thistle (*Cirsium*), mullein (*Verbascum*), lamb's-quarter, and maple-leaved goosefoot (*Chenopodium album* and *C. hybridum*).

Means of averting its Injuries.—These may be consid-

ered under three heads: (1) natural enemies; (2) preventive measures; (3) direct remedies.

Natural Enemies.—To the naturalist it has been interesting to watch how, with the insect's advance toward the E., the number of its natural enemies has increased. The farmer should learn to distinguish these his allies, and to encourage them. Among birds, the rose-breasted grosbeck (*Guiraca Ludoviciana*) often effectually clears a potato-patch of the pest. The quail also devours it, and the domestic chicken has in some sections acquired a taste for it, and has been used to good advantage. The crow also attacks it. Among quadrupeds, there is good evidence that the skunk feeds upon it. Among reptiles, the toad finds the insect to its taste. Among spiders, some species of the long-legged harvestmen or "grandfather gray-beards" (*Phalangium*) feed upon it. But the most efficient aids are found in its own class. Over two dozen of these have been described in the entomological reports made to the State of Missouri by the writer, but we can only illustrate in this connection a few of the more important ones. The only true parasite known to infest it is a tachina-fly (*Lydella doryphoræ*) belonging to the Diptera, and having the general appearance of a common house-fly. From minute, tough, ovoid, whitish eggs, laid on the back of the thoracic joints of the *Doryphora* larva, the larvæ (white, footless maggots) of this fly enter the body of their victim, and are carried into the ground when it descends to transform. Here they soon destroy their host and go through their transformations. Certain asilus-flies—a bloodthirsty family of the same order—pounce upon and suck out the juices of the beetle. In its own order a number of ground-beetles (Carabidæ), of which the fiery ground-beetle (*Calosoma calidum*) may be taken as an example, attack and devour it, and several species of ladybird (Coccinellidæ), and notably the convergent ladybird (*Hippodamia convergens*) and the 15-spotted ladybird (*Mysia 15-punctata*), feed greedily on its eggs. Among half-wing bugs (Heteroptera) several species are also very efficient in piercing the beetle, and more particularly the larva, with their strong beaks, and sucking out the vitals, the most common and efficient being the spined soldier-bug (*Arma spinosa*), the many-banded robber (*Harpactor cinctus*), and the ring-banded soldier-bug (*Perillus circumcinctus*).

FIG. 6.



Spined Soldier-bug: c, egg; b, larva; a, pupa; d, mature bug, with wings on one side extended; e, its beak magnified. Colors, c, bronze; a, b, black, yellow, and red; d, yellowish-gray.

FIG. 7.

Many-banded Robber: with beak enlarged at side, b. Colors, pale yellow and black.

FIG. 8.

Ring-banded Soldier-bug: a, mature bug; b, enlarged antenna; c, enlarged beak. Colors, polished brown and yellow.

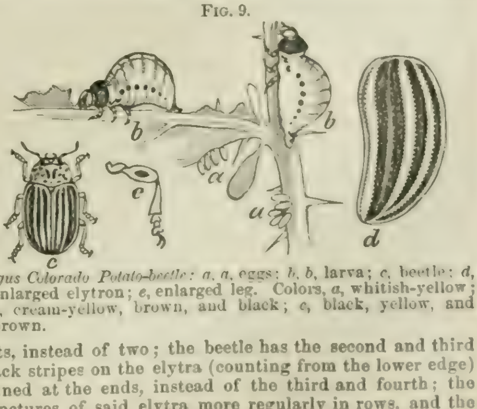
Preventive Measures.—The insect shows a preference for the more tender-leaved varieties, and such as the white Neshannock are destroyed much quicker than the early rose and peach-blow, for instance. By isolating a potato-patch in the midst of a corn-field or in timber, or by surrounding a field of the less-liked varieties with a few rows of the kinds preferred, much will be gained in the battle with the pest. Sliced potatoes dusted with Paris green, and laid upon the ground where other animals cannot reach them, will allure and kill many beetles early in the season, before planted potatoes sprout; and when the tubers are planted a dressing of ashes and hen-manure will have the effect to prevent the earth cracking, and to deter the beetle from entering the ground, and from attacking the young plants as they appear above the surface.

Direct Remedies.—Destruction by hand of the first beetles and eggs appearing on the young plants is to be strongly recommended, but great care must be had to discriminate between the eggs of the ladybirds, which resemble those of *Doryphora* in color and mode of attachment, but which are invariably somewhat smaller. A practised eye soon discriminates between them; and it is often on such minute discriminations that the farmer must distinguish between friend and foe. Numerous mechanical means—machines used by hand, and even by horse-power—have been devised to knock the insects off the vines and collect them; and during very hot and dry summer weather in the more Western States the insects perish when merely knocked on to the ground. Some care should be had in destroying large collected masses, as there is abundant evidence to show that the volatile principle of the oil contained in their bodies, when disengaged by scalding or burning, is poisonous when largely inhaled. The only cheap and effective way of protecting the plants when once the insect has been allowed to unduly multiply is by the use of Paris green. This poison is now very generally employed, either as a powder with about 25 parts of some diluent, such as ashes, lime, bran, or flour—the last the best; or in suspension at the rate of a tablespoonful of the pure green to three gallons of water, and with a certain portion of molasses or other cheap sticky substance to facilitate adhesion. This poison has been very extensively used without any evil results; and though, on theoretical grounds, grave objection has been made against its use, careful experiment by several capable parties, and particularly by Prof. R. C. Kedzie of the Michigan State Agricultural College, fully accords with an extensive practical experience covering many years, and establishes the following facts: (1) Paris green that has been four months in the soil no longer remains as such, but has passed into some less soluble state, and is unaffected by the ordinary solvents of the soil. (2) When applied in small quantities, such as alone are necessary in destroying injurious insects, it does not affect the health of the plant. (3) The power of the soil to hold arsenious acids and arsenites in insoluble form will prevent water from becoming poisoned, unless the green is used in excess of any requirement as an insecticide. Whatever means are employed by man in his warfare against this insect, concert of action is most important.

The fear that this insect might be carried to Europe on ships sailing from America has caused some alarm in European countries, and given rise to much discussion. Some nations have attempted to prevent such a catastrophe by legislative means and by prohibiting the importation of American potatoes. There is real danger of the beetle being carried over, and little doubt that it would thrive in most of the potato-growing parts of Europe. Precautionary and preventive measures, so long as they are reasonable, are therefore most wise; but the only way that the introduction of the pest can be prevented is by familiarizing the ships' officers with its appearance, and instructing them to use all possible vigilance in destroying such beetles as may be noticed on board when once out at sea. There is no more danger of its going over in or among potatoes than in other cargoes, and the prohibition of traffic with America in that commodity is puerile and a consequence of insufficient knowledge of the insect's habits.

This article would be incomplete without a brief reference to the bogus Colorado potato-beetle (*Doryphora juncta*), which so closely resembles the species under consideration that it was formerly often mistaken for it, even by good entomologists. The illustrations introduced will show the principal differences; and it only remains to add that in *juncta*, as compared with *10-lineata*, the eggs are paler; the larva is paler, with but one row of lateral black dots, instead of two; the beetle has the second and third black stripes on the elytra (counting from the lower edge) joined at the ends, instead of the third and fourth; the punctures of said elytra more regularly in rows, and the legs with pale instead of dark tarsi, and with a black spot

FIG. 9.



Bogus Colorado Potato-beetle: a, a, eggs; b, b, larva; c, beetle; d, enlarged elytron; e, enlarged leg. Colors, a, whitish-yellow; b, cream-yellow, brown, and black; c, black, yellow, and brown.

on the thighs. It feeds on the nettle (*Solanum Carolinense*), has always existed in the southern half of Missouri eastward, and never touches the cultivated potato. C. V. RILEY.

Potato Disease and Rot. See PERONOSPOREÆ, by W. G. FARLOW.

Potato-Fly. See CANTHARIS.

Potato Neck, tp., Somerset co., Md., on Tangier Sound, Chesapeake Bay. P. 2266.

Potato, Sweet. See SWEET POTATO.

Potato-Worm, the larva of the HAWK MOTH (which see).

Potchin'ki, town of Russia, government of Nizhnee-Novgorod, is noted for its manufactures of potash. P. 6000.

Potem'kin (GRIGORI ALEXANDROVITCH), b. in 1736 of a family of Polish nobility on its estate in the government of Smolensk; entered the Russian army, and was ensign in the imperial body-guard when he attracted the attention of Catharine II., shortly after her accession to the throne, by his handsome person; received immediately an appointment in the household of the empress as gentleman of the bedchamber, and superseded Orloff as her lover. This intimacy seems to have lasted only for a couple of years, but by his entire freedom from jealousy, by his mastery of the art of making himself interesting and indispensable, by a shrewd application of flattery and fear, by a thousand petty tricks, he succeeded in retaining his influence over the empress to his death, and vindicating his position at the head of the Russian polity. Not only the empress herself, but foreign monarchs—Frederick the Great, Maria Theresa, and Joseph II.—loaded him with honors and riches and submitted to all his whims; and as an alliance with Russia at this time began to be of the utmost importance to the neighboring states—Sweden, Poland, Prussia, Austria, and Turkey—he, as the dispenser of this alliance, played an important part in the politics of Europe. He was, nevertheless, a mediocre though rather good-natured person, more vain than ambitious, full of fantastical plans and restless activity; and although much of what he did was good and beneficial to his country, such as the foundation of the cities of Kherson, Kertch, Nikolaiev, Sebastopol, etc., the creation of a Russian fleet in the Black Sea, the Turkish wars which resulted in the acquisition of the Crimea, Caucasus, etc., it does not confer much honor on his name, as it was evidently done without any noble purpose, only as a sort of theatrical show. D. on the road between Jassy and Nikolaiev Oct. 15, 1791. (See Cérenville, *Vie de Prince Potemkin* (1807), and De Ligne, *Mémoire de la Cour de Russie* (1859).)

Poten'tial, in physics. If a body attract, according to the law of universal gravitation, a point, whether external or of its own mass, the sum of the quotients of its elementary masses, each divided by its distance from the attracted point, is called the "potential." It has an analogous signification in relation to electricity and magnetism. (See LAPLACE'S COEFFICIENTS.) J. G. BARNARD.

Potentil'la [dim. of the Lat. *potens*, "powerful," from its supposed virtues], a genus of herbs and shrubs of the order Rosaceæ. There are many, mostly herbs, and quite a number are natives of the U. S. The plants known as cinquefoil, five-finger, and tormentil belong to this genus. They have a highly astringent property, which is useful in medicine, and in the Orkneys and Lapland their roots have been employed in domestic tanning and dyeing.

Poten'za, town of Southern Italy, province of the same name, situated on a hill near the river Basento (anc. *Casuentus*), about halfway between Naples and Taranto. This city, which takes its name from the ancient *Potentia*, the site of which is lower down the hill) was founded by the Lucanians, and is identified with the history of that people and their territory. It has always been subject to earthquakes, and in 1694 suffered severely, but the most recent as well as the most terrible shock occurred on Dec. 17, 1857, the line of agitation being apparently from Stromboli to the extinct volcano Monte Vulture. Not only Potenza, but some 30 or 40 neighboring towns and villages were almost totally destroyed. The immediate loss of life is said to have been not less than that from the great Calabrian earthquake of 1783, and the number who died afterward from injuries received may be inferred from the fact that 4000 amputations were performed in Potenza alone. Besides those who lost their lives from the direct effects of the catastrophe, thousands perished for want of food and shelter. The walls and fortifications of Potenza were not overthrown, nor was the cathedral seriously damaged. There is now little activity of any kind here, although the neighboring country is agriculturally rich, and produces, among other things, silk, honey, and cheese of great excellence. P. in 1874, 18,513.

Potenza Picena, town of Italy, province of Macerata, in the so-called Marches. It stands on a hill overlooking the Adriatic, and below it lies the rich old abbey of Potenza. The fort which defended the port of Monte Santa is still standing, but the harbor is now so sanded up as to admit only fishing-boats. P. in 1874, 6763.

Pothier' (ROBERT JOSEPH), b. at Orléans Jan. 9, 1699; studied law; was professor of jurisprudence in his native city, and d. there Mar. 2, 1772. Besides *Pandectæ Justinianeæ* (3 vols., 1748–52), often reprinted, he wrote *Maritime Contracts*, translated by Caleb Cushing (Boston, 1821), *Contracts of Sale*, by L. S. Cushing (Boston, 1839), *The Law of Obligations or Contracts*, by W. D. Evans (Philadelphia, 1840), *Œuvres complètes* (25 vols., Paris, 1810), often reprinted.

Potidæ'a, a rich and flourishing colony of Corinth, on the narrow isthmus which connects the peninsula of Pallene with the mainland, surrendered to the Persians on their march into Greece, but withstood afterward several sieges and attacks by them with great fortitude. After the Persian wars it became a subject ally of Athens, but revolted in 432 B. C. After a siege of two years and unspeakable sufferings it capitulated, and was partly recolonized by the Athenians. It was finally destroyed by Philip of Macedon. He sold the inhabitants into slavery, and the site stood vacant till Cassander founded a new city here, which he called *Cassandreia.*

Poto'mac, a river of the U. S., forming through its whole course the boundary between Maryland and Virginia, and West Virginia, is formed by the junction of two branches, of which the northern rises in the Alleghanies of West Virginia, and the southern in the Shenandoah range, Va. In form it resembles a bow, abounds in delicious fish, is nearly 400 miles in length, receives as tributaries from Virginia the Shenandoah, Savage, and Monocacy rivers, is an estuary 6 to 8 miles wide for 100 miles of its lower course, and enters Chesapeake Bay 75 miles from the Atlantic. The city of Washington, D. C., the national capital, is situated upon its left bank, 125 miles above its mouth, to which point the tide ascends, and it is navigable for large vessels. Above Washington are several falls. The scenery of the upper Potomac is remarkably picturesque, especially the junction of the Shenandoah at Harper's Ferry. On its lower course are the birthplace and the residence of Washington, and in its whole extent it formed an important strategical line during the civil war, giving a name to the principal Northern army, and witnessing many important engagements.

Potosi', city of Bolivia, South America, capital of a province of the same name, on the northern side of the Cerro de Potosi, at an elevation of 13,350 feet above the sea-level, in lat. 19° 35′ S. and lon. 65° 25′ W. In the seventeenth century it had 160,000 inhabitants; now it has about 26,000. Thus, although it contains many fine and substantial buildings, it looks rather like a city in ruins, large portions of it being uninhabited and decaying. The surroundings are naked and barren; provisions must be brought from distant places and on bad roads. The climate, though not unhealthful, is disagreeable on account of the sudden changes of temperature. The conical peak of the Cerro de Potosi, which rises to the height of 16,150 feet and is thickly interwoven with veins of pure silver, is now perfectly honeycombed by the shafts and gangways and galleries of the works, more than 5000 mines having been worked here. The amount of silver and gold which these mines yielded was at one time almost fabulous, but of late it has decreased very much—not because the veins are exhausted, but because the mines have reached a depth in which they cannot be worked without great capital, on account of the immense volume of water in them.

Poto'si, tp., Linn co., Kan., on La Cygne River, includes Pleasonton, the county-seat. P. 1779.

Potosi, p.-v., cap. of Washington co., Mo., at W. terminus of Potosi branch of St. Louis and Iron Mountain R. R., near extensive mines of iron and lead, has a large trade in lumber and dry goods, and 1 weekly newspaper. P. 897.

Potosi, p.-v. and tp., Grant co., Wis., on Mississippi River. P. 2686.

Potosi Island, an island of McIntosh co., Ga., in the Atlantic Ocean. P. 36.

Pots'dam, city of Prussia, province of Brandenburg, at the confluence of the Ruthe and the Havel, 17 miles S. W. of Berlin. It is well laid out, with many fine streets, public squares, and promenades, and is well built, with many fine houses, public edifices, gates, bridges, and monuments. It contains a military and several other educational and benevolent institutions, large manufactures of firearms, and a great number of royal palaces and

summer-houses, old and new, some of which are built on a grand scale and surrounded with extensive gardens and parks. It was founded by the elector Friedrich Wilhelm, who built a palace here in 1673, and owes its prosperity, and even its existence, to the presence of the court. P. 43,834.

Potsdam, p.-v. and tp., St. Lawrence co., N. Y., on Racket River and on De Kalb and Potsdam junction branch of Rome Watertown and Ogdensburg R. R., 22 miles E. of Ogdensburg, noted for its extensive quarries of sandstone of a geological formation which has taken its name from this town. Within the township limits are the post-villages of Potsdam Junction, W. Potsdam, S. Potsdam, and Crory's Mills, besides the principal village, which has fine water-power from Racket River, Holly waterworks, a fire department, the fair-grounds of two agricultural societies, a State normal school, a fine edifice, with 14 teachers and 500 pupils, 6 churches, 1 weekly newspaper, numerous foundries, machine-shops, saw-mills, and manufactories, especially of furniture and agricultural implements, and one of "silver-reed" organs. The densely-wooded region traversed by the upper Racket River affords an immense supply of lumber, which is floated in rafts down the stream. P. 2891; of tp. 7774.

Potsdam Junction, p.-v., Potsdam tp., St. Lawrence co., N. Y., on Racket River, at junction of Ogdensburg and Lake Champlain with De Kalb and Potsdam junction branch of Rome Watertown and Ogdensburg R. R. P. 966.

Pots'dam Sand'stone, the name given to the lowest member of the Lower Silurian series in the classification of the New York geologists. It was derived from the town of Potsdam, St. Lawrence co., N. Y. In this region the Potsdam sandstone is 300 feet in thickness, and is mainly a red or yellow sandstone, sometimes changed to quartzite, and at the base is usually a conglomerate. From Potsdam the outcrop of this formation stretches westward to Lake Superior, where it forms the Falls of the Ste. Marie and the S. shore of the lake to Marquette, including the Pictured Rocks. The copper-bearing sandstones and conglomerates of Kewenaw Point are also generally regarded as representing the Potsdam. On the upper Mississippi the Potsdam sandstone is thicker than at the East, and is locally much more calcareous. It there contains great numbers of trilobites. Farther W., in the Black Hills and Rocky Mountains, the Potsdam sandstone has been fully identified in many places. There, as in New York, it is a red sandstone—sometimes metamorphosed, sometimes highly charged with its characteristic fossils—resting upon the crystalline Eozoic rocks. In Missouri and Texas the Potsdam sandstone is found lying at the base of the unchanged sedimentary series, resting upon the Huronian. In the Alleghany belt it extends southward to Georgia, and attains a thickness not yet observed elsewhere. About the Gulf of St. Lawrence there are strata of shale, sandstone, and limestone, reported by Murray to be of Potsdam age, 5000 feet thick, but they are certainly not the exact equivalents of the New York Potsdam, which was deposited in a mere fraction of the time they represent. In the deep wells of St. Louis and Columbus this rock is found holding its normal position beneath this Calciferous and the great mass of limestones of the Trenton series. The characteristic fossils of the Potsdam sandstone are *Scolithus linearis*—probably the cast of the burrow of annelids—the brachiopods *Lingulepis, Obolus*, and *Obolella*; the pteropods *Hyolites*; and several species of trilobites of the genera *Conocoryphe, Dikellocephalus, Agnostus*, etc.

The mode of formation of this widely-spread deposit can be easily learned by a study of its composition and structure. It is generally composed of coarse materials, often a conglomerate at the base, sandstones higher up. The sandstones are frequently ripple-marked, and in some places sun-cracked, showing that they were deposited along shore-lines where they were marked by the action of the waves, and were here and there exposed temporarily to the sun and wind. We are compelled, therefore, to conclude that the Potsdam sandstone is a beach-deposit, and that it was formed by an invasion of the sea which followed a subsidence of the old Eozoic continent. As the shore-waves moved inland, they spread behind them an unbroken sheet of sea-beach—gravel and sand. This reached as far as the sea extended. When the limit of submergence was reached, the sea remained in undisputed possession until it had spread over the Potsdam a mass of limestones—organic sediments made from the hard parts of marine animals—1000 to 2000 feet in thickness. When the Silurian sea shallowed and retreated, its organic deposits were mingled with the wash from the land carried down by drainage-streams, and the Hudson River group was formed. This completed the Lower Silurian series of sediments, and brought this geological age to a close, leaving a large part of the area occupied by the Trenton sea as dry land. No deposits were made on this till, after the lapse of ages, the sea again flowed over parts of it, forming in its advance, sojourn, and retreat the Upper Silurian circle of deposits, similar in character to those below, but containing a different group of fossils, since in its long retirement the inhabitants of the sea had so far changed that scarce a half dozen species of the old fauna came back with the new. (See GEOLOGY and PALÆONTOLOGY.) J. S. NEWBERRY.

Pot'stone, a variety of talc, sometimes wrought, like soapstone, into pots, stoves, and kettles. It abounds in Europe, and is coarser and more granular than the best soapstone.

Pott (AUGUST FRIEDRICH), b. at Nettelrede, in Hanover, Nov. 14, 1802; studied philology at Göttingen; was appointed professor in Halle in 1833, and is one of the most prominent representatives of the science of comparative philology. Of his *Etymologische Forschungen*, one of his principal works (2 vols., Lemgo, 1833–36), he gave a new and revised edition (4 vols., Detmold, 1867–73). Of his numerous works treating more particular subjects the most remarkable are *Die Zigeuner in Europa und Asien* (2 vols., Halle, 1845), *Die quinare und vigesimale Zählmethode* (1847), *Die Personennamen und ihre Entstehungsarten* (1853), *Anti-Kaulen* (1863), *Die Sprachverschiedenheiten in Europa an dem Zahlen nachgewiesen* (Halle, 1868).

Pottawat'tamie, county of W. Iowa, separated from Nebraska by Missouri River. Area, 970 sq. m. It is uneven, highly fertile, and adapted to corn and wheat culture. The county is traversed by various railroads, which centre at Council Bluffs, the capital. P. 16,893.

Pottawattamie, county of N. E. Kansas. Area, 851 sq. m. It is bounded S. by Kansas River, and its W. part is traversed by Big Blue River and Kansas Pacific R. R. It is undulating, fertile, and adapted to grain-culture. Cap. Louisville. Cap. 7848.

Pottawattamie, tp., Coffey co., Kan. P. 520.

Pottawattamie, tp., Franklin co., Kan. P. 695.

Pottawattamie, tp., Pottawattamie co., Kan., on Rock Creek. P. 1155.

Pottawattamies, a tribe of Indians of the Algonkin family who originally occupied a large portion of the peninsula of Michigan; were of a very low grade of civilization as compared with the surrounding tribes, being divided into bands recognizing no common allegiance or settled government; spoke an extremely rude dialect; were constantly at war with their neighbors, and were driven westward to Green Bay by the Iroquois toward the close of the seventeenth century. By an alliance with the French in several wars they recovered their position in Southern Michigan, and spread over Northern Indiana and Illinois. The Jesuits early established a mission on St. Joseph's River, Mich. They took part in the alliance formed by Pontiac 1763, fought against the Americans during the Revolution, were vanquished by Wayne in his Western campaign, participated in the treaty of Greenville Dec. 22, 1795, were allies of the British in the war of 1812–15, after which they soon disposed of most of their lands by successive treaties, and removed to the region now known as Kansas. In 1838 they numbered 4000. A few still reside in Michigan and in Wisconsin; the majority have been partially civilized by Catholic and Protestant missions, and are now citizens of Kansas.

Pot'ter, county of Pennsylvania, bounded N. by New York. Area, 1050 sq. m. It is elevated, and mostly covered with great forest trees. Its soil is generally good. Grain and wool are produced. Lumber and leather are the principal manufactures. The county contains detached beds of coal, but little developed. Cap. Coudersport. P. 11,265.

Potter, p.-v. and tp., Yates co., N. Y. P. 1970.

Potter, tp., Centre co., Pa. Pop. 2358.

Potter (ALONZO), D. D., LL.D., b. at La Grange, N. Y., July 10, 1800; graduated in 1818 at Union College, and afterward married the only daughter of Pres. Nott; became a college tutor 1819, and held a mathematical professorship in Union College 1821–26; took deacons' orders in the Protestant Episcopal Church 1821, presbyters' orders 1824; was rector of St. Paul's, Boston, 1826–31; professor of moral philosophy and vice-president of Union College 1831–45; became bishop of Pennsylvania in 1845; was one of the founders of the Episcopal Hospital and the Divinity School, Philadelphia. D. at San Francisco, Cal., July 4, 1865. Author of *Political Economy* (1841), *Handbook for Readers and Students* (1847), *Discourses, etc.* (1858), *Religious Philosophy* (1870), and other works.

Potter (Chandler Eastman), b. at Concord, N. H., Mar. 7, 1807; graduated at Dartmouth College 1831; taught school, practised law, served in the State legislature; edited the Manchester *Democrat* 1844–48, the *Farmer's Monthly Visitor* 1852–53, and the *Granite Farmer* 1854–55; wrote a history of Manchester; was an active member of the New Hampshire Historical Society, of which he was president 1855–57; wrote largely upon the Penobscot and other Eastern Indians, and drew up a *Military History of New Hampshire*, published in the adjutant-general's *Reports* for 1866 and 1868. D. at Flint, Mich., Aug. 4, 1868.

Potter (Clarkson Nott), son of Bishop Alonzo, b. at Schenectady, N. Y., in 1825; graduated at Union College 1842, and at the Rensselaer Institute, Troy, as a civil engineer 1843; became a surveyor in Wisconsin; studied law and was admitted to the bar in that State; commenced practice in New York City 1847; obtained an extensive business, and sat in Congress as a Democrat 1871–75.

Potter (Edward E.), U. S. N., b. May 9, 1833, in New York; entered the navy as a midshipman Feb. 5, 1850; became a lieutenant in 1858, a lieutenant-commander in 1862, a commander in 1869; served as executive officer of the Wissahickon at the passage of Forts Jackson and St. Philip and capture of New Orleans, and in all the hard-fought battles on the Mississippi in 1862, and commanded the Chippewa at the taking of Fort Fisher, Jan., 1865. Commended by Commander de Camp for "ability and courage," and recommended for promotion by Rear-Admiral Porter. Foxhall A. Parker.

Potter (Eliphalet Nott), D. D., son of Bishop Alonzo Potter and grandson of President Nott, b. at Schenectady, N. Y., Sept. 20, 1836; graduated at Union College 1861; studied theology; took orders in the Episcopal Church; was pastor of churches at Bethlehem, Pa., and Troy, N. Y.; built at the former place three churches, and at the latter two chapels; became professor of Christian evidences at Lehigh University 1866, and president of Union University (formerly Union College) 1871, adding the duties of chancellor of that institution 1872. Author of *Parochial Sermons*, and now (1876) preparing a work on *Christian Evidences at the Close of the Nineteenth Century*.

Potter (Hazard Arnold), M. D., b. in Potter, Ontario co., N. Y., Dec. 21, 1810; took his medical degree at Bowdoin College in 1835; became in 1853 a surgeon and physician at Geneva, N. Y., where he attained a national reputation as a skilled operative and clinical surgeon. As early as 1837 he detected arterial blood in the veins of a part paralyzed in consequence of injury to the spinal cord—a phenomenon which he was one of the first to announce. Served as a surgeon in the Federal army in the war of 1861–65. D. at Geneva, N. Y., Dec. 2, 1869.

Potter (Horatio), D. D., LL.D., D. C. L. Oxon., b. at La Grange, N. Y., Feb. 9, 1802, a brother of Bishop Alonzo Potter; graduated at Union College 1826; took deacons' orders in the Protestant Episcopal Church 1827, presbyters' orders 1828; was professor of mathematics in Washington (now Trinity) College, Hartford, Conn., 1828–33; became in 1833 rector of St. Peter's, Albany; in 1854 provisional bishop, and in 1861 bishop, of New York.

Potter (John), D. D., b. at Wakefield, Yorkshire, England, about 1674; educated at the Wakefield free school; graduated at University College, Oxford, 1692; published a volume of *Variantes Lectiones* on one of the works of Plutarch 1693; became fellow of Lincoln College 1694; edited Lycophron's *Alexandra* 1697; was ordained in the Anglican Church 1697; published his principal work, *Archæologia Græca* (2 vols., 1697–98); became chaplain to Archbishop Tenison 1706; regius professor of divinity at Oxford 1708; bishop of Oxford 1715, having just finished his edition of *Clemens Alexandrinus*, and became archbishop of Canterbury 1737. D. at Lambeth Oct. 10, 1747. His *Theological Works* appeared in 3 vols., 1753.

Potter (John F.), b. at Augusta, Me., May 11, 1817; educated at Phillips Academy, Exeter, N. H.; studied law and settled in Wisconsin; was a judge of Walworth co. 1842–46; member of the legislature 1856; Republican member of Congress 1857–63, acquiring celebrity during the excitement growing out of the Brooks assault upon Sumner by his proposal to fight a duel with a Southern member with bowie-knives as weapons; was a delegate to the "Peace convention" of 1861, and appointed in 1863 consul-general at Montreal, Canada.

Potter (Joseph H.), b. in New Hampshire in 1822; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of infantry July, 1843; colonel 1873; in the war against Mexico was engaged in the defence of Fort Brown, May, 1846, and in the battle of Monterey, Sept., 1846, where severely wounded (brevet first lieutenant); subsequently served on the Western and Southern frontiers, and made prisoner in Texas July, 1861; exchanged Aug., 1862, appointed colonel of the 12th New Hampshire Vols. in September, and, joining the Army of the Potomac, commanded a brigade in the battle of Fredericksburg, Dec., 1862, at Chancellorsville May, 1863, where wounded and taken prisoner; exchanged Oct., 1863. Served as assistant provost-marshal-general of Ohio Feb.–Sept., 1864, when assigned to the command of a brigade in the 18th corps, and in December in the 24th corps, of which latter he was chief of staff from Jan., 1865, till the close of the war. Appointed brigadier-general U. S. volunteers May, 1865; mustered out Jan., 1866. In Dec., 1873, became colonel of the 24th Infantry. Brevet lieutenant-colonel, colonel, and brigadier-general U. S. A. for gallantry during the war.

Potter (Nathaniel), M. D., b. on the Eastern Shore of Maryland in 1770. The greater part of his life was spent in Baltimore, where, with others, he organized the medical department of the University of Maryland, and occupied in it for thirty years the chair of the theory and practice of medicine, even down to his death. As a practitioner he was prompt to every call and exercised sound judgment; and as a teacher was impressive. D. in Baltimore Jan. 2, 1843. Paul F. Eve.

Potter (Paul), b. at Enkhuysen, in the present province of North Holland, in 1625; received the first instruction in painting from his father, an obscure painter, but soon outgrew his guidance and became the most celebrated painter of animals of his time, admired for the truth of his observation, the naturalness and variety of his composition, and the brilliant effects of his coloring. D. at Amsterdam Jan. 15, 1654. Some of his pictures, such as the *Young Bull*, at the Hague, the *Bear Hunt*, in Amsterdam, etc., are life-size, but most of them are cabinet pieces distinguished by an extraordinary finish. His etchings and drawings are much appreciated. (See *Paul Potter, sa Vie et ses Œuvres*, by J. van Westeheene (the Hague, 1867).)

Potter (Robert), b. in England in 1721; graduated at Emanuel College, Cambridge, 1741; held several ecclesiastical benefices; wrote some poems and miscellaneous essays, and produced esteemed poetical translations of Æschylus (1777), Euripides (1781–82), and of Sophocles (1788); became prebendary of Norfolk and vicar of Lowestoft and Kessingland. D. Aug. 9, 1804.

Potter (Robert B.), son of Bishop Alonzo, b. in New York about 1830; studied law, which he practised with success in New York; entered the volunteer military service 1861 as major of the 51st New York Vols.; participated with distinction in the battles of Roanoke Island, New Berne, Cedar Mountain, Manassas, Chantilly, and Fredericksburg; carried the stone bridge at Antietam, where he was wounded; became brigadier-general Mar. 13, 1863; commanded a division at Vicksburg and a corps in the Tennessee campaign; again commanded a division under Grant in the final campaign in Virginia; was brevetted major-general June, 1864, "for gallantry in several actions since crossing the Rapidan," and was shot through the body in the assault on Petersburg Apr. 2, 1865, but recovered.

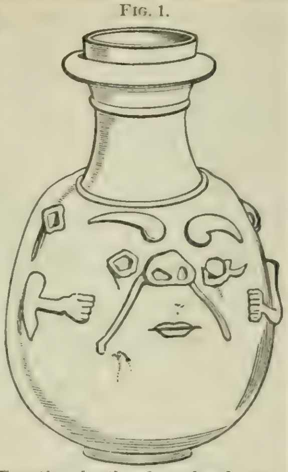
Potter's Clay. See Clay.

Potter's Hollow, p.-v., Rensselaerville tp., Albany co., N. Y. P. 138.

Pot'tery, a term applied to all objects made of baked clay, derived from the Greek word *poterion* and the French *poterie*. It was one of the oldest arts of mankind, and sun-dried bricks appear in Egypt almost coeval with the nation itself. Vases of small size made of red kiln-baked clay abound in the vicinity of the Pyramids, although the Egyptians never used baked bricks, and the so-called *porcelain* of this people, a kind of faïence of white sand, very slightly fused, and covered externally with a thin silicious glaze of a blue or green color, is of equal antiquity. At a later period yellow, red, and other colors formed by metallic oxides appear, and contemporaneously a kind of glazed ware made by covering steatite with a fused glaze. This porcelain continued in Egypt till the age of the Roman empire, or the second century A. D., and was chiefly used for objects of small size or inlaying. The bright blue is remarkably fine, but was superseded about the sixth century B. C. by a pale and dull green. The art of pottery was extensively used by the Babylonians and Assyrians, and terra-cotta or slightly-baked red clay employed in the shape of barrel-cylinders or prisms for historical records deposited in the foundations of edifices, or rectangular tablets, sometimes convex on the sides, for various records and compositions. On these the scribe impressed with a stylus the cuneiform or arrow-headed characters. Bricks of the same material were also used and inscribed in the same manner, and some of these are

as old as B. C. 2000. The vessels of these people resembled those of the Egyptians, except that the forms were more elegant and the sides thinner. They also at an early period had a faïence of glazed ware of various colors with a lead glaze, employed for bricks, architectural ornaments, and vessels. Blue was a favorite color, as in Egypt, and the bricks had sometimes pictures in outline on them. This was continued in the valley of the Euphrates after the fall of the Babylonian empire, and large coffins with oval covers of the Sassanian epoch, as late as the first century A. D., have been found extensively used in the cemeteries of Warka and Mugeyer. It may indeed be considered doubtful if the art of glazing vases was ever lost in the East. The Jews in the time of the Kings had potteries, some glazed; their unglazed ware was coarse, and strongly resembled the Egyptian. The objects of pottery brought from Moab are modern and spurious imitations of the antique. All these nations used the different processes of modelling, forming on the wheel, and stamping. The Phœnicians had also plain and glazed wares, one kind resembling the Egyptian blue faïence, the other like the early Greek, consisting of a thin silicious glaze laid over terra-cotta vases ornamented with black or maroon bands and geometric patterns. This pottery is apparently as old as the sixth century B. C., and continued till the pre-eminence of the Greek wares supplanted it about the fourth century B. C.

Fig. 1.



Egyptian bottle of unglazed ware, ornamented with grotesque head of the god Bes.

Amongst the Greeks, the invention of the potter's art was as old as Homer, by whom it is mentioned, and sun-dried clay was employed by some of the earliest potters. Kiln-dried bricks were used in the palace of Crœsus; and these, thin and tile-like, were of various sizes, named *Lydia*, or Lydian; *didora*, two palms; *tetradora*, or four palms; and *pentadora*, or five palms square. They were in extensive use and stamped with the names of makers. Other architectural members of buildings were also made of terra-cotta stamped by moulds, and statues of life-size were occasionally made of the same material about the fourth century B. C. Objects to affix to other *emblemata*, made separate from moulds, and a great number of small terra-cotta figurines, used as sepulchral deposits or votive offerings, hollow internally, with a hole to hang them up or obviate the contraction of the clay in the furnace, were made throughout Greece and Asia Minor from a very early period to the second century A. D. These were colored white with a coating of lime (*leukoma*) and gaudily painted. Some are of exquisite beauty, others caricatures or grotesques. Lamps, *lychni*, with subjects in relief on the upper surface and with the maker's name beneath; dolls with movable limbs (*neurospasta*); cones or weights; whorls or conical bracts, and some few smaller objects, were made of terra-cotta. But the principal product of the Greek potter was vases, made on the horizontal table or wheel, mostly for domestic purposes, especially the export of wine and oil; and those of Rhodes, Cnidus, and other Greek cities had impressed on their handles the device and name of the *eponymon* (magistrate for the year in which they were made). They are *amphoreis*, or amphoræ, and used as casks, and came extensively into use about the second century B. C. Some of these vases are of the oldest date of the pre-historic period of Greece, and some found on the site of Troy resemble those discovered in the mounds of Eastern Germany. Other vases of the same material, made for purposes purely sepulchral, were covered with a similar coating, painted and in part gilded. The most remarkable are the so-called *painted* (or rather glazed) vases found in the sepulchres of all Greek sites and in Etruria, and which were developments of the Phœnician, before mentioned. The glazed bands and geometric ornaments were at first accompanied by small figures of animals; human figures were subsequently introduced, but of diminished size, and became, as the art advanced, of larger size, occupying the area of the vase, while the ornamentation was reduced to smaller dimensions. These figures were traced on the moist clay by an incised or dotted line, and the colors laid on with a reed or brush; a second color was applied in the accessories over the black color of the figures, and incisions were made through the dark color of the face and limbs to indicate the details. The dark color of these early vases was manganese—the flat, superposed pipe-clay, oxides of iron and copper, and ochres. The clay of Corinth was straw-color, that of Athens fawn, but a warm red came into use as the art advanced. The whole vase, except the flat tints, was covered with a silicious glaze. These vases with black figures seem to have prevailed from the sixth to about the fourth century B. C., after which by degrees the figures were left the color of the clay, and instead of incisions lines drawn by the pencil filled up the details; the background was colored black; and the art, which had reached its apogee about the middle of the fourth, gradually changed in style from the chaste and pure to the florid and voluptuous about the third century B. C., becoming at last extinct as the states of Greece declined and metallic vases superseded those of clay. The last vases of the kind, of black color with white decorations and subjects, or entirely black with ornaments and designs stamped out from moulds, imitated those of metal. The subjects of these vases are derived from the cycle of Greek mythology; the figures are often accompanied with inscriptions, the names of the figures represented, their speeches; the names of potters, vase-painters, and of celebrated beauties are also introduced, and the names of ancient possessors are sometimes scratched on them. The subjects were copies or adaptations of the principal pictures of the time. Many vases were made for sepulchral purposes, and were covered with a *leukoma*, on which the artist drew in red outline and filled in with gaudy color subjects from the mythos of Orestes. These vases have been found at all the places which had commerce with Greece—in Etruria, the Crimea, the isles, and even Egypt—and the largest specimens are those discovered out of Greek territory.

Fig. 2.

Birth of Athene, on a Greek pelike, from Vulci.

The Etruscans worked in terra-cotta like the Greeks, their best products being statues; and although they imitated with small success the painted vases of Greece, they produced a peculiar ware of brown color with rude ornaments, and a soft black ware moulded with ornaments and figures in coarse style, imitations of works of metals, and on the different ware produced friezes or other ornaments by stamping or by a revolving cylinder. They extensively imported as objects of luxury the finest vases of Greece.

The Romans, following the Etruscans, whose statues they adopted, made great use of flat bricks (*lateres*) and tiles (*tegulæ*), like bricks, but with flanges for roofs, covered by a semi-cylindrical tile (*imbrex*) at the joint. These were employed for buildings, walls, and graves; they also had hollow square pipes (*tubi* or *tubuli*) for the flues of hypocausts, and cylindrical ones for drains. The tiles, as well

as other architectural members and ornaments, were made of a fine compact clay of red color, and those used at Rome had stamped upon them a circular stamp with a trade device, the name of the potteries where and of the consuls under whom made; provincial ones had instead the names of the legions by whom fabricated during the first and second centuries A. D. Statues, figurines, lamps with bas-reliefs of different subjects and names of makers, vases, or casks of huge size (*dolia*) and other vessels for domestic use, especially amphoræ and phials, were also produced by the potteries. But the best ware of the first two centuries A. D. was the so-called Samian, first made at Cuma, Capua, and Arretium in Italy, and afterward throughout Spain, Gaul, Britain, and Germany, of a red sealing-wax color and appearance throughout, with subjects stamped in relief, and the names of potters. It was principally used for small vases, and covered with a silicious glaze. An inferior black-and-brown ware was made in the provinces till about the third century A. D.

Outside the limits of the civilized world, the inhabitants of Europe made at the early or pre-historic period hand-made vases of a rude, friable, imperfectly-baked brown ware, with a few other articles of pottery, differing in type according to locality, and much improved subsequently after contact with the Roman. This rude ware was followed by the Anglo-Saxon and German with stamped ornaments, but the use of unglazed pottery and terra-cotta declined in the Dark and Middle Ages in Europe, and did not revive till the fourteenth century. Great jars, water-bottles, and some other vessels have been made from that period to the present day in the West and East, the earthenware being of a harder texture; and about the fourteenth century a glazed earthenware, consisting principally of jugs covered with a green glaze, came also into use. This succeeded the Roman glazed ware for some small objects of a brown or olive color produced by lead. According to some, the use of glazes was introduced into Spain as early as the eighth century A. D., and some tiles used for the early churches and Alhambra date from 1300. The conquest of Majorca (1155) is thought to have introduced metallic glazes, and a new departure took place about 1415, when Lucca della Robbia employed them for architectural ornaments. A century later the majolica-ware, as it is called, was used for plates, jars, and other objects of luxury, painted with gay colors, especially yellow, from designs by Raphael, Marc Antonio, and others. Pesaro, Gubbio, Faenza, Forli, and Rimini were the chief sites of this pottery, which flourished in Italy till the eighteenth century, and has been successfully imitated recently by the English potteries. Although introduced into France, where it flourished till the close of the seventeenth century, it was surpassed in that country by the potter Palissy about 1550, who produced dishes and objects with animals in relief of a hard gray paste covered with a fine enamel—a style also recently revived; and by the so-called Henry II. ware, made of pipeclay, with various colors finely glazed. Germany also made majolica and glazed wares at the same time, and Holland the delftware imitated from the Chinese, and stoneware bottles for wine and tankards glazed by salt and ornamented with reliefs produced by a mould. These vessels were much prized and extensively exported.

Fig. 3.

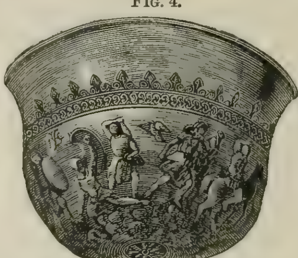
Etruscan wine-pitcher, of black ware: Perseus and the Gorgons.

In England, except the rudely-glazed pitchers, the principal produce of the potteries was the so-called Norman tiles, used for the floors and other parts of religious edifices. They were made of red clay, with white or yellow devices of a floral or architectural character, and glazed. The tiles are of small size, about four inches square, and are supposed to have been made by the monasteries. The first improvement in the English potteries was caused by the introduction of Dutch potters in the seventeenth century, who manufactured stone and delftware at Fulham and Lambeth. In the same century the potteries of Burslem in Staffordshire produced only coarse earthenwares till the arrival of German potters and the discovery of the use of flint and more suitable materials; but the great improver was Wedgwood, who invented several improved wares, as well as terra-cottas, and whose small objects in relief, with designs by the sculptor Flaxman, elevated the beauty of the production, especially by his works in biscuit, used for objects of virtu. Subsequently, in 1767, the art of applying designs from copper-plates to pottery, and that of gilding it, were discovered. Great improvements were made by Spode about 1800 in the production of soft porcelain by the introduction of feldspar, borax, and bone. Although Staffordshire was the chief site of the potteries, stoneware has continued to be made at Lambeth and Vauxhall, and other potteries were distributed over the country at Fulham, Bristol, Leeds, and Lowestoff, most of which are now extinct.

The introduction of Chinese porcelain gradually effected a revolution in the European potteries, which endeavored to rival, with more or less success, the products of the Celestial Empire. The invention of pottery or earthenware is attributed by the Chinese to Hwang-te, who lived about B. C. 2700, and it is extensively used to the present day for the ordinary requirements of life—jars and other objects. Tiles of this ware glazed yellow were employed for the celebrated Porcelain Tower or pagoda of Nanking. Porcelain was not made in China till the time of the Han dynasty, about B. C. 185, when it was invented at Sinping, and about A. D. 538 the celebrated potteries at Kingtechin, consisting of 3000 furnaces and 56 establishments, were established. Crackle, produced by suddenly cooling the ware, was invented about A. D. 1279, and eggshell in 1573. The date of the introduction of porcelain manufacture into Japan is not exactly known, although some historians place it B. C. 27, in the time of Sinra, who introduced it from the Corea. Chinhan (B. C. 203) is thought to have colonized the Corea in the time of the Chinese Tsin dynasty. But it was not till A. D. 662 that a Booddhist monk introduced translucent porcelain into Japan, and it came to Europe in the sixteenth century, principally from Hizen, which produced a red, blue, and gold ware called at the time "old Japanese." The best wares came from Idsumi Yama, or the mountain Idsumi. At Owari all kinds of porcelain, called *setamoni*, were made. The oldest potteries, however, were those of Kioto or Miaco, the capital, celebrated for its red and gold ware. Titsu produced a kind of pots; Satsuma, porcelain with delicate orange tints; Awadji, a cream-colored faïence; and Hiogo, a celadon ware. The Japanese porcelain is whiter, of finer quality, and more beautifully colored than the Chinese.

It is not known that porcelain existed at an early period in the Corea or Indo-China, but some examples find their way from those countries into the hands of collectors. Chinese porcelain seems to have been exported to Arabia in the eighth century A. D., and was known to Arab writers of the twelfth century. It found its way to Europe at the beginning of the sixteenth century, but it was not till the commencement of the eighteenth century that the secret of making it was discovered. In 1712 the Jesuits had sent from Jaouchow descriptions from Chinese books, as well as of the processes carried on for its fabric, but Réaumur, although he determined the true character of the ware, was unable to obtain the materials. In 1709, Böttcher, a chemist of Berlin who had fled to Saxony, produced a perfect white porcelain at Meissen, near Dresden, from the kaolin found at Aue in the Erzegebirge, and the shapes and painting were rapidly improved by his successors and assistants. Although every attempt was made to retain the secret, the art was soon known all over Germany, and at Vienna in A. D. 1720 an establishment was founded, and has been followed by others at Carlsbad and Prague. Others appeared in 1755 at Frankenthal, and a private (but subsequently royal) porcelain manufactory at Berlin in 1751. In France, although soft porcelain was attained in 1695, and the manufactory of Sèvres established in 1756, the requisite kaolin and pihtuntsze were not discovered till 1768, and soft porcelain continued till 1804. Other places in France also manufactured this ware, but that of Sèvres was always pre-eminent for elegance of shape, beauty of color, and the painting. Hard porcelain was also made in Italy and Spain, and a manufactory flourishes in Portugal. In England soft porcelain was first produced at Bow in the

Fig. 4.



Proto-Samian cup, with an Amazonomachia in relief, from Athens.

eighteenth century, and at Chelsea at the close of the seventeenth, but it was not till French and German artists had been procured that the Chelsea ware attained that beauty of form and painting for which it is distinguished. The vases were imitated from France and Dresden: the establishment was abandoned in 1795. Minor manufacturers at other places produced hard porcelain, but it gradually gave way in England to the cheaper soft porcelain, and, although again produced by Minton in 1850, has never been extensively used.

In the East, the potteries are chiefly of unglazed ware, although glazed ware, both of tin and lead, has been made in Turkey, Arabia, and Persia since the twelfth century A. D. In Africa the tribes of negroes make a black-and-red ware slightly baked and not glazed, and in Oceanica, Feejee alone produced a hard-baked red earthenware glazed, or varnished with a gum. In America the different products of the aboriginal races produced different kinds of earthenware, chiefly unglazed. That of North America, including Canada, resembles the Celtic and Teutonic of the so-called pre-historic period. In the mounds of Ohio pipes—some with the bowls in shape of animals—and gourd-shaped bottles have been found. The Mexicans attained considerable excellence in the fabrication of pottery, producing large vases of earthenware, with moulded figures of men and animals, painted with flat colors, and bowls painted inside with ornaments in red, black, and white. They also produced a polished ware. All are hand-made, and not produced by the wheel, and a kind of it continues to be made at the present day. Similar wares were made in Central America; and in the S., Peru, during the rule of the incas, had a fine pottery, chiefly flasks or drinking-vessels, often with two cylindrical necks and orifices, and the body moulded in the shape of the human head, animals, and gourds. Some of these are finely executed, and ornamented with figures drawn with great skill, and slightly glazed or polished. The modern pottery of Peru is far inferior, as is that of South America in general. Great black casks or jars were made to hold the desiccated bodies of some of the tribes of the continent. Brazil produces a large quantity of pottery, chiefly double-necked bottles, and jars (*talhas*) capable of holding fifteen gallons of liquid.

In the U. S. attempts were made early in the present century to establish works for the production of porcelain and pottery—one in New Jersey in 1816, others at Philadelphia, abandoned in 1836. Trenton, N. J., has extensive fire-brick and terra-cotta works; Jersey City manufactures glazed red and white granite ware and a good porcelain; Greenpoint, Long Island, N. Y., has large porcelain-works; and East Liverpool, O., produces fine stone ware.

Pottery and porcelain are divided into soft pottery, fine earthenware, stone or granite ware, and porcelain. The soft porcelain is distinguished by fusing at a lower temperature. At all times the pride of the potters has recorded their names upon their productions; the Greeks wrote them; the Romans stamped them in relief; the Chinese used square seals in red or blue, not impressed or in relief, having the dates of manufacture (commencing with Hung-Woo (A. D. 1368) and continuing till the present day), the names of establishments, persons, and sometimes devices; the Japanese employed the same, and in Europe initial letters, arms of town and patrons were glazed in colors, or else devices—such as a globe and cross for Berlin; a sun, crowned eagle, or comet for Sèvres. Initials, as B. by Palissy, N. for the potteries of Nevers, and the name in full by Wedgwood and others, either in relief or glazed, were used. Thousands of these names and devices occur, and require a special knowledge to refer the pieces to their exact place and period. Large prices are paid by amateurs and collectors for choice and rare specimens of porcelain and ancient Greek vases. S. BIRCH.

Pottery and Porcelain Manufacture [*Earthenware, Stoneware, Ceramics;* Ger. *Porzellan, Steingut, Töpferei;* Fr. *poterie*]. The peculiar properties of clay and its general distribution have made it the most available material for the manufacture of useful and ornamental vessels from the most remote antiquity. Its plastic quality when wet renders the work of giving it any desired form very simple, and its hardness and firmness after baking give it a great amount of durability, notwithstanding its brittleness. For this reason vessels of pottery and bricks are among the oldest and most numerous relics we have of ancient races all over the world. Clay is the product of the disintegration or weathering of silicious rocks. Feldspar, mica, hornblende, etc. are silicates of alumina, potash, soda, lime, magnesia, oxide of iron, etc., which occur in the crystalline rocks associated with grains of quartz. By the long-continued action of water, carbonic acid, etc., they are decomposed; the alumina retains a certain proportion of the silica, combines water, and becomes clay, while the other bases are removed more or less completely either as soluble silicates (potash and soda) or as soluble bicarbonates, etc. (lime, magnesia, etc.). The immediate effect of this decomposition is the conversion of the firm rock into a soft mass of clay (more or less firm) and of quartz-sand. By the action of water this mass is finally separated into sand, which, owing to its size, is deposited while the water is still in motion, and clay, which is held in suspension until the water becomes quiet, when it is deposited in beds. Owing to the difference in the mineral constituents of the original rocks, and in the extent to which the decomposition and separation has proceeded, there is the greatest variety in the composition, and consequently in the quality, of the resulting clays. The chief and characteristic constituent of all clays is the hydrous silicate of alumina, called *kaolinite* ($Al_2O_3.2SiO_2 + 2H_2O$), which contains 46.36 SiO_2, 39.72 Al_2O_3, 13.91 H_2O. Associated with this there is always a considerable quantity of fine quartz-sand (SiO_2), a little silicic hydrate (H_2SiO_3), or alkaline silicate, variable proportions of undecomposed feldspar, mica, hornblende, etc., oxide of iron, carbonate of lime, organic matter, etc. Riley (*Chem. Soc. J.*, xii. 13; xv. 311) has shown that nearly all clays contain titanic acid; he found from a trace to 1.05 per cent. The formation of kaolinite from feldspar is here shown:

Feldspar	K_2O,	$Al_2O_3, 6SiO_2$	+ Aq.
Kaolinite		$Al_2O_3, 2SiO_2$	+ $2H_2O$
Potassium silicate	K_2O	$4SiO_2$	+ Aq.

Clay occurs in soft masses, which can generally be readily crushed. It is plastic when wet, this most important quality varying with the purity; the more plastic is said to be *fat* or *long*—the less *lean, meagre*, or *short*. It concretes into a hard mass on drying, and after baking is often so hard as to strike fire with steel. If it contains little besides pure clay (kaolinite) and silica (sand), it is infusible at a white heat, but the presence of undecomposed silicates, feldspar, etc., or of alkalies, lime, magnesia, oxide of iron, etc., renders it more fusible. Oxide of iron, if present to any extent, causes it to become red on baking. The pure, highly-plastic clays are liable to crack in drying and to lose their shape. This is counteracted by adding sand. To prevent distortion in firing, hard-burned stoneware is ground to powder and incorporated with the clay. The degree of shrinkage which occurs in drying the clay depends on the purity of the clay and the percentage of water it contains—from 14 to 31 per cent. on the surface of articles, from 20 to 43 on the volume. A fusible and a refractory clay when baked together form a mass which is no longer porous (stoneware). The clays employed in ceramic manufacture are—(1) Refractory clays, as kaolin or porcelain clay, fire-clay, pipe-clay, etc. (2) Fusible clays, as potter's clay, loam, or brick-clay, etc. (3) Calcareous clays or marls. (4) Ferruginous clays, as ochre, reddle, etc.

Kaolin, or *Porcelain Earth*, is white, with often a yellowish tint. It is meagre to the touch, burns white, and is infusible in the porcelain furnace. It is found in connection with the crystalline rocks—granites, porphyries, etc. Its chief localities are (1) Bavaria: Aschaffenburg, Stolberg, Diendorf, Oberedsdorf; (2) Prussia: Morl and Trotha near Halle (material for Berlin porcelain manufacture); (3) Saxony: Schneeberg, Mionia; (4) Hungary: Brenditz, Carlsbad, Prinzdorf; (5) France: St. Yrieux, near Limoges; (6) England: St. Anstel, in Cornwall; (7) China; (8) Japan; (9) U. S.: Brandon, Vt.; New Castle and Wilmington, Del.; Jacksonville, Ala.; Edgefield, S. C.: Augusta, Ga., etc. The composition of kaolin is shown in the following analyses:

	Passau.	Zettlitz.
Silica	44.90	45.96
Alumina	34.29	37.97
Sesquioxide of iron	0.85	0.83
Lime	1.23	0.20
Magnesia	0.27	0.44
Potassa	0.59	1.00
Soda	0.39	0.65
Water	16.85	14.21
	99.37	101.26

As the kaolin is first raised, it has the appearance of mortar, containing grains of quartz and other minerals. It is exposed to a stream of water, and the milky liquid is carried through a series of settling-vats, where the coarser particles are deposited. The liquid is then run into shallow reservoirs, where the kaolin settles. It is afterward dried for market.

Fire-clay is one of the most refractory varieties. It is used for crucibles, gas-retorts, stove-linings, and fire-bricks. It is found in the Carboniferous strata, immediately under the coal-beds, whence it is called the *under clay*. The following analyses show the composition of this clay:

	Amblecote.	Stourbridge.	Dourdan, Seine-et-Oise.	Savanas, Ardèche.
Silica	61.33	60.27	60.60	58.76
Alumina	26.22	23.89	26.39	25.10
Protoxide of iron	1.06	1.74		
Sesquioxide of iron	......	......	2.50	2.50
Lime	0.41	0.72	0.84	trace
Magnesia	0.19	0.66	......	2.51
Alkalies	0.68	0.95		
Water	10.11	11.21	9.20	12.50
	100.	99.44	99.53	101.37

Pipe-clay, Potter's Clay, Plastic Clay, compact, smooth, even unctuous to the touch; may be polished by the finger when dry. It has a great affinity for water, adheres strongly to the tongue, forms a tenacious paste with water; infusible in the porcelain furnace, but acquires great solidity in firing, which distinguishes it from common clays used for coarse earthenware. Some varieties burn white, some red. It is used for fine stoneware. Such clay is abundant at Hackensack and Perth Amboy, N. J., East Liverpool, O., etc.

	Strasbourg.	Stourbridge.	Forges-les-Eaux.
Silica	66.70	63.70	52
Alumina	18.20	20.70	27
Magnesia	0.60		
Oxide of iron	1.60	4.50	2
Water	12.00	10.00	19
	99.10	98.90	100

Ordinary Potter's Clay is very plastic, but contains such quantities of oxide of iron, lime, etc. as to cause it to fuse at high temperatures, and generally to burn dark-red. Such clay abounds at Elizabethport, N. J., and many other localities. The following are common potter's clays:

	Provins, Seine-et-Marne.	Livernon, Lot.	Helsingborg.
Silica	57.	61.	60.
Alumina	37.	30.	24.
Oxide of iron	4.	7.6	7.5
Lime	1.7	2.4	0.5
	99.7	101.	92.

Dorsetshire Blue Clay is a fusible clay which burns white; it is abundant at Wareham. The Glasgow red or brown clay is a fusible clay much prized for common black ware, flower-pots, etc.:

	Wareham blue clay.	Glasgow red clay.
Silica	46.38	49.44
Alumina	38.04	34.26
Protoxide of iron	1.04	7.74
Lime	1.20	1.48
Magnesia	trace	1.94
Water	13.44	5.14
	100.	100.

Common Clay, or *Loam*, is an impure mixture of clay and sand, generally containing sufficient iron to burn red. It is found at the surface, occurs almost everywhere, and is used for bricks, drain-tile, and coarse pottery. Beds occur in some of the Western States which are so free from iron that they burn to a cream color; the Milwaukee bricks are notably of this character.

Marls are clays containing considerable quantities of carbonate of lime. In water they fall to powder, and form a non-adhesive, pasty mass. They fuse easily. The following analyses show their character:

	Chambray.	Savone.
Silica	49.50	37.00
Alumina	29.00	11.00
Oxide of iron	3.00	6.50
Carbonate of lime	18.00	45.00
Carbonate of magnesia	0.50	
	100.00	99.50

Varieties and Classification of Clay Wares.—The plasticity of wet clay makes it possible to fashion vessels from it which when dry may be baked or fired. The resulting ware will vary in color, texture, hardness, solidity, and transparency according to the nature of the clay and of the materials which are in some cases added to it. The application of the glaze to the outside of the ware introduces still further differences. Clay ware is subdivided into *dense* and *porous* ware. The first is semi-vitrified, and is not porous on the fracture; it includes true porcelain, tender porcelain, granite-ware, and stoneware. The second kind consists of a refractory mass which shows no signs of fusion, and is consequently porous. It may be glazed to render it impervious to water. It includes earthenware, faïence, bricks, tiles, etc. The two classes graduate into each other by insensible shades of difference. The following are the most important varieties of ceramic ware:

I. Porcelain.—Mass uniformly fluxed, dense, not scratched by knife, texture fine and uniform, translucent, very sonorous, white. (1) *Hard or Real Porcelain.*—Mass difficult of fusion, consists of infusible kaolin with quartz, and a flux of feldspar or lime. The glaze is composed of the same flux; contains no lead or tin. (2) *Tender Porcelain.*—Mass easily fusible. (*a*) French tender porcelain: a glass-like mass, a potash-alumina silicate, prepared without clay, and consequently not properly a clay ware; containing lead, and glazed with lead; (*b*) English tender porcelain, *ironstone china.* The mass pipe-clay, with flux of gypsum and bone-ash. Glaze, clay, chalk, borax, and oxide of lead.

II. Stoneware.—Mass dense, hard, not scratched by knife, sonorous, fine-grained, homogeneous, showing incipient fusion, scarcely translucent on the edges, white or colored. (3) *Fine stoneware, granite ware, firestone ware.*—Mass white or colored, composed of plastic pipe-clay and kaolin, with flux of feldspar (Cornish stone). Glazed or not; glaze often contains lead. (4) *Common Stoneware.*—Mass reddish-gray or bluish, generally without glaze or with a salt glaze.

III. Earthenware.—Mass earthy, porous, pretty hard, opaque, texture open, little sonorous. (5) *Fine Earthenware* (*Faïence*).—Mass white, hard, and sonorous. Glaze, of crystal containing lead, borax, feldspar, etc., or opaque with tin: majolica, delftware, etc. (6) *Common Earthenware.*—Mass finely granular, uniform, more or less colored (yellow). Glaze, a soft white or colored enamel. (7) *Ordinary Pottery.*—Mass earthy, porous, opaque, soft, homogeneous, texture very open, very porous, always colored. Glazed or unglazed; glaze may contain lead or not; is always easy of fusion, and transparent. (8) *Bricks, Tiles, Terra-cotta Ornaments, etc.*—Mass not uniform, always colored, very soft, porous, and open, little sonorous, opaque, fusible at a high temperature; sometimes glazed. (9) *Fire-brick, Crucibles, etc.*—Mass difficultly fusible, or infusible; not glazed.

Hard Porcelain was made by the Chinese and Japanese long before the Christian era. A revival of the manufacture, which had declined in consequence of an invasion, is spoken of as having occurred 485 B. C. Chinese porcelain was first imitated in France in a very imperfect manner in 1695. The manufacture of real china was invented in Germany by Böttcher in 1709. The duke of Saxony (August II. of Poland) built him a factory at Meissen near Dresden, and in 1710 he was installed as director. The process was guarded as a great secret, but it finally became known, and was established in 1720 in Vienna, 1751 in Berlin, 1755 at Nymphenburg near Munich, 1758 at St. Petersburg, and in 1765, after the discovery of kaolin at St. Yrieux, it was substituted for the tender porcelain at Sèvres. The hard porcelain is composed of kaolin, quartz to prevent excessive shrinkage on drying, and a flux (to fuse and bind the whole together) which consists of feldspar or gypsum. The proportions used at Berlin in 1863 were kaolin 28, quartz 66.6, protoxide of iron 0.70, magnesia 0.6, lime 0.3; at Nymphenburg, kaolin 65, sand therewith 4, quartz 21, gypsum 5, broken biscuit-ware 5; at Vienna, kaolin from Zedlitz 34, kaolin from Passau 25, kaolin from Unghvar 6, quartz 14, feldspar 6, broken ware 3; at Meissen, kaolin from Aue 18, kaolin from Sosa 18, kaolin from Seilitz 36, feldspar 26, broken ware 2. At Sèvres chalk from Bougival is a constant addition to the mass; it contains—

Carbonate of lime	95.50
Carbonate of magnesia	0.80
Silica	0.80
Oxide of iron, manganese, and alumina	1.70
Water	1.20
	100.

The feldspar is brought from various localities; that from Bohemia contains—

Silica	65.87
Alumina	25.66
Sesquioxide of iron	0.27
Lime	0.36
Magnesia	0.10
Potassa	4.71
Soda	3.09
Water	0.58
	100.64

The kaolin is washed and ground to free it from impurities and make it uniform. The quartz, feldspar, and broken ware are ground in mills with water, and the different constituents are then mixed, and the mixture is ground and strained until it is perfectly uniform. At Sèvres the mixture is so made as to secure the following composition for the dry mass:

Parts.	Silica.	Alumina.	Lime.	Potash.
48 kaolin	30.00	16.90	0.05	0.96
48 feldspar	28.30	17.04	0.53	2.01
4 lime	....	....	4.00	
100 Total	58.30	33.94	4.58	2.97

The liquid mass, known as *slip*, is now treated for the removal of water, either by evaporation, by passing it over beds of plaster of Paris, by which the water is absorbed,

or by the aid of filter-presses. The moist mass is then slapped, kneaded, and trodden to make it uniform, and is put away in moist cellars to undergo a species of decay to make it more plastic. During this process the mass becomes dark-colored by the reduction of the iron, and exposure to the air is necessary to reoxidize this.

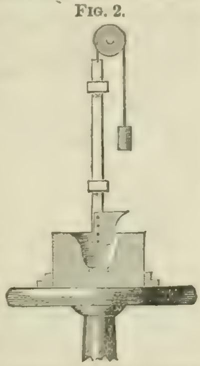
Forming.—When the mass is ready, it is formed either on the potter's wheel or in moulds. "The potter's wheel con-

FIG. 1.

The Potter's Wheel.

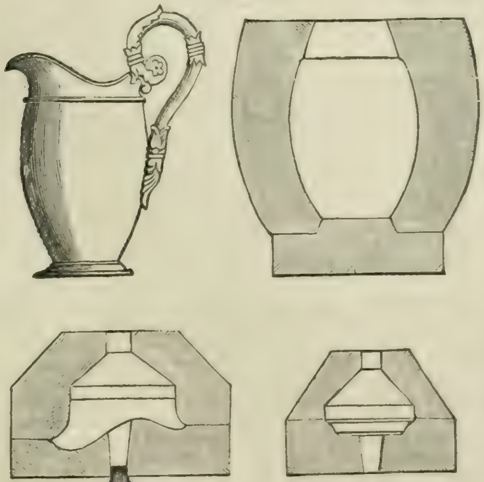
sists of a vertical iron axis, on which is a horizontal disk, which is made to revolve by the feet of the operator on a lower disk or by steam. A lump of the plastic mass is placed upon the wheel, the thumb being placed in the centre of the lump and pressed downward; a hollow is thus formed, which is widened or the walls continued vertically according to the shape of the vessel to be made. The constant revolution of the wheel easily allows of the moulder obtaining a perfectly cylindrical form. By thus humoring the clay, elongating the vessel, again depressing it, widening it, and by continued manipulation in this manner, the most exquisite shapes are produced. To form the ridges or sharp edges of the vessel a small piece of iron, a strip of horn or wood, termed a bridge, is used. The perfectly-formed vessel is cut away from the wheel by a piece of brass wire." (*Wagner.*) Many articles are made on plaster of Paris forms. The mould is taken from the original article in parts, which are made to fit together accurately. The wet plastic mass is made to fill all the indentations accurately, and when it has stood long enough to enable the porous mould to absorb enough moisture from it to make it firm, the mould

FIG. 2.



Forming a tea-cup on the potter's wheel.

FIG. 3.

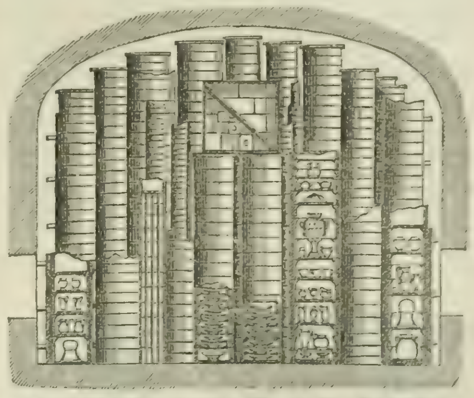


Gypsum moulds for a pitcher.

is opened and the article released. For cups, plates, saucers, etc. the plaster form is placed on the wheel. The mass is rolled out into a sheet, pressed upon the mould, the wheel set in motion, and a brass knife, cut to the exterior form of the plate or saucer, or the interior form of the cup, is held against the mass as it revolves, and the surface scraped to the desired form. The handles for the cups are made in separate moulds and attached by moistening the surfaces. Many articles, such as pitchers, busts, etc., are cast in plaster moulds. The mass is thinned with water to a thick cream. The mould is filled with this, and allowed to stand till by the absorption of water it is lined with a firm layer of the mass of sufficient thickness. The still fluid mass within is then poured out, the whole allowed to stand till the mass is firm, when the mould is opened. Flowers, medallions, etc., are moulded separately in plaster, and then attached in their proper places. The texture of drapery is imitated by means of a piece of tulle, which is laid on the mass and burned off in the baking. When all the parts have been combined, and the article has been carefully finished with tools, it is allowed to dry.

Firing.—The next step is the firing or baking of the ware. In order to protect it from ashes and smoke, it is

FIG. 4.

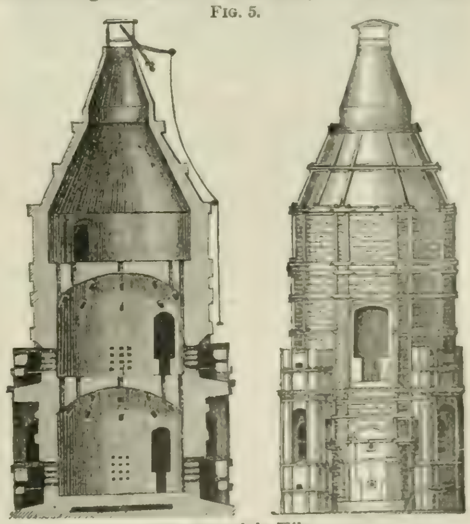


A chamber of the porcelain kiln, showing the seggars.

carefully enclosed in fire-clay vessels called *seggars*. These seggars are piled one upon another in columns in the kiln or oven, which is a large circular reverberatory furnace with three chambers, one above the other, and five fires around the outside. Heat is applied gradually at first, but is finally carried to a strong red. This high temperature is maintained for seventeen or eighteen hours, when the kiln is opened and allowed to cool gradually for three or four days. The seggars are then removed and the ware taken out.

Glazing.—In some establishments the green ware is coated with the glaze before the first firing; in others the green

FIG. 5.



The Porcelain Kiln.

ware is first baked to *biscuit*, the glaze applied, and fused by a second firing. Some articles, statues, vases, etc., are not glazed, but are sold as *biscuit*. The glaze for porcelain is made to resemble the mass of the ware as nearly as possible, except that it must be more fusible. At Meissen it is composed of—

Quartz	37.0
Kaolin from Seilitz	37.0
Lime from Pirna	17.5
Broken porcelain	8.5
	100.

At Berlin—

Quartz	43
Kaolin from Morle	31
Gypsum	14
Broken porcelain	12
	100

At Sèvres a mixture of pegmatite from St. Yrieux (feldspar) and quartz is used. The mixture contains 74.3 silica, 18.3 alumina, 6.5 potassa, 0.4 lime, 0.2 magnesia. The materials are ground and mixed in the same manner as the mass, and the final slip, of the consistence of cream, is applied by dipping the biscuit ware into the tub or vat. After the dipping process the part of the piece held by the workman is coated with glaze by the aid of a brush. When dry the ware is replaced in the seggars and again fired.

Decorating the porcelain is accomplished by applying metallic oxides mixed with a suitable flux, as a silicate or borate, or both together. The colors are therefore colored glasses, which are reduced to powder, mixed with oil of lavender, and applied with a brush. The following list of colors is given by Wagner: Oxide of iron, for red, brown, violet, yellow, and sepia; oxide of chromium, for green; oxide of cobalt and potassium-cobalt-nitre, for blue and black; oxide of uranium, for orange and black; oxide of manganese, for violet, brown, and black; oxide of iridium, for black; oxide of titanium, for yellow; oxide of antimony, for yellow; oxide of copper (and protoxide), for green and red; chromate of iron, for brown; chromate of lead, for yellow; chromate of barium, for yellow; chloride of silver, for red; chloride of platinum, for platinizing; purple of Cassius, for purple and rose-red. The burning-in of the colors is effected in a muffle furnace. For gilding, precipitated gold is applied, mixed with honey and a flux, as nitrate of bismuth. After it is burned in, it is brightened by burnishing. Bright gilding can be secured without burnishing by using a solution of sulphuret of gold or fulminating gold in balsam of sulphur. For silvering, the metal precipitated by copper or zinc, and for platinizing, platinum-black, are employed.

Fig. 6.

The muffle for fixing the colors on decorated porcelain.

Composition of Hard Porcelain.

	Berlin.	Superior china.
Silica	72.96	71.04
Alumina	24.78	22.46
Lime	1.04	3.82
Alkali and loss	1.22	2.68
	100.00	100.00
Sp. gr.	2.419	2.314

Artificial teeth are extensively manufactured from hard porcelain, the materials being feldspar, quartz, and a little kaolin. The yellow tint is produced by titanic acid, pink by gold, gray or blue for the tips by platinum-sponge or cobalt. The feldspar must not be so fine as to completely flux the quartz to a glass. The feldspar, clay, etc., are ground to an impalpable powder under water, dried, and made into a paste. That composing the body of the tooth is of different materials from that composing the base or enamel. The teeth are made in brass moulds, and this is quite a delicate process. The enamel is first put in place with a small steel spatula; the platinum rivets, by which the teeth are fastened to the plate, are placed in position, and then the body is pressed into the mould. They are then submitted to powerful pressure and dried. After being dried, they are submitted to a process called biscuiting, in which they can be cut like chalk. They are then sent to the trimmers, who scrape off all projections and fill up all depressions which may have been left in the operation of moulding, and then wash them with what is technically termed "enamel." This is composed of various substances more fusible than the tooth itself, and answers to the glaze in common porcelain-making. It is ground to a fine powder and suspended in water, and is laid on with a camel's-hair brush. They are now sent to the gummers, who apply the gum. This is colored with oxide of gold, and is applied in the same manner as the enamel. After being dried, they are burned. This operation is carried on in a muffle. The teeth are placed on a bed of crushed quartz, which is placed on a slab of refractory clay. After being exposed to an intense heat for some hours, they are taken out, cooled, and assorted.

French Tender Porcelain, or *Frit Porcelain*.—The manufacture of this peculiar ware began in France in 1695 at Sèvres, and was continued till 1751, when it was superseded by the hard porcelain, invented by Böticher. It is not properly porcelain, nor even a clay ware, but an imperfectly-fused glass. The mass or body is composed of (1) frit, (2) chalk, (3) marl. The frit is made by heating together in a calcining furnace the following mixture:

Melted saltpetre	22.0
Sea-salt, gray	7.2
Alum, generally burned	3.6
Alicante soda	3.6
Gypsum (Montmartre)	3.6
Sand (Fontainebleau)	60.0
	100.

This mixture was not completely fused in the furnace, but merely reduced to a pasty mass, and well stirred to secure uniformity, yielding a white spongy frit. This was crushed and lixiviated to remove soluble salts, and then ground with millstones under water to a fine powder in order to form a paste. Chalk and white calcareous marl from Argenteuil were also separately ground up with water, and freed from impurities by settling, etc. The three materials, suspended in water, were then mixed in the following proportions, calculated for the dry powders:

Frit	75.....75
Chalk	8 to 17
Marl	17 to 18

This corresponds to an average composition for the mass of—

Silica	76
Alumina	2
Lime	16
Soda and potassa	5
Magnesia, etc	1
	100

The pulp was allowed to remain for a month to dry, and was then again pulverized. This mass was almost entirely wanting in plasticity, owing to the almost complete absence of clay. It possessed so little cohesion that it could not be worked at all till it received an addition of 12 per cent. of soap and glue or gum-tragacanth, and then only by pressing in plaster moulds, not on the potter's wheel. After moulding, the articles were dried, and finished on the lathe with iron tools. The firing lasted from 75 to 100 hours, and was a very delicate operation. Owing to the fusible nature of the mass, the articles had to be supported at all points in the seggars to prevent their losing their form. Plates, saucers, etc. were arranged upon earthen moulds, so placed as to permit shrinkage without loss of form. Other articles were supported on forms made of the same mass, which suffered during the baking the same contraction, and could consequently be used but once.

The glaze or enamel was a kind of crystal or flint glass; it was prepared by melting in crucibles—

Sand from Fontainebleau, burnt	27
Flints, calcined	11
Litharge	38
Carbonate of potash	15
Carbonate of soda	9
	100

The fused mass was ground fine, and diffused in water, mixed with a little vinegar, to the consistence of cream. As the biscuit ware was not porous enough to take the glaze by immersion, it was necessary to pour the slip over it. The articles were then baked again for 30 hours in separate seggars, but without supports, in the upper chamber of the kiln, which was not hot enough to soften the body of the ware. As the first glaze was not very equal, it was necessary to apply a second, and return the pieces to the kiln a third time. For the decoration of this ware the colors required careful and peculiar preparation and treatment. The peculiarities of this old French tender porcelain are—body fine, dense, vitreous, hard, very translucent, fusible; glaze vitreous, transparent, tolerably hard.

It was similar to cryolite glass, or *hot-cast porcelain.* It was very expensive to manufacture, owing both to the labor required and the high percentage of loss. It was also very fragile, and, like glass, incapable of bearing rapid changes of temperature, the heat of boiling water frequently cracking it. It possessed some advantages as to painting, and could be made very brilliant in its decorations.

English Tender Porcelain, or *Ironstone China,* is manufactured exclusively in England, where hard porcelain cannot be economically made for the want of clay sufficiently refractory for the seggars. The mass or body is composed of (1) plastic clay; (2) kaolin, "china clay" from Cornwall; (3) granite or "Cornish stone" (pegmatite), which consists of feldspar with some quartz; (4) chalk flints; (5) bone-ash, consisting of phosphate of lime, with some phosphate of magnesia, carbonate of lime, etc. The use of this material is due to Mr. Spade in 1802, and constitutes the peculiarity of English china. Recently, other forms of phosphate of lime, as apatite, phosphorite, staffelite, or sombrerite, have been substituted. (6) Steatite (soapstone) is sometimes used to diminish the contraction of the wares in the furnace. It contains 44 of silica, 44 of magnesia, 2 of alumina, 7.3 of sesquioxide of iron, 1.5 oxide of manganese, 1.2 oxide of chromium. These materials are all ground in water to an impalpable slip. A frit is then made of—

Cornish stone	40
Flint	28
Carbonate of soda, crystals	20
Borax	7
Oxide of tin	5
	100

This is ground to slip, and the mass is then made up of—

Plastic clay, blue	45.
Kaolin	33.
Cornish stone	7.5
Flint	3.
Bone-ash	52.
Frit	5.
	100.

Or the mass is not fritted in part, but mixed all at once, in the following or other proportions:

	I.	II.
Plastic clay	50	19
Kaolin	18	11
Flint	0	21
Bone-ash	29	49
Broken ware	3	
Mould refuse of unfired mass	100	100
	200	200

The mass is very plastic, in consequence of the large percentage of clay, and is readily formed either on the potter's wheel or in plaster moulds. The ware is burned in seggars. The firing lasts from 48 to 50 hours, and from 20 to 30 hours are allowed for cooling.

The glaze for table ware is composed of—

Cornish stone	34	Fritted, ground, and mixed with 10 per cent. of Cornish stone, and 20 per cent. of white lead.
Chalk	17	
Flint	15	
Borax	34	
	100	

A little oxide of cobalt is added to increase whiteness. The white lead is sometimes omitted, and the necessary fluidity secured by a larger addition of borax. The glaze is applied to the biscuit by immersion. The firing requires about 17 hours.

The colors are prepared from metallic oxides, ground up with fusible glasses or fluxes. The flux most generally used consists of red lead 6, borax 4, flint 2. The painted goods are fired in the enamel-kiln or muffle.

Peculiarities.—English porcelain, when carefully made, has almost all the advantages of the old Sèvres, being translucent and exhibiting the brilliancy which can only be obtained on soft glazes, while it presents none of the difficulties to the manufacturer which arose from the want of plasticity and the fusible nature of the mass of the old Sèvres, as it is extremely plastic, and can be fired at lower temperatures in seggars of inferior clays. The following analyses have been published:

	I.	II.
Silica	39.88	40.40
Alumina	21.48	24.15
Phosphate of lime	26.44	15.32
Lime	10.06	14.22
Magnesia	....	0.43
Alkalies and loss	2.14	5.28
	100.	99.80

A vase made in 1871 contained only 3.67 per cent. of phosphoric acid, which corresponds to 8 per cent. of bone-phosphate of lime.

Parian, Carrara, etc., Statue Porcelain, is a fine unglazed, hard porcelain, made with a more fusible feldspar than ordinary porcelain. The peculiar creamy-yellow tint is due to a little oxide of iron contained in the materials; the surface is wax-like. Its composition is variable: some contains bone-ash, some silicate of barium, some only kaolin and feldspar. Parian was first prepared by Copeland in England in 1848, though statues and medallions had been previously made in hard porcelain biscuit at Meissen. The statues, etc., are cast in different pieces in plaster moulds with liquid slip, and afterward united—some before, some after, firing. Owing to the large amount of water in the slip, the mass contracts one-fourth its bulk in the firing. The best Parian is made in England. The following mixtures for Parian are given by Muspratt:

No. 1. Frit.

Well-washed Lynn or Isle of Wight sand	80 pounds.
Feldspar	35 "
Cornish stone	15 "
Pearlash	12 "

The whole mixed together with water, and fired in flinted seggars at the earthenware heat.

Mass.

Frit	50
Feldspar	130
China clay	130
Fine-powdered glass	20

These ingredients being all well ground together.

No. 2. Frit made as before.

Mass.

Frit	50
Feldspar	35
Feldspar calcined at a gloss heat	35
China clay	75
Bone	75
Powdered glass	15

Ure gives the following account of the manufacture of Parian figures: "As the most direct method of illustrating the process of making these figures, let us suppose the object under view to be a figure or group, and this we will assume to be two feet high in the model. The clay, which is of the most perfect character, is mixed with flint, as in the case of manufacturing the finest stone china, and it is used in a semi-liquid state about the consistency of cream; this is poured into the moulds forming the various parts of the subject (sometimes as many as fifty); the shrinking that occurs before these casts can be taken out of the mould, which is caused by the absorbent nature of the plaster of which the mould is composed, is equal to a reduction of one inch and a half in the height. The moulds are made of plaster of Paris, which, when properly prepared, has the property of absorbing water so effectually that the moisture is extracted from the clay, and the ware is enabled to leave the mould, or 'deliver,' with care and rapidity. Prior to use, the plaster (gypsum) is put into long troughs, having a fire running underneath them, by which means the water is drawn off, and it remains in a state of soft powder; and if its own proportion of water be again added to it, it will immediately set into a firm, compact body, which is the case when it is mixed to form the mould. These casts are then put together by the 'figure-maker;' the seams (consequent upon the marks caused by the subdivisions of the moulds) are then carefully removed, and the whole worked upon to restore the cast to the same degree of finish as the original model. The work is then thoroughly dried to be in a fit state for firing, as, if put in the oven while damp, the sudden contraction consequent upon the great degree of heat instantaneously applied would be very liable to cause it to crack; in the process it again suffers a further loss of one inch and a half by evaporation, and it is now but one foot nine inches. Again, in the 'firing' of the bisque oven, its most severe ordeal, it is diminished three inches, and is then but eighteen inches high, being six inches, or one-fourth, less than the original. Now, as the contraction should equally affect every portion of the details of the work in order to realize a faithful copy, and as, added to this contingency, are the risks in the oven of being 'over-fired,' by which it would be melted into a mass, and of being 'short-fired,' by which its surface would be imperfect, it is readily evident that a series of difficulties present themselves which require considerable practical experience successfully to meet. Indeed, the difficulties which surround the manufacture of Parian prevent its being rendered to the public at such a price as those would desire who wish to secure the introduction, amongst the people, of all examples which are calculated to refine their tastes. A biscuit china is, by a somewhat similar process, employed in several of the porcelain-manufactories on the Continent for the production of statuettes, busts, etc., but in color and character they are all inferior to the English Parian."

Stoneware differs entirely from porcelain. It is dense,

sonorous, fine-grained, semi-fused, does not cling to the tongue. It is entirely opaque; is either white or colored. It may be made entirely of plastic clays, as in the case of the commoner kinds, or of a mixture of these, with fluxing materials, as kaolin, quartz, feldspar, etc., as in the case of finer varieties, such as granite ware, Wedgwood, etc. It may be unglazed, or glazed with a borax-and-lead glaze, or merely a salt glaze. Stoneware gradually passes into earthenware, so that it becomes difficult to draw a sharp line of division between the two classes of ware. Semi-fusion and an absence of porosity are the distinguishing characteristics of stoneware.

Fine Stoneware, Granite Ware.—The materials generally employed in England are (1) plastic clay (blue); (2) kaolin, Cornish china clay; (3) flint; (4) Cornish stone, pegmatite, feldspar, with some quartz. Some of the proportions in mixing the mass are as follows:

White stoneware bodies for jugs, etc.	I.	II.	III.	IV.
Cornish stone	80	40	100	30
Cornish clay	20	10	20	10
Blue clay	40	20	18	18
Flint	20	...	40	2

with the addition of a little blue cobalt to whiten. For colored bodies metallic oxides are added to the mass: (1) for sage, oxide of chromium and cobalt; (2) for drab, 15 per cent. of common marl and a little oxide of nickel; (3) for dove-color, 1 per cent. of oxide of manganese and ½ per cent. of oxide of cobalt. For American (New York City) granite or iron stone the mixture consists of (1) plastic blue clay from Woodbridge, N. J.; (2) kaolin from Spring Garden or elsewhere; (3) quartz from Middletown, Conn.; (4) feldspar from the same locality. These are ground up with water to slips till one pint of each weighs as follows: plastic clay, 24 ounces; kaolin, 26 ounces; quartz, 32 ounces; feldspar, 32 ounces. These are mixed and evaporated to the proper consistence. If the clay be in excess, the pieces shrink too much, and are not sound. If clay and feldspar are in excess, or quartz deficient, the ware cracks or "crazes," which is the worst fault. If feldspar is deficient, the mass hardly unites. It is thus apparent that granite ware is composed of the ingredients of hard porcelain, with a large admixture of plastic clay. The "C. C.," or cream-colored ware, consists of the same materials as the granite, except that only one-half as much of the porcelain mixture of kaolin, quartz, and feldspar is added to the plastic clay. The pieces are formed as described under *Hard Porcelain,* either on the wheel or in plaster moulds by moulding on the wheel, pressing, or casting. The ware is fired in seggars, either in a porcelain kiln or in simpler kilns, horizontal or vertical.

The Glaze.—"A good enamel is an essential element of fine stoneware; it should experience the same dilatation and contraction by heat and cold as the biscuit which it covers. The English enamels contain nothing prejudicial to health, as many of the foreign glazes do; no more lead being added to the former than is absolutely necessary to convert the silicious and aluminous matters with which it is mixed into a perfectly neutral glass. Three kinds of glazes are used in Staffordshire—one for the common pipe-clay or cream-colored ware; another for the finer pipe-clay ware to receive impressions, called *printing body;* a third for the ware which is to be ornamented by painting with the pencil. The glaze of the first or common ware is composed of 53 parts of white lead, 16 of Cornish stone, 36 of ground flints, and 4 of flint glass; or of 40 of white lead, 36 of Cornish stone, 12 of flints, and 4 of flint or crystal glass. These compositions are not fritted, but are employed after being simply triturated with water into a thin paste. The following is the composition of the glaze intended to cover all kinds of figures printed in metallic colors: 26 parts of white feldspar are fritted with 6 parts of soda, 2 of nitre, and 1 of borax; to 20 pounds of this frit, 26 parts of feldspar, 20 of white lead, 6 of ground flints, 4 of chalk, 1 of oxide of tin, and a small quantity of oxide of cobalt, to take off the brown cast and give a faint azure tint, are added. The following recipe may also be used: Frit together 20 parts of flint glass, 6 of flints, 2 of nitre, and 1 of borax; add to 12 parts of that frit, 40 parts of white lead, 36 of feldspar, 8 of flints, and 6 of flint glass; then grind the whole together into a uniform cream-consistenced paste. As to the stoneware which is to be painted, it is covered with a glaze composed of 13 parts of the printing-color frit, to which are added 50 parts of red lead, 40 of white lead, and 12 of flint, the whole having been ground together. The above compositions produce a very hard glaze, which cannot be scratched by the knife, is not acted upon by vegetable acids, and does no injury to potable or edible articles kept in the vessels covered with it. It preserves for an indefinite time the glassy lustre, and is not subject to crack and exfoliate, like most of the continental stoneware made from common pipe-clay. In order that the seggars in which the articles are baked after receiving the glaze may not absorb some of the vitrifying matter, they are themselves coated, as above mentioned, with a glaze composed of 13 parts of common salt and 30 parts of potash, simply dissolved in water and brushed over them." (*Ure.*)

Printing and Painting.—"There are two distinct methods of printing in use for china and earthenware: one is transferred on the bisque, and is the method by which the ordinary printed ware is produced, and the other is transferred on the glaze. The first is called 'press-printing' and the latter 'bat-printing.' The engraving is executed upon copper plates, and for press-printing is cut very deep, to enable it to hold a sufficiency of color to give a firm and full transfer to the ware. The printer's shop is furnished with a brisk stove having an iron plate on the top immediately over the fire, for the convenience of warming the color while being worked, also a roller-press and tubs. The printer has two female assistants called 'transferrers,' and also a girl called a 'cutter.' The copper plate is charged with color mixed with thick boiled oil by means of a knife and 'dabber' while held on the hot stove plate for the purpose of keeping the color fluid; and the engraved portion being filled, the superfluous color is scraped off the surface of the copper by the knife, which is further cleaned by being rubbed with a boss made of leather. A thick firm oil is required to keep the different parts of the design from flowing into a mass or becoming confused while under the pressure of the rubber in the process of transferring. A sheet of paper of the necessary size and of a peculiarly thin texture, called 'pottery tissue,' after being saturated with a thin solution of soap and water, is placed upon the copper plate, and being put under the action of the press, the paper is carefully drawn off again (the engraving being placed on the stove), bringing with it the color by which the plate was charged, constituting the pattern. This impression is given to the 'cutter,' who cuts away the superfluous paper about it; and if the pattern consists of a border and a centre, the border is separated from the centre, as being more convenient to fit to the ware when divided. It is then laid by a transferrer upon the ware and rubbed first with a small piece of soaped flannel to fix it, and afterward with a rubber formed of rolled flannel. This rubber is applied to the impression very forcibly, the friction causing the color to adhere firmly to the bisque surface, by which it is partially imbibed: it is then immersed in a tub of water, and the paper washed entirely away with a sponge, the color, from its adhesion to the ware and being mixed with oil, remaining unaffected. It is now necessary, prior to 'glazing,' to get rid of this oil, which is done by submitting the ware to heat in what are called 'hardening kilns,' sufficient to destroy it and leave the color pure. This is a necessary process, as the glaze, being mixed with water, would be rejected by the print, while the oil remained in the color. The printing under the stoneware glaze is generally performed by means of cobalt, and has different shades of blue according to the quantity of coloring-matter employed. After having subjected this oxide to the processes requisite for its purification, it is mixed with a certain quantity of ground flints and sulphate of baryta, proportioned to the dilution of the shade. These materials are fritted and ground, but before they are used they must be mixed with a flux consisting of equal parts by weight of flint glass and ground flints, which serves to fix the color upon the biscuit, so that the immersion in the glaze-liquor may not displace the lines printed on, as also to aid in fluxing the cobalt.

"The 'bat-printing' is done upon the glaze, and the engravings are for this style exceedingly fine, and no greater depth is required than for ordinary book engravings. The impression is not submitted to the heat necessary for that in the bisque, and the medium of conveying it to the ware is also much purer. The copper plate is first charged with linseed oil, and cleaned off by hand, so that the engraved portion only retains it. A preparation of glue being run upon flat dishes about a quarter of an inch thick, is cut to the size required for the subject, and then pressed upon it, and, being immediately removed, draws on its surface the oil with which the engraving was filled. The glue is then pressed upon the ware, with the oiled part next the glaze, and, being again removed, the design remains; though, being in a pure oil, scarcely perceptible. Color finely ground is then dusted upon it with cotton wool, and a sufficiency adhering to the oil leaves the impression perfect and ready to be fired in the enamel-kilns.

"The following are the processes usually practised in Staffordshire for printing under the glaze: The cobalt, or whatever color is employed, should be ground upon a porphyry slab, with a varnish prepared as follows: A pint of linseed oil is to be boiled to the consistence of thick honey,

along with 4 ounces of rosin, half a pound of tar, and half a pint of oil of amber. This is very tenacious, and can be used only when liquefied by heat, which the printer effects by spreading it upon a hot cast-iron plate. The printing plates are made of copper, engraved with pretty deep lines in the common way. The printer, with a leathern muller, spreads upon the engraved plate, previously heated, his color, mixed up with the above oil-varnish, and removes what is superfluous with a palette-knife; then cleans the plate with a dossil filled with bran, tapping and wiping as if he were removing dust from it. This operation being finished, he takes the paper intended to receive the impression, soaks it with soap-water, and lays it moist upon the copper plate. The soap makes the paper part more readily from the copper, and the thick ink part more readily from the biscuit. The copper plate is now passed through the engraver's cylinder press, the proof leaf is lifted off and handed to the women, who cut it into detached pieces, which they apply to the surface of the biscuit. . . . The stoneware biscuit never receives any preparation before being imprinted, the oil of the color being of such a nature as to fix the figures firmly. The printed paper is pressed and rubbed on with a roll of flannel, about 1½ inches in diameter, and 12 or 15 inches long. This is used as a burnisher, one end of it being rested against the shoulder, and the other end being rubbed upon the paper; by which means it transfers all the engraved traces to the biscuit. The piece of biscuit is laid aside for a little, in order that the color may take fast hold; it is then plunged into water, and the paper is washed away with a sponge. When the paper is detached, the piece of ware is dipped in a caustic alkaline ley to saponify the oil, after which it is immersed in the glaze-liquor, with which the printed figures readily adhere. . . . When the paper impression is applied to pieces of porcelain, they are heated before being dipped in the water, because, being already semi-vitrified, the paper sticks more closely to them than to the biscuit, and can be removed only by a hard brush.

"The impression above the glaze is done by quite a different process, which dispenses with the use of the press. A quantity of fine clean glue is melted and poured hot upon a large flat dish, so as to form a layer about a quarter of an inch thick, and of the consistence of jelly. When cold, it is divided into cakes of the size of the copper plates it is intended to cover. The operative (a woman) rubs the engraved copper plate gently over with linseed oil boiled thick, immediately after which she applies the cake of glue, which she presses down with a silk dossil filled with bran. The cake licks up all the oil out of the engraved lines; it is then cautiously lifted off, and transferred to the surface of the glazed ware which it is intended to print. The glue-cake being removed, the enamel surface must be rubbed with a little cotton, whereby the metallic colors are attached only on the lines charged with oil: the piece is then heated under the muffle." (*Ure.*)

Ornaments and Coloring.—"Common stoneware is colored by means of two kinds of apparatus—the one called the blowing-pot, the other the worming-pot. The ornaments, made in relief in France, are made hollow (intaglio) in England by means of a mould engraved in relief which is passed over the article. The impression which it produces is filled with a thick clay paste, which the workman throws on with the blowing-pot. This is a vessel like a tea-pot, having a spout, but it is hermetically sealed at top with a clay plug, after being filled with the pasty liquor. The workman by blowing in at the spout causes the liquor to fly out through a quill pipe which goes down through the clay plug into the liquor. The jet is made to play upon the piece while it is being turned upon the lathe; so that the hollows previously made in it by the mould or stamp are filled with a paste of a color different from that of the body. When the piece has acquired sufficient firmness to bear working, the excess of the paste is removed by an instrument called a *tournasin* till the ornamental figure produced by the stamp be laid bare; in which case merely the color appears at the bottom of the impression. By passing in this manner several vessels of clay liquor of different colors over each other with the blowing-pot, network and decorations of different colors and shades are very rapidly produced. The serpentine or snake pots, established on the same principle, are made of tin plate in three compartments, each containing a different color. These open at the top of the vessel in a common orifice, terminated by small quill tubes. On inclining the vessel, the three colors flow out at once in the same proportion at the one orifice, and are let fall upon the piece while it is being slowly turned upon the lathe, whereby curious serpent-like ornaments may be readily obtained. The clay-liquor ought to be in keeping with the stoneware paste. The blues succeed best when the ornaments are made with the finer pottery mixtures given above. . . . To produce yellow impressions upon brown stoneware, ochre is ground up with a small quantity of antimony. The flux consists of flint-glass and flints in equal weights. The composition for white designs is made by grinding silex up with that flux, and printing it on as for blue colors upon brown or other colored stoneware, which shows off the light hues." (*Ure.*)

Enamel colors for painting on granite ware, etc., are metallic oxides with a fusible flux, as borax, flint, oxide of lead, etc. They are applied with essential oils—turpentine or lavender. The ground is laid by applying boiled oil with a camel's-hair brush, then levelling, *bossing*, to secure a uniform coating, and finally applying the color in the form of powder with cotton wool. Gold is used in the form of an amalgam ground to powder with flux, and is applied either to the oiled surface or with a brush. After the ware has been baked in the muffle, the dead surface of gold is burnished with agate.

Metallic Lustres are applied to a surface of lead glaze, composed of 60 litharge, 36 feldspar, 15 of flint. Silver and platina are applied on a white ground, gold and copper on a colored ground. Gold and platina are applied to ware made on purpose, composed of 4 parts of clay, 4 of flint, 4 of china clay, and 6 of feldspar. To make brown figures in relief on a white body, this is mixed with water till it weighs 26 ounces per pint. Gold lustre is prepared by dissolving gold in aqua regia, adding tin, and pouring into balsam of sulphur a solution of sulphur in linseed oil. Platina lustre is obtained by a mixture of a solution of platina in aqua regia with *spirit of tar* (tar and sulphur boiled in linseed oil), or by applying the ammonia-chloride of platinum. Iron lustre is obtained with a solution of iron in hydrochloric acid, mixed with spirit of tar. These lustres are applied with a camel's-hair brush, burned in the muffle, and burnished if necessary.

Wedgwood Ware includes a variety of fine stonewares, mostly unglazed, which were introduced by Wedgwood. They are known as jasper, onyx, agate, porphyry, terra-cotta, basalt, etc. Owing to the peculiar composition of the mass, it is capable of receiving the most exquisite finish and delicacy of detail. Jasper or onyx ware consists of a porcelain-like mass, either white or colored throughout with metallic oxides. By a combination of white on a colored ground the most beautiful cameos, medallion portraits, etc., are produced. The following mixtures are characteristic for the white body:

	I.	II.	III.	IV.
Blue plastic clay	26	15	90	35
Kaolin, Cornish china clay	...	15	60	15
Flint	15	15	40	10
Feldspar, Cornish stone	15	30		
Sulphate of baryta	47	10	160	50
Sulphate of strontia	10			
Sulphate of lime	6	23	8	
Bone-ash	...	...	.....	25
	119	108	358	108

The colored bodies were produced by adding to these metallic oxides—0.25 to 1.5 per cent. of oxide of cobalt for blue; oxide of chromium or oxide of nickel with potash for greens; oxide of manganese for dark purple; gold precipitated by tin for rose; antimony for orange; oxide of copper for leaf-greens; oxides of iron and manganese or ochres for black; nickel and umber for brown. This paste is very plastic, and may be worked on a lathe or in moulds. The ornaments, in the same or different colors, are moulded separately, applied with gum-water, and carefully finished with tools. One firing is sufficient, unless the inner surface is to be glazed. Some of the most beautiful results were obtained with white medallions on a deep-blue ground. Wedgwood's copy of the Portland Vase is one of the most celebrated specimens of this ware. Basalt or black Egyptian ware is employed for the reproduction of ancient Egyptian vases, etc. It is made of the following mixtures:

	I.	II.	III.
Blue plastic clay	200	100	200
Red clay	.....	.....	300
Ochre, calcined	200	100	100
Iron scales, protosesquioxide	.....	35	
Oxide of manganese	60	40	100
	460	275	700

Encaustic Painting was introduced by Wedgwood as a revival of the work of the ancient Etruscans, whose ware shows none of the glossy lustre of enamels or vitrifiable colors. His colors were composed as follows, the "slip" being the body of his jasper ware:

White.		Black.	
Blue clay	20	Egyptian black slip	12
China clay	10	White slip	3
Flint	10	Blue slip	3
Feldspar	5		
Green.		**Blue.**	
White slip	12	White slip	25
Blue slip	1	Cobalt-oxide	1¼
Nickel-oxide	1		

Glazing or Enamelling is rarely resorted to with this kind of fine stoneware. The interior of the Wedgwood vessels is sometimes enamelled: for the black ware, for instance, a mixture of 6 parts of red lead, 1 of flint, and ⅛th part of oxide of manganese is used. A peculiar thin glaze, or rather gloss, is often given to stoneware by the process called *smearing*. The once-baked ware is placed in seggars which are smeared on the interior with more or less volatile mixtures, which assume the form of vapors during the second firing, and, reacting with the materials of which the ware is composed, produce thin glazes consisting of silicates or boro-silicates. Pieces of ware coated with the mixtures, called *refractories*, are often placed in the seggars with the articles to be glazed. The following are smears often used:

	I.	II.	III.	IV.
Litharge	6	...	...	4
Stone	3	...	...	1
Common salt	3	3	5	2
Bone-ash	...	5	5	
Flint	...	...	10	1
Nitre	...	...	3	
	12	8	23	8

The glazes used for porcelain or for granite ware may also be employed by immersion. Unglazed Wedgwood ware is sometimes made without sulphate of baryta. The following is a suitable mixture: plastic blue clay, kaolin, fireclay, together one-half; the other half feldspar, Cornish stone. This is more fusible and much cheaper than hard porcelain. It may be colored superficially, or ornamented with colored mixtures of a similar material in relief. *Mortar body* is composed of 6 parts of plastic blue clay, 1 of kaolin, china clay, 2 of flint, 3 of Cornish stone.

Lacquered wares, called also *terralite* and *siderolite*, are intermediate between fine and common stoneware, have no glaze, but a strong surface-color of varnish or lacquer. The color is mixed with varnish and applied to the baked ware, which is then heated in a slow oven to fix the surface. Another fine stoneware is known as lava, and extensively manufactured in Germany. The mass is plastic, and is often made into baskets in imitation of willow wicker-work.

Common Stoneware is made of certain plastic clays without the addition of any fluxing materials. Fine sand or pulverized fragments of stoneware are sometimes added when the clay is not sufficiently rich in quartz, to prevent undue shrinkage and cracking during the firing. The ware is semi-fused; the color is generally gray. The clay is merely kneaded in the pug-mill and worked by hand. Much of this ware is formed on the wheel; large vessels for chemical works, etc., are moulded. An agreeable color is often produced by a wash of ferruginous clay or ochre. For firing, horizontal kilns or furnaces are used, with no seggars. The mass being vitreous, glaze is unnecessary. Cheap glazes are, however, often used, such as iron slag ground with water, or usually the salt glaze. This glaze is secured by throwing salt into the kiln toward the close of the firing. The salt (chloride of sodium) being volatile, rises in vapor, and, in the presence of steam from the ware or fuel, is decomposed by the silica of the ware, forming hydrochloric acid, which escapes as gas, and a silicate of soda on the surface of the ware, which, uniting with the clay, forms a silicate of soda and alumina, an artificial feldspar like the glaze on hard porcelain. Muspratt gives the following analyses of stoneware:

Stoneware Glazed.

Place.	Silica.	Alumina.	Oxide of iron.	Lime.	Magnesia.	Alkali.	Loss.	Parts.	Description.
St. Amand	75.00	22.10	1.00	0.25	traces.	0.84	0.81	100.00	Common body; earthy glaze.
Helsingborg	74.60	19.00	4.25	0.62	traces.	1.30	0.23	100.00	Coarse grayish body, ill moulded; glazed with salt.
Voisinlieu	74.30	19.50	3.90	0.50	0.80	0.50	0.50	100.00	Fine whitish body, well moulded; salt glaze.
Vauxhall	74.00	27.04	2.00	0.60	0.17	1.06	0.13	100.00	Fine whitish body, well moulded, with a porous external surface; salt glazed.
Freehen	64.01	24.50	8.50	0.56	0.92	1.42	0.09	100.00	Dark brown body, fine, well moulded; covered with an earthy glaze.

Stoneware Unglazed.

Place.	Silica.	Alumina.	Oxide of iron.	Lime.	Magnesia.	Alkali.	Loss.	Parts.	Description.
Baltimore	67.40	29.00	2.00	0.60	......	0.60	0.40	100.00	Very fine whitish body.
Wedgwood	66.49	26.00	6.12	1.04	0.15	0.20	......	100.00	Very fine yellowish body, very sonorous, well moulded.
Saveignies	65.80	27.64	4.25	1.12	0.64	0.24	0.31	100.00	Clear brown body, coarse, very sonorous.
Japan	62.04	20.30	15.58	1.08	traces.	traces.	1.00	100.00	Very fine body, well moulded, of a deep brown-red color.
China	62.00	22.00	14.00	0.50	traces.	1.00	0.50	100.00	Very fine body, well moulded, of a deep brown-red color.

Earthenware includes those varieties of pottery which present an open, porous body, which is opaque, little sonorous, and generally pretty hard. It is sometimes unglazed for water-coolers, crucibles, bricks, tiles, etc., but its porosity makes it necessary to glaze it for holding liquids, and by glazing and decoration it can be made very beautiful. The peculiarities of the manufacture are (1) the use of clay and flint without any flux, or of clays alone; and (2) firing at a temperature so low as to preclude the fusion of any of the constituents. The glaze must necessarily be very fusible. This ware includes the fine English ware, Dutch or delftware, the majolica or faïence, ordinary pottery, terra-cotta, bricks, tiles, crucibles, etc.

Fine Earthenware is largely manufactured in England, the materials being the same as those for fine stoneware: (1) blue plastic clay; (2) kaolin, Cornish china clay; (3) flint; and (4) feldspar, Cornish stone. These two wares pass into each other by insensible gradations, the earthenware being distinguished by a smaller percentage of feldspar, Cornish stone, and by the lower temperature of the firing. The difference is shown in the following figures:

	Granite, or ironstone china ware.	Cream-colored ware.	Fine earthenware.
Blue clay	17.54	45	20.84
Cornish china clay	26.31	24	33.33
Flint	21.06	18	33.33
Cornish stone	35.09	23	12.50
	100.	100	100.

The material is very plastic, and readily formed on the wheel or by pressing in plaster moulds. The ware is fired in seggars. The glaze contains lead, and often borax, sometimes fritted, is ground to slip, and applied to the biscuit by immersion. A little cobalt oxide is added for whites, and other oxides for colors. The glazes for fine stoneware are all applicable. The following are a few examples:

	Cream-color.	Rocking-ham.	Printed ware.
White lead	300	...	60
Red lead	.....	42	
Cornish stone	150	6	100
Blue clay			
Kaolin	.....	$4\frac{1}{2}$	10
Flint	35	$4\frac{1}{2}$	60
Borax	4	...	70
Oxide manganese	.....	6	
Whiting	.....	...	25

Decorating is executed as in the case of fine stoneware.

Clay Pipes are made from extremely plastic clay, free from oxide of iron and lime. The ends are sometimes glazed to prevent adhesion to the lips. The glaze is composed of the oxides of lead and tin, with sand, salt, and soda-ash.

Delftware, Majolica, Faïence, are soft, porous, opaque earthenwares coated with an opaque enamel, the colors applied to the enamel by the brush, or by printing and transfer, and the ware subjected to a third firing in the muffle. The materials are plastic clay, calcareous clays, and quartz-sand. The Paris ware is composed of:

Plastic clay from Arcueil	8
Greenish clay marl	36
White calcareous marl	28
Yellowish marly sand	28
	100

The mass is very plastic, easily formed on the wheel, and, if subjected to a high temperature, fuses. The following is an example of a white enamel for this ware: Calcine together 77 parts of lead and 23 of tin: combine 44 parts of the resulting mixture of oxides with 44 of sand, 2 of red lead, 8 of salt, and 8 of soda. For colors use for yellow 9 parts of oxide of antimony; blue, 5 parts of oxide of

cobalt; green, 5 parts of oxide of copper; violet, 4 parts of oxide of manganese, with white enamel in each case to make 100 parts. Oxide of chromium may be used for green, and gold for rose and purple-red. Carnation-pink, a chromium compound of tin, is prepared by calcining 100 parts of oxide of tin, 34 of chalk, 4 of bichromate of potash, 5 of silica, and 1 of alumina, and washing with hydrochloric acid. Lustres, etc., are obtained as already described. Analyses of these wares from Muspratt:

Description of earthenware.	Silica.	Alumina.	Lime.	Magnesia.	Oxide of iron.	Carbonic acid and loss.
Italian from Lucca della Robbia	49.65	15.50	22.40	0.17	3.70	8.58
Majolica	48.00	17.50	20.12	1.17	3.75	9.46
Old Spanish	46.04	18.45	17.64	0.87	3.04	13.96
Manasses, near Valencia.	54.71	18.80	19.69	trace.	2.20	4.60
Delft	49.07	16.19	18.01	0.82	2.82	13.09
Persian	48.54	12.05	19.25	0.30	3.14	16.72
From Rouen	47.96	15.02	20.24	0.44	4.07	12.27
From Nevers	56.49	19.22	14.96	0.71	2.12	6.50
From Paris	61.50	12.99	16.24	0.15	3.01	6.10

Common Earthenware, or Pottery, is earthy, very porous, soft, colored, and easy of fusion. It is made of common plastic clays, with, when necessary, an addition of sand or refuse fire-brick or anthracite coal-ashes. The glaze is generally obtained by applying red lead or galena to the green ware and firing only once. The ware is formed on the wheel. To make the glaze, opaque oxide of tin is often added, and other metallic oxides for colors. As articles of food kept in such vessels are liable to become poisonous by dissolving the lead, a glaze free from lead may be prepared from 100 parts of borax, 50 of feldspar, and 50 of loam. *Terra-cotta* is a variety of earthenware. *Bricks* and *tiles* are prepared from common clays. *Fire-brick, stove-linings,* and *crucibles* are made from very refractory clays, free from iron, etc. Fragments of burned bricks are always added. (See article BRICKS, by GEN. Q. A. GILLMORE.)

Statistics.—Pottery is manufactured in all countries. Hard porcelain is made at the imperial factory at Berlin, the royal works at Meissen, Nymphenberg, Sèvres, and largely at private establishments in Germany, and especially at Limoges in France. In the U. S. its manufacture has been successfully introduced by T. C. Smith & Son at the Union Porcelain Works at Green Point, Long Island. Tender porcelain is largely manufactured in England. Granite ware, Wedgwood, Parian, and other varieties of fine stoneware and of fine earthenware, faïence, and majolica are most extensively made in England. The "Potteries" in Staffordshire many years ago employed 100,000 operatives, using 250 kilns. Trenton, N. J., and East Liverpool, O., are the seats of the largest industries in the U. S. These wares are also largely manufactured in Cambridge, Mass., New York, Jersey City, N. J., Philadelphia, Baltimore, Cincinnati, O., St. Louis, and other cities.

Literature.—See POTTERY; Brongniart, *Traité des Arts céramiques* (Paris, 1844); Arnoux, *Lectures on the Results of the Great Exhib.* (Lond., 1852); Marryat, *Pottery and Porcelain* (Lond., 1857); Birch, *Ancient Pottery* (Lond., 1858); W. Chaffers, *Marks and Monograms on Pottery* (Lond., 1863); R. W. Binns, *A Century of Pottery in the City of Worcester* (Lond., 1865); *Descript. Cat. of Majolica in S. Kensington Museum;* Treadwell, *Manual of Pottery and Porcelain* (N. Y., 1872); Jacquemart, *Hist. of the Ceramic Art* (Lond., 1873); Eliza Meteyard, *Wedgwood and his Works* (Lond., 1873); Champion, *Two Centuries of Ceramic Art in Bristol* (Lond., 1873); Beckwith, *On Pottery* (N. Y.); W. P. Blake, *Ceramic Art at the Vienna Exhib.* (U. S. Com., N. Y., 1875); Audsley and Bornes, *Keramic Art of Japan* (Lond., 1875); F. Knapp, *Technology* (vol. ii., Lond., 1848); ib., *Lehrbuch der chem. Technologie* (Braunschweig, 1874); Muspratt's *Chem.* (especially last Ger. ed.); B. Kerl, *Abriss der Thonwaaren-industrie;* R. V. Wagner, *Technologie* and *Jahresb. d. chem. Tech.* C. F. CHANDLER.

Pot'tinger (HENRY), BART., b. in county Down, Ireland, in 1789; went in 1804 as a cadet to India, where he rose through all the grades of the service; was political resident in Cutch and Scinde 1824–39; was made a baronet Dec., 1839; went to China as ambassador and superintendent of British trade 1841; co-operated with Admiral Parker in effecting the capture of Amoy and other places; concluded the treaty of peace of Aug. 29, 1842, which opened five Chinese ports to the commerce of all nations; was appointed governor of Hong-Kong Apr., 1843; became privy councillor on his return to England May, 1844; was governor of Cape Colony 1846–47, and governor and commander-in-chief of Madras presidency 1847–54. D. at Valetta, Malta, Mar. 18, 1854. Author of *Travels in Beloochistan and Sinde* (1816).

Pot'to, a name applied to the KINKAJOU (which see).

Potts (GEORGE), D. D., b. at Philadelphia, Pa., Mar. 15, 1802; graduated at the University of Pennsylvania 1819,

and was for more than two years a member of the class which graduated at Princeton Seminary 1822; was pastor of a church at Natchez, Miss., 1823–35, of the Duane street church, New York, 1836–44, and of the University Place church from 1844 to his death, Sept. 15, 1864. Author of a number of published sermons, addresses, and pamphlets, and had a controversy with Dr. (afterward Bishop) Wainwright (1844) of the Protestant Episcopal Church on the necessity of episcopal ordination.

Potts (STACY GARDNER), b. at Harrisburg, Pa., in 1800; edited the *Emporium* newspaper 1821; was admitted to the bar 1827; member of the legislature 1828–29; clerk of the New Jersey court of chancery 1831–41; judge of the supreme court 1852–59; one of the commissioners to revise the laws of New Jersey 1845; wrote frequently for periodicals; published *Village Tales* (1827), *Precedents and Notes of Practice in the New Jersey Court of Chancery* (1841). D. at Trenton, N. J., Apr. 9, 1865.

Potts'grove, tp., Montgomery co., Pa., includes the borough of Pottstown. P. 2895.

Potts'town, p.-b., Pottsgrove tp., Montgomery co., Pa., on Philadelphia and Reading R. R., 35 miles from Philadelphia, has 2 seminaries, good public-schools, 12 churches, 1 daily and 2 weekly newspapers, the works of the Pottstown Iron Co., the repair-shops and offices of the Pennsylvania and Reading R. R., a rolling-mill, and an anthracite furnace. It is located in a rich agricultural and mineral section. P. 4125.

DAVIS & BINDER, EDS. "POTTSTOWN DAILY LEDGER."

Potts'ville, city, cap. of Schuylkill co., Pa., situated on the N. bank of the Schuylkill River, 93 miles by rail from Philadelphia, at the terminus of the Philadelphia and Reading R. R., owes its importance to the anthracite coal-trade, being the emporium of the Schuylkill coal-region. Iron ore abounds, and two shafts are now being sunk to the depth of 1500 feet in order to reach the underlying coal-vein. It has 3 furnaces, 2 rolling-mills, several boiler, engine, and machine shops, stove and hollow-ware foundries, a spike-mill, 2 planing-mills, a pottery, a boat and stave factory, and other minor manufacturing interests. Pottsville contains 18 churches, 10 banks, an opera-house, a benevolent home for children, a free reading-room, 1 horse railway, 2 daily and 5 weekly newspapers. P. 12,384. H. C. SHEAFER, ED. "MINER'S JOURNAL."

Pouched Rat. See GOPHER.

Pouchet' (FÉLIX ARCHIMÈDE), M. D., b. at Rouen, France, Aug. 26, 1800; took his medical degree at Paris 1827; became professor of natural history in the museum of Rouen, and in 1838 a professor in the medical school and the upper school of science of Rouen; attained fame as an observer of the so-called spontaneous generation, upon which he published two memoirs (1857 and 1863); author of several botanical, zoological, physiological, and other works; published in 1865 a well-known popular scientific work called *L'Univers*, translated into English.

Poughkeep'sie, city and tp., on the eastern bank of Hudson River, 75 miles N. of New York and 69 miles S. of Albany, is the capital of Dutchess co., N. Y., is in lat. 41° 42′ 13″ N., lon. 73° 55′ 29″ W., and is the western terminus of Poughkeepsie Hartford and Boston R. R. Poughkeepsie was settled by the Dutch at the close of the seventeenth century. The first substantial building was erected not far from 1705. The legislature of New York met in Poughkeepsie in 1778 to give assent to the Articles of Confederation. Here also, on July 26, 1788, the national Constitution was ratified in State convention. The city is partly upon a hillside sloping to the river, but chiefly upon table-land, back of which is College Hill, whose summit is 500 feet above the town. It is one of the most delightful places of residence in the U. S. It is distinguished for its seminaries of learning, having 4 large boarding-schools for girls, 2 for boys, and a commercial college. Here also, 2 miles E. of the city, is the flourishing Vassar College for young ladies, founded in 1861 by Matthew Vassar. Poughkeepsie contains 20 churches, 6 national banks, 1 savings bank, a public library, orphan asylum, old ladies' home, hospital, and other charitable institutions. Outside the city limits, to the N., is the Hudson River Hospital for the Insane, occupying one of the finest sites on the river. There are many important and flourishing manufacturing interests in the city, among which are dyewoods, carpets, pins, iron, and shoes. The city has 2 gas companies, 5 weekly newspapers and 3 daily. A horse railroad connects the western and eastern extremes, running from the river to Vassar College. Among the corporate companies is the Poughkeepsie Bridge Co., having in contemplation a bridge across the Hudson as a connecting-link between New England and the coal-regions. The city has clean and finely-shaded streets, and many

beautiful residences. It has a good sewerage system, and an abundant supply of water from Hudson River, the water being forced by pumps to a large reservoir on College Hill, and thence distributed throughout the city. P. of city, 20,080; of tp., exclusive of city, 4009.

FRANCIS B. WHEELER.

Pouillet′ (CLAUDE SERVAIS MATHIAS), b. at Cuzance, department of Doubs, France, Feb. 16, 1791; was educated at the normal school of Paris; became teacher of physical science to the sons of Louis Philippe, and in 1829 professor, afterward director, of the Conservatory of Art and Industry, but retired after the *coup d'état*. D. at Paris June 15, 1868. He wrote *Éléments de Physique expérimentale et de Météorologie* (2 vols., 1827) and *Notions générales de Physique et de Météorologie* (1850), besides several minor works.

Poujoulat′ (JEAN JOSEPH FRANÇOIS), b. Jan. 26, 1808, at Lafare, department of Bouches-de-Rhône, France; studied at Aix and Paris; accompanied Michaud in 1830 to the Orient, and in 1839 to Italy, and participated in several of his publications; wrote *Histoire de Jerusalem* (2 vols., 1841), *Histoire de St. Augustin* (3 vols., 1844), *Le Cardinal Maury* (1855), and other works.

Poulp [Fr. *poulpe*], the generic name of the eight-footed dibranchiate cephalopods. (See CEPHALOPODA and OCTOPODA.)

Poul′son (ZACHARIAH), b. at Philadelphia, Pa., Sept. 5, 1761; edited and published the *American Daily Advertiser*, the first daily newspaper in the country, from Oct., 1800, to Dec. 28, 1839; published *Poulson's Town and Country Almanac* for many years, and was long printer to the State senate. D. at Philadelphia July 31, 1844.

Poul′tice, a soft composition of bread, flaxseed, meal, slippery-elm bark, or herbs, applied warm or at as high a temperature as the part to which it is applied will bear, in order to hasten inflammation and produce suppuration. Cold poultices or other cataplasms—for instance, of cotton-wool steeped in water—are applied to prevent inflammation or mitigate pain.

Poult′ney, p.-tp., Rutland co., Vt., 18 miles S. W. of Rutland, on Rutland and Washington division of Rutland and Saratoga R. R., has an academy and several schools, 18 churches, 1 bank, 1 newspaper, a foundry and machine-shops, hotels, wagon and carriage shops, an establishment for making cheese-factory apparatus, and slate-quarries. P. 2836. B. FRISBIE, ED. "JOURNAL."

Poult′ry [from the Fr. *poule*, "a hen"], all domesticated birds, Gallinaceæ, such as the common fowl, the Guinea fowl, the turkey, and the pigeon, and palmipeds, such as the duck and the goose, as far as they are reared for useful purposes. The rearing of poultry is generally considered as a subordinate branch of rural economy. In Northern France and in the Prussian province of Pomerania it is carried on with great energy, and yields a very handsome profit. One reason why the rearing of poultry has remained comparatively undeveloped on the farm is no doubt that poultry in large numbers may easily become not only a nuisance, but hurtful to the fields. To this objection it may be answered, however, that poultry can be reared with advantage in enclosures of comparatively small size. (See *The People's Practical Poultry-Book*, by D. T. Moore, New York, 1871.)

Pounce, the name for powdered cuttle-fish bone (so called). It is used in making moulds for delicate castings, for tooth-powder, for polishing, etc. Pounce is also powdered sandarach or rosin, used for blotting-sand, etc.

Pound. See AVOIRDUPOIS, PHARMACY, and WEIGHTS AND MEASURES.

Pound′ridge, p.-v. and tp., Westchester co., N. Y. P. 1194.

Pound Ster′ling, a denomination of English money, equal in value to 20 shillings, or 240 pence, into which a pound of silver was anciently divided, thus giving origin to the term "pound." The word "sterling" is of obscure origin, but is probably derived from *Easterling*, the popular name of the Baltic and German traders who visited London in the Middle Ages. The silver penny was first called Easterling. (See COINAGE, by E. B. ELLIOT.)

Poussin (CASPAR). See DUGHET.

Poussin′ (NICOLAS), b. at Audely, in Normandy, 1594; d. 1665; studied art in Paris with Varin and Duchesne; went to Rome in 1624; attended the schools of Sacchi and Domenichino; was deeply interested in antique art and fascinated by Raphael; worked hard in obscurity and poverty; attracted the favorable regard of Cardinal Barberini, for whom he painted the *Death of Germanicus* and the *Capture of Jerusalem*; made his way to reputation and prosperity; was invited to Paris by Louis XIII.; received with distinction by Cardinal Richelieu; offered apartments at the Tuileries and the position of court-painter, with a salary of £120 a year. The jealousies of other artists made him uncomfortable; he went to Rome on the plea of bringing his wife to Paris, and never returned. Poussin was a careful and industrious painter, with great enthusiasm for his art, on which, however, he refused to set as high a market-price as his merit and popularity warranted; in consequence whereof he lived and died in moderate circumstances. Sir Joshua Reynolds warmly commended the accuracy and extent of his knowledge, and John Ruskin bestows on his landscapes an uncommon share of his usually reluctant praise. Poussin loved to paint subjects from classical mythology, landscapes with figures, buildings of stately architecture with classical accessories. He was a skilful draughtsman, a sober colorist, learned, but poetic and imaginative; he combined a devoted love of his art with literary habits and fondness for the society of cultivated men. Between 300 and 400 of his works are named in catalogues; the National Gallery in London has eight; the Dulwich Gallery, fourteen; the European galleries contain enough to make his style familiar to all who are interested in studying his work. Many of his finest pictures have been engraved. O. B. FROTHINGHAM.

Povo′a de Varzim′, town of Portugal, province of Entre Minho-e-Duro, on the Atlantic, has a good harbor and valuable fisheries. Pop. 6200.

Powder. See GUNPOWDER, by COL. J. G. BENTON.

Pow′ell, county of Central Kentucky. Area, 200 sq. m. It is intersected by Red River, an affluent of the Kentucky. It is uneven and fertile. Corn is a leading product. Cap. Stanton. P. 2599.

Powell, tp., Craighead co., Ark. P. 1098.

Powell, tp., Scott co., Va. P. 2261.

Powell (BADEN), F. R. S., b. at Stamford Hill, near London, Aug. 22, 1796; graduated at Oriel College, Oxford, 1817; took orders in the Church of England, and was Savilian professor of geometry at Oxford from 1827 till his death, at London June 11, 1860. Author of many contributions to scientific periodicals, of several mathematical treatises, and published *An Historical View of the Physical and Mathematical Sciences* (1834), *The Connection of Natural and Divine Truth* (1838), *A View of the Undulatory Theory of Light* (1842), *Essays on the Spirit of Inductive Philosophy, the Unity of Worlds, and the Philosophy of Creation* (1855), *Christianity without Judaism* (1857), *The Order of Nature considered in Reference to the Claims of Revelation* (1859), and an essay *On the Study of the Evidences of Christianity*, in the celebrated volume entitled *Essays and Reviews* (1860).

Powell (CHARLES STUART), b. in England in 1749; was for some years an actor at the Covent Garden Theatre, London; was manager of the Haymarket; appeared on the stage at Boston, Mass., Aug. 13, 1792, being the first occasion that dramatic performances were represented in that city; opened the new Boston Theatre as manager Feb., 1794, with a prologue written by Robert Treat Paine, who was intimately connected with the undertaking; remained in Boston until 1796; was for some years manager of a theatre at Halifax, N. S. D. there Apr. 26, 1811.

Powell (JOHN HARE), b. at Philadelphia, Pa., in Apr., 1786; educated at Philadelphia College; was secretary of legation in London under William Pinkney, returning Dec., 1811; became brigade-major to Gen. T. Cadwallader Sept., 1814, and inspector-general Dec., 1814; was a successful merchant and a scientific agriculturist; one of the founders of the Pennsylvania Agricultural Society 1823; was instrumental in improving the breeds of horned cattle and sheep in the U. S.; was a good speaker and debater; wrote much for the agricultural journals, and author of *Memoirs of the Pennsylvania Agricultural Society* and of *Hints for American Farmers*. D. at Philadelphia June 14, 1856.

Powell (JOHN WESLEY), b. at Mount Morris, N. Y., Mar. 24, 1834; removed in childhood to Wisconsin, where he received a common-school education and became a teacher; spent two years at Oberlin College 1854–56; devoted himself to natural history; travelled extensively in the Western States collecting specimens; was a volunteer in the war for the Union; lost his right arm at Shiloh; rose to be major; became professor of geology in the Wesleyan University, Bloomington, Ill., 1865; undertook in 1867, under authority of Congress, a scientific exploration of Colorado Territory, upon which he has been engaged for several years with great success, consisting chiefly of a topographical survey of the valley of Colorado River, where interesting discoveries have been made by Maj. Powell's parties in geology, palæontology, archæology, and ethnology. The work is still (1876) in progress as the second division of the geographical and geological survey of the Territories.

Powell (Lazarus W.), b. in Henderson co., Ky., Oct. 6, 1812; graduated at St. Joseph's College, Bardstown, Ky., 1833, and at the Transylvania Law School 1835; became a successful lawyer and agriculturist; governor of Kentucky 1851–55; U. S. Senator 1859–65. D. at Henderson, Ky., July 3, 1867.

Powell (Snelling), brother of Charles S., b. at Caermarthen, Wales, in 1758; made his début as an actor at the opening of the Boston Theatre Feb. 2, 1794, and was subsequently a successful manager of that theatre. D. at Boston Apr. 8, 1821.

Powell (William Byrd), M. D., b. in Bourbon co., Ky., Jan. 8, 1799; graduated at the Transylvania University 1820, at its medical school 1823; gave special attention to the physiology of the brain and of the temperaments, prosecuting this study among the Indian tribes, and professing to read the temperament from an examination of the cranium alone; became professor of chemistry in the Medical College of Louisiana 1835; organized the Memphis Medical Institute 1849, taking the chair of cerebral physiology; removed to Covington, Ky., 1851; was professor in the Eclectic Medical Institute at Cincinnati 1856–59; wrote largely for medical, scientific, and literary journals; published treatises on eclectic medical practice, and a work entitled *Natural History of the Human Temperaments* (1856), in which he laid down a method for the infallible measurement of the vital force. D. at Covington May 13, 1866.

Powells, tp., Etowah co., Ala. P. 122.

Powell's Ford, v., Johnston tp., Shenandoah co., Va. P. 704.

Pow'er [O. Fr. *pouvoir*]. The power of a quantity is the result obtained by taking that quantity a certain number of times as a factor. We may regard the number 1 as the basis of the powers of all quantities; and inasmuch as we have not yet introduced any other factor, we may consider it as the 0 power. Now, let us take a to represent any quantity, and let 1 be multiplied by it; the result may be written a^1; and because a is taken once as a factor, this result may be called the *first power*. If this power is multiplied by a, the result may be written a^2; and because a has been taken twice as a factor, this result is called the *second* power; and so on. After n successive multiplications by a, we reach a result which may be written a^n, and which is called the nth power of a. If we commence with 1, which is the 0 power of a, we have the series

$$1,\ a^1,\ a^2,\ a^3,\ .\ .\ .\ .\ a^n,$$

n being any positive whole number. This series is called the series of *ascending* powers. If we now commence with a^n, and divide successively by a, we have a series of descending powers, and when we reach the term 1, if we go on with the division, we shall have, in continuation, the series

$$\frac{1}{a},\ \frac{1}{a^2},\ \frac{1}{a^3},\ .\ .\ .\ .\ \frac{1}{a^n}.$$

From analogy, the terms of this new series may be written

$$a^{-1},\ a^{-2},\ a^{-3}\ .\ .\ .\ a^{-n},$$

from which we see that the entire series may be placed under the form

$$a^{-n},\ .\ .\ .\ a^{-2},\ a^{-1},\ a^0,\ a^1,\ a^2\ .\ .\ .\ a^n,$$

a series such that any term may be derived from the preceding one by multiplying by the root a, or from the succeeding one by dividing by the root a. This series illustrates the relation between positive and negative powers. In each term the number written over the root a is an *exponent;* when the exponent is positive, it indicates that the term may be derived from 1 by continued multiplication; and when the exponent is negative, it shows that the corresponding term may be derived from 1 by continued division; these views illustrate the intimate relation that exists between the operations of algebraic multiplication and algebraic division.

In what precedes, the exponent is regarded as a whole number, but by an extension of the definition of the term *power* we are led to call any expression of the form a^n a power, whether n is entire or fractional, positive or negative, real or imaginary. This extension of the definition does not in any way affect the rules for operating on powers, but it necessitates a suitable interpretation of the results. These rules of interpretation are indicated in the following table of analytical equivalents, in which m and n are supposed to be positive whole numbers:

$$a^{\frac{m}{n}} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m;$$

$$a^{-n} = \frac{1}{a^n} = \left(\frac{1}{a}\right)^n;$$

$$a^{-\frac{m}{n}} = \frac{1}{\sqrt[n]{a^m}} = \frac{1}{a^{\frac{m}{n}}}.$$

It is to be remarked that a may be any quantity whatever, either numerical or algebraic, positive or negative, monomial or polynomial.

The following are some of the properties of powers that are of practical use in algebraic and arithmetical operations; the powers alluded to are supposed to be integral—that is, their exponents are positive whole numbers: (1) The difference of any like powers of two numbers is divisible by the difference of the numbers. (2) The difference of like even powers of two numbers is divisible both by the sum, and also by the difference of the two numbers. (3) The sum of like odd powers of two numbers is divisible by the sum of the numbers. (4) The expression $x^m + x^n$ is divisible by $x+1$ when $m-n$ is an odd number. (5) The expression $x^m - x^n$ is divisible by $x-1$, and also by $x+1$ when $m-n$ is an even number. (6) Neither the sum nor the difference of any two like powers of a degree superior to the second is a perfect power of the same degree. (7) If m is a prime number, and x a number not divisible by m, the expression $x^{m-1}-1$ is exactly divisible by m.

The last principle gives rise to the following conclusions:

All second powers are of the form $5n$, or $5n \pm 1$;
All third powers are of the form $7n$, or $7n \pm 1$;
All fourth powers are of the form $5n$, or $5n \pm 1$;
All fifth powers are of the form $11n$, or $11n \pm 1$;
All sixth powers are of the form $13n$, or $13n \pm 1$;

and generally, when m is prime, all mth powers are of the form $(m+1)n$; when $2m+1$ is prime, all mth powers are of the form $(m+1)n+1$. W. G. Peck.

Power (Tyrone), b. in Waterford co., Ireland, Nov. 2, 1797; removed to Wales in early life; made his début on the stage at the Cardiff theatre; played in the principal cities of England, including London; excelled in the delineation of Irish characters; made successful tours in the U. S. 1833–35 and 1840–41, and embarked for Europe Mar. 11, 1841, in the steamship President, which was never heard of afterward. Author of two novels and a work of travels in America.

Power (William), M. D., b. 1814; graduated at Yale College, Conn., in 1834; was resident student of the Baltimore almshouse; took his medical degree in the University of Maryland, and went to Europe to continue his professional studies; in 1845 he was made professor of the theory and practice of medicine in his alma mater. D. Aug. 15, 1852.

Power-Loom. See Loom, by W. E. A. Axon.

Pow'er of Attor'ney (law), a written instrument by the terms of which the person executing it constitutes another his agent or attorney, and authorizes such agent to perform the act or acts therein named in his name and on his behalf. In regard to the nature and extent of the agency created, powers of attorney are either general or special. They are general when the agent is empowered to represent the principal generally in some designated business or transaction, and to do all acts whatsoever in connection therewith—as, for example, a power given by a merchant to a clerk authorizing him to make and endorse all the notes or checks in the principal's business. They are special where the agent is restricted to the performance of some particular act or acts specifically mentioned and described in the instrument itself—as, for example, a power given by a merchant to his clerk authorizing the latter to sign some particular note or notes or to draw some check or checks specified and identified. They may in general be either sealed or unsealed, but by virtue of the technical rules of the common law in respect to the peculiar efficacy of a seal, an agent cannot be delegated to execute a conveyance of land or other writing required by law to be under seal, unless his power of attorney conferring the authority is also sealed. This ancient dogma, which attributed such efficiency to the seal, has, however, been abandoned in many of the States. With reference to the duration of the authority, powers of attorney are either revocable or irrevocable. They are irrevocable when the authority conferred is also coupled with an interest; that is, when the attorney is at the same time clothed with a personal and legal interest in the act or in the results of the act to be done by him. For example, if a debtor should give to his creditor a power of attorney to collect certain moneys owing to the principal, and to apply the proceeds when received toward the payment of the existing debt between the parties, the instrument being thus designed as a security, it would operate as an equitable assignment of the demand to the attorney, would confer an interest upon him, and would be irrevocable. In all other cases they are revocable. Powers of attorney are always to be strictly construed, so that the extent of the authority granted shall not be enlarged by implication. Thus, it is a settled doctrine that general expressions are

confined in their effect and operation to the particular subject-matter in connection with which they are found.

JOHN NORTON POMEROY.

Powers, in law. In its most important technical signification this term denotes the peculiar species of authority conferred upon a person by a will or a deed, which enables him to create and bestow some estate in lands greater than, or in addition to, the interest in the same lands held by himself. If an individual owns land in fee, he can by virtue of such ownership create and transmit any interest therein known to the law, and his authority to do so would not be a "power." And if he owns a life estate, he can by virtue thereof create and transmit any lesser interest; for example, he can execute a valid lease of the land which will endure as long as his own life—that is, until his own estate terminates. If, however, the holder of a life estate was authorized to give leases of the land which would endure after his death—that is, after his own estate had ended—or was authorized to transfer the land on his death to such persons as he might choose, he would plainly be able to create and bestow interests greater than, or in addition to, the interest which he holds; and this authority is termed a power. Powers as thus described form a part of the highly-artificial system of English real property law, which grew up in the interests of landed proprietors, and with the design of perpetuating family greatness. They are chiefly used in family settlements, and by their means the original proprietor, when framing his will or deed, can anticipate and guard against many contingencies, can provide for new and different dispositions on the happening of such events, and can thus retain, as it were, an active control over his property even after his own death. These doctrines have been incorporated into the jurisprudence of the American States, yet, from the great difference in our social customs, they are of comparatively little importance in this country. Resort is seldom had, except occasionally in some of the older communities and more artificial societies, to these means of regulating the succession to family estates. No department of the law is more intricate or presents greater difficulties to the student than that which relates to the doctrine of powers; it is full of exceedingly refined and subtle distinctions, and its rules present a most striking illustration of the artificial processes of logic in which the older lawyers and judges so much delighted. The limits of a single article will permit a very general outline only of the subject and a brief explanation of its most prominent features.

Powers may be created and conferred either by a will or a deed. The original proprietor who executes the will or deed, and thereby creates and confers the power, is termed the "donor," while the one upon whom it is bestowed is called the "donee." After having provided for such present or future estates in the land as he thinks proper, the grantor may reserve a power to himself to alter these dispositions, to revoke certain gifts, to substitute others in their stead, or to transfer them to other beneficiaries; or he may empower one or more of the persons to whom he has given estates to make dispositions out of or in addition to their interests; or, finally, he may authorize persons upon whom he has conferred no interests in the land to do acts in reference to the estates given to others—as, for example, to sell and convey them or to alter or revoke them. Powers are divided into several classes, the first and most important being collateral and those coupled with an interest. A power is collateral when held by a donee to whom no estate or interest in the land itself has been given. For example, where a testator has devised his lands in fee to specified individuals, but in the same will has authorized the executors under certain circumstances to sell and convey the same lands by deed, no estate is vested in the executors, and yet they may divest the interest of the devisees and transfer a perfect title to the property. This species of power is often used in order to raise money for the payment of debts and legacies. Powers coupled with an interest are those given to a donee upon whom some estate in the same lands is also conferred. They are subdivided into *appendant* and *in gross*. An appendant power is one which the donee must exercise out of the estate conveyed to himself. If land is given to A for his own life, with power to grant leases thereof for any number of years—say twenty-one—so that the leases would endure for their whole term although A might die before their expiration, such power would be appendant. A power in gross is one that enables the donee to create estates which do not take effect out of his own, but are in addition to it, not coming into enjoyment until it is ended. Thus, if land is conveyed to A for his life, but he is authorized to transmit it by will or by a deed taking effect at his death, the power is in gross, for the estate which he confers is not cut out of his own. Another classification is into those *of appointment* and those *of revocation*. A power is one of appointment when the donee is enabled to create and bestow new and different estates from those originally given in the deed or will; it is one of revocation when the donee is enabled to divest, abridge, or revoke estates already given. Either of the species may be collateral, appendant, or in gross. A power of appointment is said to be general when the estate may be conferred upon whomsoever the donee pleases; it is special when he is restricted to a specified class of persons. In general, the donee is not obliged to execute a power, but if it is held by him in trust for certain beneficiaries, they may compel a performance. A court of equity will sometimes interfere and perfect an incomplete performance. JOHN NORTON POMEROY.

Powers (HIRAM), b. in Woodstock, Vt., July 29, 1805. The first twelve years of the life of this remarkable man were passed in his native village, where he had abundant opportunity to cultivate his love of nature, but no stimulus whatever for his artistic genius. Occasions, however, were not wanting for the exercise of those mechanical gifts which almost always form a part of the peculiar endowment of the artist, and the skill of the youthful Powers in inventing ingenious toys, building dams and bridges, casting miniature cannon, etc. secured him an immense following of truant boys, while his wonderful talent of narrating with the most picturesque vividness not only strange adventures originated by his own imagination, but the simplest incidents of the daily walk to and from school, made him no less acceptable to his more quiet companions. In 1817 his parents, having lost a considerable part of their very moderate competence, removed with their large family to Cincinnati. Here the future artist remained till 1835, availing himself, in the mean time, of any honest employment that came in his way, and always giving more than satisfaction to his employer, both by his fidelity and by his extraordinary resources under difficulties. While in the workshop of a clockmaker he displayed such ingenuity and skill in the construction of a hand-organ with twelve automatic figures that his services were eagerly sought for by a certain Monsieur Dorfeuille, manager of one of the city museums. Powers accepted this offer in 1829, having in the mean time received from a Prussian acquaintance some valuable hints about modelling, and especially as to the method of taking casts from models. He had been already two years in the employment of Dorfeuille, preparing ever-fresh surprises for the manager and his public by new mechanical contrivances, new groups of wax figures, etc., when he beheld *for the first time in his life* a bust in marble. It was a portrait of Washington by Canova, on exhibition, and after gazing at it a long time, silent and motionless, Powers said, quietly and emphatically, as if to himself, "*That is what I shall do.*" But it was not till 1835 that he was able, through the encouragement and aid of his friend Mr. Longworth, to go to Washington, where he began his new career by constructing a revolving *jet d'eau* for the Capitol grounds, and by modelling the heads of several distinguished men—J. Q. Adams, Jackson, Van Buren, Webster, Calhoun, Preston, etc. The personal appearance of Powers was at this time very striking. He was tall and thin, his movements rather angular than graceful, and his manner and address showed an entire unfamiliarity with social conventionalities. But the uncommon beauty of his manly features was lighted up by large, dark, lustrous eyes, whose expression was at once frank, intelligent, and thoughtful, and his whole bearing indicated that respect for himself and for others which is the root of all true dignity and true courtesy. The contact with high artificial refinement into which he was afterward necessarily brought by a long life of artistic success, though it effaced everything like rusticity, never obscured this charming simplicity of manner, habits, and character—a simplicity which the high and truthful instincts of his nature never suffered to degenerate for a moment into vulgar affectation. At one period of his life a strong personal resemblance was noticeable between him and the English sculptor Gibson, but to those who saw him in his advanced years, when his noble features, marked by thought rather than by age, were softened by his long silver hair and beard—which seemed, on the contrary, to heighten the keen flash of his undimmed eyes—he was like no one else.

After spending two winters in Washington, Powers, with the assistance of Col. Preston and Mr. Longworth, removed with his family (he had married Miss Gibson of Cincinnati in 1833) to Florence, Italy, where he could have greater facilities for executing his works in marble, as well as for study. Here he settled in 1837, Greenough having preceded him and giving him a truly brotherly welcome. His busts soon acquired a worldwide reputation for fidelity to nature and the highest possible finish, and the insufficiency of his pecuniary resources obliged him to confine himself

to this branch of his art to the extent of his orders. But he devoted every spare moment to ideal work, and the *Greek Slave*—finished in 1843, and now in the possession of A. T. Stewart—secured for its author a position among modern sculptors which later criticism has in vain assailed. Many repetitions of this exquisite statue have been made, most of them for England. The lovely, graceful head of *Proserpine*, the *Fisher Boy*, and other large and small ideal works followed as the artist could spare the time from his more productive portrait-busts. In estimating the genius of this artist it should not be forgotten that the necessity of providing for a large family was always more or less imperative upon him, and was, in a greater or less degree, a constant restraint upon the free exercise and development of his highest gifts. It is true that Powers belonged both in theory and in practice to the so-called *naturalistic* or *realistic* school, but they who think this a defect should remember that the boyhood and youth of the artist were spent where Nature was his only teacher, and consequently he gave his whole soul to her lessons. Not only did he then never see a real work of art, but all that may be learned from books was almost equally out of his reach. When at last he found himself surrounded by the works of the great masters, his theories were already matured, and the circumstances alluded to above strongly tended to confine him to their practice. For all those who knew Powers intimately it would be as difficult to conceive that the character of his works was determined by the limitations of his native genius as to believe that the elegant repose which so distinguished his ideal creations, and which he held to be an essential quality in all high sculpture, was the result of a natural passivity of temperament. Powers returned no more to his native country—a circumstance which explains the fact that he never received an order for any national work—but he remained a thorough American to the last, and those who remember him during the years of our civil war will never forget the patriotic zeal which burned in him like a consuming flame, and which, upon provocation, broke forth so scathingly. In the winter of 1873 the already declining health of this eminent artist became so impaired that he was obliged to discontinue work; as the spring advanced he was more and more weakened by a distressing cough, his voice was reduced to a whisper, and on the 27th of June the sudden rupture of a blood-vessel closed his earthly life. Besides the above-named works, Powers executed a large number of portrait and ideal busts of great merit, as well as many statues; among the latter, those of Washington, *America*, *Eve Disconsolate*, *The Last of the Tribes*, etc. C. C. MARSH.

Powers, Mechanical. See MECHANICAL POWERS, by PROF. WILLIAM P. TROWBRIDGE, A. M., M. N. A. S.

Pow'eshiek, county of Central Iowa. Area, 576 sq. m. It is level and fertile. Products, live-stock, grain, and wool. Is traversed by Iowa Central and Chicago Rock Island and Pacific R. Rs. Cap. Montezuma. P. 15,581.

Poweshiek, tp., Jasper co., Ia., on S. Skunk River and on Chicago Rock Island and Pacific R. R. P. 1239.

Powhatan', county of Central Virginia. Area, 280 sq. m. It is bounded N. and S. by the Appomattox. Its soil is naturally very productive. Tobacco and grain are leading products. Cap. Powhatan Court-house. P. 7667.

Powhatan, p.-v., cap. of Lawrence co., Ark., 35 miles N. E. of Jacksonport.

Powhatan, tp., Pocahontas co., Ia. P. 180.

Powhatan, tp., James City co., Va. P. 1117.

Powhatan, the principal chief of several confederate clans or tribes of Eastern Virginia at the time of the settlement of Jamestown in 1607, usually called "emperor" by the early writers, though the number of his subjects was estimated at only 8000, was hostile to the English, with whom he repeatedly came into collision. Having taken Capt. John Smith prisoner, he was about to put him to death when his daughter, Pocahontas, interfered and saved the life of the captain. Powhatan's principal residence was at Werowocomoco on York River, within the present limits of Gloucester co., where he maintained considerable pomp, being always attended by a body-guard of four warriors. D. in Apr., 1618.

Powhatan Court-house, p.-v. in the v. of Scottsville, cap. of Powhatan co., Va., 30 miles W. of Richmond.

Powhatan Point, p.-v., Belmont co., O., on Ohio River. P. 201.

Pownal, p.-v. and tp., Cumberland co., Me. P. 981.

Pownal, p.-v. and tp., Bennington co., Vt., on Hoosick River and Troy and Boston R. R. P. 1705.

Pow'nall (THOMAS), LL.D., b. at Lincoln, England, in 1722; graduated at Cambridge 1743; became secretary to the commissioners for trade and plantations 1745; was employed in the commissariat department during the war in Germany; came to New Jersey as secretary of the province 1753; became lieutenant-governor 1755; was a member of the colonial congress which met at Albany in 1754 to devise measures of defence against the French; was governor of Massachusetts 1757–60, of South Carolina 1760–61, after which he became director-general of the office of control; sat in Parliament, where he opposed in many well-considered speeches the rash policy of the Crown toward the American colonies, and published *The Administration of the Colonies* (1766), *A Topographical Description of the Middle British Colonies* (1775), and other works on archæology and politics. D. at Bath, England, Feb. 25, 1805.

Powy, tp., San Diego co., Cal. P. 91.

Poydras' (JULIEN), b. probably in Louisiana in the latter half of the eighteenth century; accumulated a large fortune; was the first delegate in Congress from the Territory of Orleans (the present State of Louisiana) 1809–12; gave $100,000 to found a female orphan asylum and $20,000 for a college at Point Coupée. D. at Point Coupée June 25, 1824.

Poygan, p.-v. and tp., Winnebago co., Wis. P. 843.

Poyner, tp., Black Hawk co., Ia., on Cedar River. P. 1063.

Poynette', p.-v., Dekorra tp., Columbia co., Wis., on Madison and Portage R. R. P. 300.

Poy Sip'pi, p.-v. and tp., Waushara co., Wis. P. 612.

Pozoblanc'o, town of Spain, province of Cordova, in the Sierra Morena, has 8007 inhabitants.

Poz'zo di Bor'go (CARLO ANDREA), b. at Alata, in Corsica, Mar. 8, 1768; studied law at the University of Pisa, and settled as an advocate at Ajaccio, where he lived in great intimacy with Joseph and Napoleon Bonaparte. This friendship soon cooled, however, and the relation between the former friends assumed a very bitter character when Pozzo di Borgo espoused the cause of Paoli, who showed great confidence in him. In 1791 he represented Ajaccio in the National Assembly, and sided with the Girondists, but returned to Corsica in 1792; held a high position in the government of the island during its occupation by the English, and fled, after their expulsion, to London. Here he became the agent of the French *émigrés*, and began his flying missions from one court to another to form plots and coalitions against France. In 1803 he entered the Russian diplomatic service, and the interest which Alexander I. took in him gave him a rich opportunity of gratifying his truly Corsican hatred against the Bonapartes. The intimacy which sprang up between Napoleon and Alexander after the Peace of Tilsit brought him for a moment into great danger; Napoleon demanded his extradition, and he fled first to Austria, then to England. But he was soon able to resume his work, and he did it with increased energy and increased success. It was he who brought about the rupture between Alexander and Napoleon at the close of 1810, and it was he who seduced Murat and Bernadotte. Again, it was he who persuaded Alexander to continue the war in 1813, and it was he who determined the allies to reject Napoleon's offers of peace. He wrote the famous proclamation which preceded the entrance of the allies into France—that they waged war against Napoleon, not against the French people—and he had at last the triumph of signing the Treaty of Paris in 1815 as Russian ambassador. After the fall of Napoleon he remained in the Russian service, and enjoyed great esteem from the Russian court, though perhaps not always full confidence. In 1826 the emperor Nicholas made him a count and employed him as ambassador in Paris and London, where he was the oracle of the doctrinaires and detested by the radicals. D. at Paris Feb. 15, 1842.

Pozzuolana. See CEMENTS, by GEN. Q. A. GILLMORE, U. S. army.

Pozzuo'li [Gr. *Dicæarchia*; Lat. *Puteoli*], town of Southern Italy, province of Naples, on the seashore about 6 miles W. of the city of Naples. This town, which, when St. Paul landed here after his perilous voyage, was one of the great seaports of the world, is now reduced to comparative insignificance. The streets are narrow, irregular, ill paved, and many of them very steep. The public buildings are of little interest, except when, as in the case of the cathedral, they are transformed pagan temples. The large and safe harbor, which once swarmed with foreign ships from Egypt, from Phœnicia, and indeed from all the commercial world, is now so filled up as to be frequented only by small fishing-craft. Of the long line of porticoes, resting on piles driven beneath the water to protect the port on the S., and which served alike as a promenade

and an exchange, nothing whatever remains. Ten crumbling arches of the ancient mole may still be seen, as well as other ruins of more or less importance. The neighborhood of Pozzuoli, however, abounds in interest both for the antiquarian and the geologist. The famous temple of Serapis (which has supplied the museum of Naples with some of its choicest treasures, and given occasion for most curious observations upon the secular changes in the coast-level), the temples of Neptune, etc., the theatre, the amphitheatre, the Grotto of the Sibyl, the Solfatara, Lakes Lucrinus and Avernus—all are within a short walk of Pozzuoli. Indeed, it may be said that no corner of the earth offers a wider field for united artistic, historical, and scientific study than does this beautiful region, which, blooming as it were over volcanic fires, has witnessed such marvellous vicissitudes. The population, occupied chiefly with agriculture, fishing, soap-making, etc., is about 16,000.

Pradier′ (Jean Jacques), b. at Geneva May 23, 1792; studied sculpture at Paris under Lemot 1809–12, and at Rome 1812–16; lived afterward in Paris, and d. there June 4, 1852. The most celebrated of his works are *Philoctetes and Ulysses*, *Psyche*, *The Graces*, *Venus and Cupid*, *The Bacchante*, and *Phryne*.

Pradt, de (Dominique Dufour), generally known under the name of Abbé de Pradt, b. at Allanche, department of Cantal, France, Apr. 23, 1759; was vicar-general to the archbishop of Rouen and member of the Constituent Assembly in 1789; fled in 1791 to Hamburg, and wrote violent pamphlets against the Revolution; returned to Paris in 1801; was appointed grand almoner to the emperor and archbishop of Mechlin as a reward for the willingness and talent with which he carried on the least honorable negotiations of the imperial polity; hastened in 1814 to join the Bourbons, and produced a matchless scandal by his denunciations of the fallen emperor, *Histoire de l'Ambassade dans le Grand-Duché de Varsovie en 1812*, but was nevertheless not very successful; renounced his see, in which he had not been confirmed by the pope, for an annuity; retired to his estates in Auvergne; wrote commentaries and memoirs on every event which attracted general attention; lastly, *Un Chapitre sur la Légitimité* (1830), but did not succeed in making another sensation. D. in obscurity Mar. 18, 1844.

Praed (Winthrop Mackworth), b. in London in 1802; educated at Eton, where he was distinguished for the brilliancy of his classical scholarship, as well as by his literary talent; was the associate of John Moultrie and H. N. Coleridge in editing the *Etonian;* graduated at Trinity College, Cambridge, 1825; contributed to Knight's *Quarterly Magazine;* was called to the bar 1829; sat in Parliament as a Conservative for St. Germain, and subsequently for Great Yarmouth and Aylesbury; became secretary of the board of control 1834, and afterward recorder of Barnstaple and deputy high steward for the University of Cambridge; was noted for his opposition to the Reform bill, and wrote for the annuals, magazines, and other periodicals many scholarly essays and graceful "verses of society." D. July 15, 1839. His *Poems* were edited in New York by R. W. Griswold (1844), and with a *Memoir* by W. H. Whitmore (2 vols., 1859), and a complete edition, with a memoir by Rev. Derwent Coleridge, was issued by his sister, Lady Young (2 vols., 1864).

Præneste. See Palestrina.

Præ′tor [Lat.], in ancient Rome, the title of several high officials. The prætor (called after 246 b. c. *prætor urbanus*) was the third officer in rank in the state, inferior to the consuls only. He was first chosen in 366 b. c. No plebeian was ever a prætor until 337 b. c. The consuls themselves when at the head of armies were designated as prætors. The *prætor peregrinus* was a magistrate who had oversight of the relations between the *peregrini* and full citizens. In later times the number of prætors was very much increased, of whom some were assigned to the provinces. It was also customary to send prætors, after their regular term of service had expired, to the provinces, where they served as proprætors. The prætors were in fact judges of civil and criminal law, and their decisions greatly enriched and amplified the Roman law.

Præto′rians [Lat. *prætoriani* or *cohors prætoria*], the personal guard of the Roman emperors. During the time of the republic the general in command had a guard, a *cohors prætoria*, which consisted of picked soldiers from the legions, and which was paid better than the common soldiers. But at the end of a campaign this guard was always dissolved and its members returned to the legions. Augustus, however, transformed (in 27 b. c.) his *cohors prætoria* into a standing body of troops, consisting of ten cohorts, each numbering 1000 men (horse and foot), of which he kept three in Rome for service in the palace, while the rest were stationed in the neighborhood of the metropolis. Tiberius gathered all the cohorts to Rome for the sake of maintaining a better discipline, and built them a fortified camp in the north-eastern corner of the city, and Vitellius increased their number to sixteen cohorts. Originally, only Italians were employed in this guard, but later Macedonians and Illyrians. The term of service was sixteen years; the pay double that of the legions; the rank of a private of the guard equal to that of a centurion in the legions; and when the time of service expired each soldier received 20,000 sesterces. But besides these legal advantages the prætorians soon acquired others; indeed, they became one of the most important political bodies in the Roman empire, and played a part similar to that of the Janizaries afterward in Constantinople. In order to secure their favor every new emperor bestowed upon them new privileges and great dotations, and ere long they assumed the right of electing and deposing the emperor. At last they even sold the purple. After the death of Pertinax (in 193 a. d.) they put the crown up at auction, and Didius Julianus bought it. But in the same year Severus dissolved the whole corps and gave it another organization. Their power was not broken, however, and its frightful abuse continued until Constantine (in 312 a. d.) saw fit to dispense with them altogether.

Pragmat′ic Sanc′tion, a diplomatic term which originated with the Byzantine court, and denoted the highest and most solemn state ordinances issued by the emperor. It was early introduced into France, and has become historical as applied to four important instruments—namely, (1) that by which Charles VII. and the States General of France, assembled at Bourges in 1438, adopted those decrees of the Council of Bâle which authorized the election of bishops by cathedral chapters, and which were condemned by the pope. (See Gallicanism.) (2) That by which the same decrees were adopted by the German Diet, assembled at Mentz in 1439. (3) That by which Charles VI., emperor of Germany, who had no male issue, settled the right of succession to his Austrian dominions on his daughter, Maria Theresa. It was accepted by the various peoples over which he ruled, consented to by the different members of his family, guarantied by all the European states, but immediately after his death (Oct. 20, 1740), the war of the Austrian Succession (see Succession Wars) broke out. (4) That by which Charles III. of Spain in 1759 settled the right of succession to the kingdom of the Two Sicilies on his third son, Ferdinand.

Prague [Bohemian, *Praha*], the capital of Bohemia, in lat. 50° 5′ N., lon. 14° 25′ E., nearly in the centre of the country, on both sides of the Moldau, presents a very picturesque and imposing aspect on account of the diversity of the surface on which it stands and its numerous towers, spires, and domes. It is surrounded with a wall 12 miles in circumference; outside the wall extend the two large suburbs, Karolinenthal and Smichow. The city proper consists of five parts—the Altstadt, Neustadt, and Josephstadt on the right bank of the Moldau, and the Hradschin and Kleinseite on the left—connected with each other by several bridges, of which the most remarkable is the Charlesbridge, built 1358–1503 of stone, 31½ feet broad, 1572 feet long, resting on sixteen arches and adorned with statues. The Altstadt, consisting of narrow, crooked streets lined with tall, queer-looking old houses, the Neustadt, of a more modern and elegant appearance, and the Josephstadt, the Jewish city, form the business part of Prague; the Hradschin and Kleinseite consist almost exclusively of palaces and public buildings. Here is the imperial castle, one of the largest and most magnificent royal residences in Europe, of an elegant architecture and overlooking from its elevated position the whole city, the plain of the Moldau, and the neighboring hills. The Hradschin Place, formed by the immense palaces of the primate, the ex-emperor Ferdinand, and Prince Schwarzenberg, extend in front of the castle. On the terrace in the rear of the castle stands the church of St. Veit, a beautiful Gothic structure built 1343–85, and containing the tomb of St. Nepomuk, the patron saint of the country, with his monument of solid silver weighing 30 cwts., and a splendid mausoleum of Carrara marble erected by Rudolph II. over the Bohemian kings. Among the most prominent buildings of the Kleinseite are the so-called Sachsenhaus, built in the thirteenth century; the gorgeous church of St. Nicolai, erected in 1628 by the Jesuits; the palaces of Waldstein with beautiful gardens, of Fürstenberg with a large library and a valuable picture-gallery, of Nostits with a collection of coins, a large library, and an art-gallery, etc. In the Altstadt is the beautiful church Am Teyn, the old Hussite church, founded in 1407, and containing the monuments of the two Bohemian martyrs, Cyrillus and Methodius, and of the Danish astronomer Tycho Brahe; the

two towers and the gable were erected by Georg Podiebrad, who was crowned king here in 1458. The most celebrated of the public institutions of the city is the university, with a library containing about 140,000 vols., a botanical garden, a laboratory, an observatory, and the faculties of theology, law, medicine, philosophy (which comprises also languages and history), and the exact sciences. It was founded in 1348 by Charles IV., and was frequented in the fifteenth century by about 20,000 students. Subsequently, its importance decreased, first on account of the Hussite wars, next on account of that general stagnation and repression which the house of Austria brought over Bohemia as over Hungary. In the present century, especially since its reorganization as a principal Czechish institution, its prosperity is again increasing. In 1873 it was frequented by 1811 students. The commerce and industry of the city are considerable. Three important annual fairs are held here, and leather, glass, liqueurs, rosoglio, chemicals, woollens, linens, metal ware, and machinery are manufactured. The suburbs are the industrial quarters. Prague was founded in the eighth century, and has ever since formed the leading centre of the Czech community. After the connection of Bohemia and Austria the country was often dragged into wars entirely foreign to its interests, and Prague, as its capital and a strong fortress, has several times suffered severely from sieges and bombardments. P., including the suburbs, 189,949. CLEMENS PETERSEN.

Prai′rie [Fr. *prairie*, a "meadow"], a tract of country in its natural state covered with grass. These are sometimes of great extent, and are characteristic features of the physical geography of the interior of all large continents. The most extensive prairies known are in the central part of the great continental mass which includes Europe and Asia. Here they are called *steppes*, and they cover all Southern Siberia, reaching far into European Russia. Toward the E. they pass into the great Desert of Gobi, which sustains almost no vegetation. The greater part of the Siberian plains is covered with grass, and they afford pasturage for the herds of a large nomadic population. In South America there are two great areas of prairie—viz. the plains bordering the river Orinoco, called *llanos*, which are more than 200,000 sq. m. in area, and the plains of Buenos Ayres, in the southern part of the continent E. of the Andes, locally known as *pampas*. Besides these there are great grass-covered areas on the tributaries of the Amazon. In North America it is estimated that fully one-half of the surface is prairie, the most extensive district of this character being that lying between the Mississippi and the Rocky Mountains, a belt 500 miles in width, reaching from the interior of Mexico far into the British possessions. That portion of this area which belongs to the U. S. is popularly known as the *Plains*. E. of the Mississippi most of the country was originally occupied by forest, but in Illinois, Wisconsin, and Indiana more than one-half of the surface is covered with grass to the exclusion of trees.

The origin of prairies has been a matter of considerable difference of opinion, and has given rise to much discussion. Mr. Leo Lesquereux, who has written much upon it, in the reports of the geological survey of Illinois takes the view that prairies have all been lake-beds, first occupied by aquatic plants, and then, as filled or drained, covered with grasses, which have excluded trees by complete occupation. Prof. J. D. Whitney, in the report of the geological survey of Iowa, attributes the prevalence of herbaceous and the absence of arborescent vegetation in prairie districts to the fineness of the soil. Prof. Alexander Winchel has suggested that the vegetation of prairies is pre-glacial; that when the ice and water of the Glacial period were withdrawn, the surface of the Drift deposits was covered with grasses which sprang from seeds that had retained their life from pre-glacial times. Other writers have contended that annual fires—which sweep over the prairies and burn the tops of the grass without destroying the roots, while fatal to young trees—afford a sufficient cause for the absence of trees from the Western prairies. There can be no question that all the influences mentioned above have had some local effect in creating, extending, and maintaining prairies, but they are each and all inadequate to explain the broader and more general facts in the distribution of herbaceous and arborescent vegetation. A large part of the diversity of opinion which exists in regard to the origin of prairies is due to the limited observation of many of those who have written on the subject; and it is probable that if the advocates of the different theories proposed could all traverse the great grass-covered plains of the West, and could study on the spot the phenomena they have discussed, they would be more harmonious than they now are. Any one who has seen much of the prairies of this continent, or who in the study of the subject has looked beyond the limits of a single State, can hardly have failed to discover that climatic influences have had more to do with the distribution of forest and prairie than all local causes combined. In passing from the Atlantic to the Pacific we find the surface presenting all sorts of topographical features, the soil of every diversity of physical or chemical composition, and underlain by all kinds of geological formations—in one district covered by unbroken forests, in another by continuous sheets of herbaceous vegetation. For example, the Atlantic slope and Alleghany Mountain belt, and all the southern portion of the Mississippi Valley, are covered with forests. Then along a line running N. E. and S. W. we find a belt of mingled forest and prairie, the prairie predominating toward the N. and W. Passing this belt, we enter the great prairie-region of the West, which stretches away over mountain and plain for hundreds of miles in every direction. The Rocky Mountain belt is, for the most part, forest-covered. Beyond this lies the arid region of the "Great Basin," where vegetation of all kinds is very scarce and the only true deserts of North America are located. Beyond this lies the great wall of the Sierra Nevada, covered with forest. The California Valley is prairie except where belts of magnificent trees border the draining streams. The Coast Mountains are, for the most part, wooded—densely so toward the N., more sparsely southward. If, now, the rainfall of the belts enumerated be examined, it will be found to be so directly and inseparably connected with the distribution of vegetation as to afford a satisfactory explanation of all its most important phenomena. The forest-covered area E. of the Mississippi is swept by the rain-bearing winds that come from the Gulf of Mexico with a north-easterly direction. The average annual rainfall in this district is about 45 inches. The grass-covered area of the Plains lies along the W. N. W. margin of the great Gulf Stream of our atmospheric circulation, and the rainfall there ranges from 10 to 30 inches, with an average of not more than 20 inches. No forest of mixed growth will flourish where the rainfall is less than 20 inches, and the variation of precipitation on the Plains sometimes carries down the annual rainfall to less than 10 inches over large areas. This produces a drought which, if continued through many months, would be fatal to all trees, except those growing along the margins of streams, while the grasses would not be materially affected by it. It should be noticed that the streams that cross the Plains rise in the mountains and are perennial. Their banks are generally lined with timber, showing that the local supply of water is there sufficient to maintain a forest growth, while the deficiency of moisture on the adjacent plains has through ages proved an insurmountable barrier to the spread of timber.

In the interval between the humid and dry regions just described the forests and prairies interlock, and here local peculiarities of soil seem to determine the prevalence of trees or grass. Where the soil is peculiarly fine and impervious it is with difficulty penetrable by the roots of trees, and during wet seasons or the rainy months of the year such surfaces are flooded with water, while in the dry season they are completely desiccated. Thus they become now too wet and again too dry for the growth of trees. On the contrary, where there are sandy or gravelly soils or sub-soils, these become deeply saturated with moisture, and, penetrated by the roots of trees, afford them a constant supply of water. Hence, the groves and belts of forest in prairie countries are generally limited to tracts of this kind of soil.

The Rocky Mountain belt is a great condenser of moisture, as is shown by the fact that nearly all the great rivers of the continent flow from it—viz. the Mississippi, Arkansas, Red River, Rio Grande, Colorado, and Columbia. As a consequence, most of this belt is covered with a forest-growth. In the Great Basin the rainfall is everywhere small—from 2 to 12 inches. For this reason, vegetation of all kinds is scarce, and trees are almost unknown there. The Sierra Nevada—which stretches across all our territory as an unbroken wall, with an average altitude of 7000 feet—by cooling the Pacific rain-bearing winds that blow upon it, causes a copious precipitation of moisture, and it is therefore clothed with luxuriant forests.

The great California Valley is excessively hot in summer, and almost no rain falls there between May and November. We there very naturally find all kinds of soil—fine, coarse, gravel, sand, and clay—covered with herbaceous plants, except along the streams, where there are belts of timber proportioned to their volume. The Coast Mountains are well watered and well wooded, especially toward the N. On the coast of Washington Territory the rainfall is greater than anywhere else within the area of the U. S., reaching 68 or 70 inches, and here we find the densest forests that exist in our country.

An examination of the distribution of forest over other continents will lead to the same conclusion. As the sea is the great evaporating surface from which the rains that

vivify the land are derived, those portions of the land nearest the sea are usually best watered, and the interiors of continents are generally dry and treeless. The distribution of forest, prairie, and desert in other districts than the interiors of great bodies of land will be found to depend upon the local atmospheric circulation, the tracts of the rain-bearing wind-currents being marked by forests, those avoided by them being left as deserts, while intermediate areas are more or less generally clothed with grass.

The question of the origin of prairies is not one of merely abstract and scientific interest, but is of great practical importance to the inhabitants of large portions of our own and other continents. If the rainfall chiefly controls the distribution of forest, any effort to propagate trees in prairie-regions will be only measurably successful. It is true that the area of forests is diminished by the annual fires that sweep over the prairies; and this cause of the limitation of forest-growth may be removed by art. It is also true that a forest, by excluding the sun and wind and checking drainage, retains in some degree the moisture that falls upon it; and this tends to create the conditions upon which its growth depends. But it should be remembered that along the line of junction between forests and prairies the variations of climate are not only extreme, but peculiarly calamitous. Observations made along our frontier show that droughts of months' and even years' continuance are liable to occur there; and when the forest has spread or has been extended to a line beyond which there is no reserve of moisture—no maxima of rainfall that can compensate for the minima—droughts are liable to occur which will destroy the forest-growth of many years. The life of a tree continues for centuries, and during its continuance, should a period of extreme drought occur, whether at the tenth or hundredth year, it would be fatal. Hence, it will require not less than 100 years to determine accurately how far the forest-growth can be carried by human aid into prairies from which it is excluded by natural causes. Fortunately, the value of the great grass-covered plains is not dependent on the solution of this problem, for they form the finest area for grazing and stock-raising which we possess. It is even probable that the higher and drier prairies will be more useful to the inhabitants of the country if devoted to stock-raising than though persistent efforts should be successful in covering them with forests or crops. J. S. NEWBERRY.

Prai′rie, county of Central Arkansas. Area, 800 sq. m. It is somewhat uneven, very fertile, and well timbered. Cotton, corn, and rice are among the leading products. Traversed by Memphis and Little Rock R. R. and navigable White River. Cap. Devall's Bluff. P. 5604.

Prairie, tp., Arkansas co., Ark. P. 1035.

Prairie, tp., Boone co., Ark. P. 1214.

Prairie, tp., Carroll co., Ark. P. 1568.

Prairie, tp., Drew co., Ark. P. 266.

Prairie, tp., Franklin co., Ark. P. 1440.

Prairie, tp., Madison co., Ark. P. 1251.

Prairie, tp., Newton co., Ark. P. 501.

Prairie, tp., Pulaski co., Ark. P. 1292.

Prairie, tp., Searcy co., Ark. P. 202.

Prairie, tp., Washington co., Ark. P. 3884.

Prairie, v., Sumpter tp., Cumberland co., Ill. P. 305.

Prairie, tp., Edgar co., Ill. P. 829.

Prairie, tp., Hancock co., Ill. P. 1380.

Prairie, tp., Shelby co., Ill. P. 1218.

Prairie, tp., White co., Ill. P. 1603.

Prairie, tp., Benton co., Ind. P. 278.

Prairie, tp., Henry co., Ind. P. 1623.

Prairie, tp., Kosciusko co., Ind. P. 1248.

Prairie, tp., Tipton co., Ind. P. 1547.

Prairie, tp., Warren co., Ind. P. 667.

Prairie, tp., White co., Ind. P. 1998.

Prairie, tp., Davis co., Ia. P. 600.

Prairie, tp., Delaware co., Ia. P. 474.

Prairie, tp., Keokuk co., Ia. P. 704.

Prairie, tp., Mahaska co., Ia. P. 1364.

Prairie, tp., Wyandotte co., Kan. P. 916.

Prairie, tp., Audrain co., Mo. P. 1191.

Prairie, tp., Chariton co., Mo. P. 1473.

Prairie, tp., Franklin co., Mo. P. 1502.

Prairie, tp., Howard co., Mo. P. 2476.

Prairie, tp., Jackson co., Mo. P. 3493.

Prairie, tp., Lincoln co., Mo. P. 1241.

Prairie, tp., McDonald co., Mo. P. 907.

Prairie, tp., Montgomery co., Mo. P. 1658.

Prairie, tp., Randolph co., Mo. P. 2863.

Prairie, tp., Schuyler co., Mo. P. 1653.

Prairie, tp., Franklin co., O. P. 1364.

Prairie, tp., Holmes co., O. P. 1413.

Prairie Bayou, tp., Hot Springs co., Ark. P. 859.

Prairie Bluff, p.-v., Wilcox co., Ala. P. 2960.

Prai′rieburg, p.-v. and tp., Linn co., Ia. P. 116.

Prairie City (MAJORITY POINT P. O.), v. of Sumpter tp., cap. of Cumberland co., Ill., near St. Louis Terre Haute and Vandalia R. R., has 1 newspaper.

Prairie City, p.-v. and tp., McDonough co., Ill., on Chicago Burlington and Quincy R. R., contains 1 seminary, 1 lyceum, 5 churches, 1 bank, 1 newspaper, 2 lumber-yards, a fine park, several mills, 3 wagon manufactories, and 2 elevators. P. of v. 1078; of tp. 1645.
CHARLES W. TAYLOR, ED. "HERALD."

Prairie City, p.-v., Des Moines tp., Jasper co., Ia., on Des Moines Valley R. R., has 1 weekly newspaper, and is a shipping-point for live-stock and agricultural products.

Prairie City, p.-v. and tp., Bates co., Mo., near Osage River. P. 1786.

Prairie Creek, tp., Logan co., Ill. P. 1164.

Prairie Creek, tp., Vigo co., Ind. P. 1236.

Prairie Creek, tp., Dubuque co., Ia. P. 1022.

Prairie-Dog, a species, or rather group of species, representing the genus *Cynomys* of the family Sciuridæ, peculiar to the plains of North America. They are not at all related to the dogs, as the popular name implies, but are very closely allied to the tree and ground squirrels, from which they only differ generically; the name has been obtained simply because the ordinary utterance of the animals is a chattering noise somewhat recalling the yelp of a dog. They are considerably larger than the squirrels, being generally about a foot in length, exclusive of the tail, which is short and about two to nearly five inches in length, according to the species. They affect the prairies of Western America, congregate in large numbers, and form communities designated as "villages." They burrow to a considerable distance in the ground, throwing up around the mouths of the burrows hillocks on which they are wont to mount and from thence survey the doings of the community. These burrows are quite close together, and constitute one of the elements of danger to travellers on the Western prairies, as horses are liable to stumble and fall into them unawares. The species now recognized are —(1) *Cynomys ludovicianus,* the common prairie-dog inhabiting the great plains E. of the Rocky Mountains; and (2) *C. columbianus,* or the short-tailed prairie-dog, which is peculiar to the parks and plains within and W. of the Rocky Mountains down to the plains of the Columbia River. THEODORE GILL.

Prairie du Chien, p.-v. and tp., cap. of Crawford co., Wis., on Mississippi River, near the mouth of the Wisconsin, and on Chicago Milwaukee and St. Paul R. R., situated on a long prairie, 1 mile wide, stretching from the river to a range of bluffs on the E., has 6 churches, 2 newspapers, 2 Catholic colleges (male and female), numerous mills, machine-shops, and manufactories, and a considerable river-trade. First settled by Americans in 1835. P. 2700.

Prairie du Long, tp., Monroe co., Ill. P. 1146.

Prairie du Sac, p.-v. and tp., Sauk co., Wis. P. 2258.

Prairie Green, tp., Iroquois co., Ill. P. 480.

Prairie-Hen, or **Pinnated Grouse** (*Cupidonia cupido*), a peculiar form of the grouse family, restricted to the U. S. and found chiefly on comparatively open plains and prairies. It inhabits from the Eastern States to the prairies of the Wisconsin Valley, and southward to Louisiana, but is now very rare or extinct in the eastern portion of its range, although a few are said to still remain on the island of Martha's Vineyard and some neighboring islands, as well as Long Island. It is found in great numbers on the plains of the Western States, and forms a favorite object of sport; it is also from those sections that birds are sent in considerable numbers to the Eastern markets. The species is at once recognizable by the extension of feathers to the lower end of the tarsus, the air-bladders, and the long and lanceolate feathers of the sides of the neck, and the short subtruncate tail; the generic name (*Cupidonia*) alludes to the long neck-feathers, which have recalled to the imagination of some the fabled Cupid; beneath these feathers on each side is a bare and distensible air-sac developed in the male, and connected with the organs of voice. During the love-season the male inflates the bladders, which then resemble small oranges, lowers his head

to the ground, and opening his bill gives utterance to a single sound, produced partly by means of the air contained in these bladders, which are alternately filled and emptied as he makes his booming noise. If these sacs are punctured they are no longer resonant. The species feeds chiefly upon berries of various plants, as well as upon the buds, and in some places encroaches considerably upon the domains of the farmer. THEODORE GILL.

Prairie Plains, p.-v., Grimes co., Tex. P. 642.

Prairie Ronde, tp., Kalamazoo co., Mich. P. 1163.

Prairie Spring, tp., Jackson co., Ia. P. 1161.

Prairie-Squir'rel, a name given to the species of *Spermophilus*, a genus of the family Sciuridæ, found in various parts of the U. S. These are simply squirrels, affecting the ground rather than the trees, and having a shorter tail than the tree-squirrels, and also provided with cheek-pouches. They live on the prairie-lands of the Western States and Territories, make burrows, and generally associate together in considerable communities. Eleven species are now recognized as inhabitants of various parts of the U. S.; the best known are the *Spermophilus 13-lineatus* (striped gopher and prairie-squirrel of Illinois, Iowa, and other of the more eastern Western States), and the *Spermophilus Franklini* (great gopher of Illinois and corresponding latitudes upward to the Saskatchewan region). (See also SCIURIDÆ.) THEODORE GILL.

Prai'rieton, p.-v. and tp., Vigo co., Ind., on Wabash River. P. 955.

Prai'rieville, p.-v. and tp., Barry co., Mich. P. 1280.

Prairieville, tp., Brown co., Minn. P. 214.

Prairie-Wolf. See WOLF.

Prâkrit [Sans., "natural," "unrefined"], a name applied to those obsolete tongues and dialects of India which were derived from the Sanskrit or kindred to it. There were many dialects of this class. Most of its literature is found in dramas and inscriptions. Prâkrit grammar has been elaborated by several native and European writers. Among these are the ancient grammarian Vararuchi, the German Lassen, and E. B. Cowell, an English scholar.

Prase [Gr. πράσον, a "leek"], a leek-green variety of quartz, containing hornblende, sometimes cut as a gem.

Pra'ti (GIOVANNI), b. Jan. 27, 1815, at Dascindo, Italian Tyrol; began his studies at Trent, and took his degree at Padua. His youthful poem, *Edmenegarda*, marks an epoch in modern Italian poetry, and his early *Canti Lirici*, *Canti per il Popolo*, *Memorie e Lacrime*, and the *Ballate* increased his popularity. In 1844 he established himself at Turin, and consecrated his poetic genius to the glory of the house of Savoy, for which he was named court-poet and loaded with honors. In 1847 appeared his two volumes of *Passeggiate Solitarie*; in 1849, *Canti Politici*. With other minor pieces followed three epic poems, *Rodolfo*, *Ariberto*, *Armando*. He has now ready a collection of sonnets entitled *Anima e Mondo*. Prati now lives in Rome.

Pra'to in Toscana, town of Italy, province of Florence, situated in a most fertile plain surrounded by hills, on the right bank of the Bisenzio, about 12 miles N. W. of Florence. It is a walled town, with five gates and a castle, and the public buildings are very respectable, though without special interest. Of the twenty churches the cathedral is the most noteworthy. Little is known of Prato earlier than the twelfth century, when it became a part of the Florentine territory. It is now a place of considerable manufacturing activity, the water of the Bisenzio being largely used to work machinery, and has important publishing establishments. The chief domestic industry is straw-plaiting, which is almost universal among the women. P. 39,594.

Prato'la Peligna, town of Italy, province of Aquila degli Abruzzi, on the left bank of the Connino, near its junction with the Pescara. P. in 1874, 6567.

Pratt, county of S. Dakota, traversed by Bad and White rivers, is a pastoral region, deficient in timber.

Pratt, county of S. Kansas, on the tributaries of upper Arkansas River, recently formed. Cap. Prattsville.

Pratt (BENJAMIN), b. at Cohasset, Mass., Mar. 13, 1710; was brought up a mechanic, but, having lost a limb in youth, devoted himself to study; graduated at Harvard 1737; became a lawyer; was distinguished for learning, eloquence, and love of liberty; was representative of Boston in the legislature 1757–59; wrote some fugitive verses and made extensive preparations for a history of New England; was appointed chief-justice of New York upon the nomination of Gov. Pownall. D. Jan. 5, 1763.

Pratt (CHARLES). See CAMDEN, EARL OF.

Pratt (DANIEL D.), b. at Palermo, Me., Oct. 26, 1813; removed in childhood to Central New York; graduated at Hamilton College 1831, went to Indiana 1832; taught school; became a clerk in the office of the secretary of state; studied law; settled at Logansport 1836; was a member of the legislature 1851 and 1853; elected to Congress 1868; chosen U. S. Senator before taking his seat, and appointed commissioner of internal revenue 1875. D. at Logansport, Ind., June 17, 1877.

Pratt (DANIEL JOHNSON), PH. D., b. at Westmoreland, Oneida co., N. Y., Mar. 8, 1827; graduated at Hamilton College 1851; was for ten years principal of Fredonia Academy, after which he became assistant secretary of the regents of the University of the State of New York, and in 1869 recording secretary of the Albany Institute. He was one of the originators of the annual "convocation" of the professors in the colleges and academies of New York, an organization of eminent utility; is author of *Annals of Public Education in the State of New York from 1626 to 1800*, and (in greater part) of the *History of the Boundaries of the State of New York* (2 vols.), presented to the legislature as a report by the regents of the university. He has also prepared many reports upon educational subjects and other papers which have appeared in pamphlet form.

Pratt (ENOCH), b. at Middleborough, Mass., in 1781; graduated at Brown University 1803; was pastor of the Congregational church at W. Barnstable 1807–35; wrote a *History of Eastham, Wellfleet, and Orleans* (1844). D. at Brewster Feb. 2, 1860.

Pratt (MATTHEW), b. at Philadelphia, Pa., in 1734; studied painting several years at London under Benjamin West; returned to Pennsylvania 1768; painted portraits of the most prominent men of the times, including many members of the constitutional convention of 1787, and aided his schoolmate, Charles W. Peale, in forming his museum. D. at Philadelphia in 1805.

Pratt (ORSON), b. at Hartford, Washington co., N. Y., Sept. 19, 1811; was educated in common schools in Columbia co.; became a member of the Mormon Church, in which he is now (1876) one of the "twelve apostles;" professor of mathematics in Deseret University and Church historian, and has been for several sessions Speaker of the Utah house of representatives. Author of *Cubic and Bi-Quadratic Equations*, *The Great First Cause*, *The Absurdities of Immaterialism*, and many religious pamphlets; has in MS. *Lectures on Astronomy* and *Differential Calculus*, and is engaged in the preparation of a work to be entitled *A New System of the Universe*.

Pratt (PHINEHAS), b. in England in 1590; came to Massachusetts with Capt. Weston's colony June, 1622, settling at Wessagusset, afterward called Weymouth; abandoned that place Feb., 1623, on the failure of the colony, and made his way alone through the wilderness to Plymouth, pursued by the Indians; resided many years in Plymouth Colony; afterward removed to Charlestown, Mass. D. there Apr. 19, 1680. Author of a *Declaration of the Affairs of the English People that first inhabited New England* (1662), addressed to the general court, and ancestor of a numerous New England family.

Pratt (ZADOCK), b. at Stephentown, Rensselaer co., N. Y., Oct. 30, 1790, of poor parents; commenced business 1812 as a saddler and harness-maker; turned his attention to the tanning business 1817, by which he made a considerable fortune; located a tannery in 1824 among the Catskill Mountains on Schoharie Kill, Greene co., which became the largest establishment of the kind in the country and the nucleus of the thriving town of PRATTSVILLE (which see); was elected to Congress 1836, and again 1842; became noted for his advocacy of cheap postage; procured the establishment of the national bureau of statistics, and prepared the plans for the new post-office building at Washington; became colonel of militia 1823, State senator 1830, presidential elector 1836 and 1852; was an active Democratic politician, a delegate to the Baltimore convention of 1852; established a newspaper and a bank at Prattsville, and was president of the Mechanics' Institute of New York, as well as of many other industrial or benevolent institutions. D. at Bergen, N. J., Apr. 6, 1871.

Pratts'burg, p.-v. and tp., Steuben co., N. Y., on Rochester and Buffalo branch of Erie R. R., 14 miles N. of Bath, has a fine park, a union free school, 4 churches, 2 private banking-houses, 1 newspaper, 2 grist-mills, and 1 furniture manufactory. P. of v. 639; of tp. 2479.
PAUL C. HOWE, ED. "NEWS."

Pratts'ville, tp., cap. of Pratt co., Kan.

Prattsville, p.-v. and tp., Greene co., N. Y., on Schoharie Kill, named from Col. Zadock Pratt, who established here the largest tannery in the world; has 3 churches, an academy, a weekly newspaper, and several manufactories. P. of v. 489; of tp. 1240.

Pratt'ville, p.-v. and tp., cap. of Autauga co., Ala., 15 miles W. of Montgomery, has a large academy, 3 churches, 2 cotton-factories, 1 gin-factory, 1 newspaper, 1 sash, blind, and door factory, 2 good hotels, a foundry, and a carriage and wagon establishment. P. of v. 1346; of tp. 3675. WM. C. HOWELL, ED. "AUTAUGA CITIZEN."

Pratz', du (LE PAGE), b. in Holland about 1690; entered the French army in early youth; was engaged in campaigns in Germany; became a member of a French "Western Land Company," which obtained the grant of a tract of land near New Orleans, La.; conducted an expedition thither 1718; made fruitless efforts at colonization; ascended the Mississippi 1720, and settled among the Natchez; explored Missouri and Arkansas rivers; was for several years treasurer of the land company at New Orleans; returned to France 1734; published a valuable *History of Louisiana* (3 vols., 1758). D. in 1775.

Prawn, a name applied to the long-tailed decapod crustaceans of the family Palæmonidæ, easily distinguished by the long and serrate-edged beak. There are many species. All have two pairs of antennæ and stout legs. They are often very richly colored and sometimes transparent. The ring-horned prawn (*Pandalus annulicornis*) is extensively taken in European seas. To the genus *Hippolyte* belong the beautiful Æsop prawns. The common prawn of Europe (*Palæmon serratus*) is a large species, prized for the table. It is caught in nets and baskets. It is sometimes four inches long. The common American prawn (*Palæmon vulgaris*) is too small for the table. Many of the species are tropical.

Praxit'eles, a Greek sculptor, head of the Attic school, b., it is thought, at Athens about 392 B. C. Of his life nothing is known; of his works we have an idea through tradition, descriptions, images on coins, copies, and fragments. His favorite material was marble, though he wrought also in bronze. His subjects were the gods and goddesses of the national religion, fauns, satyrs—all with few exceptions, as the *Rape of Persephone*, a group of mænads, and another of wild bacchanals, of a graceful, gentle, soft, and dreamy character. The *Cnidian Venus*, celebrated in antiquity, which travellers went to Cnidus expressly to see, which King Nicomedes is said to have offered in vain to buy at the price of the whole debt of the island, is feebly represented by the copies. Another famous Venus was at Cos. The *Cupid* of the Vatican, the *Satyr* in the Capitol, the *Apollo Sauroktonos* in Florence and the Louvre, the *Narcissus* in Naples, are familiar to visitors at the galleries and to lovers of art. Praxiteles has been called the sculptor of the beautiful, as Phidias was of the sublime. O. B. FROTHINGHAM.

Pray (ISAAC CLARK), b. in Boston, Mass., in 1813; graduated at Amherst College 1833; became a journalist at Boston and New York, and subsequently a successful theatrical manager and actor, and both in the U. S. and in England aided in the professional training of several theatrical celebrities, including Charlotte Cushman; published *Prose and Verse* (1835), *Poems* (1837), *Book of the Drama* (1851), *Memoirs of James G. Bennett* (1855); was author of several burlesques and other plays, including a tragedy, *Virginius;* edited several magazines and other periodicals, and conducted the Philadelphia *Inquirer* 1859–60. D. at New York Nov. 28, 1869.

Prayer [O. Fr. *preier*] is a principal branch of every kind and part of religious worship in every age and nation. It is the chief expression of religion and accompanies every state of feeling. In its fulness it brings every part of the soul, in every mood, into activity toward God. It is a necessity of humanity, prompted by nature and instinct, confirmed by reason, by man's moral nature and common sense, commanded by revelation, and commended by the highest examples. It may be secret, social, or public, mental or spoken, ejaculatory or continued, extemporaneous or studied, written and elaborate, simple or complex. Prayer includes address to God, adoration, acknowledgment of mercies, confession, contrition, supplication for temporal and spiritual good, thanksgiving, and intercession. It implies belief in, and dependence on, a Superior Being, a feeling of need and desire, and expectation of answer. It is offered while standing, bowing, kneeling, or prostrate; with lifted, outspread, or clasped hands; with eyes closed or turned toward heaven, toward the images of the gods, the holy place, or the East. The Bible describes it as bowing the knees, looking up, lifting or pouring out the soul or heart, calling on the name of the Lord, conversing with or crying unto God or to Heaven, drawing near to God, beseeching, making supplication, or seeking the Lord's face. Christian prayer is a duty to God, to our fellows, and ourselves. It is directed to a personal God, who is a Sovereign and Father; in Christ's name, and with relation to his atonement and intercession; by the help of the Holy Spirit; according to God's will; with understanding, definiteness, sincerity, simplicity, reverence, penitence, humility, dependence, submission, confidence, the forgiving spirit, frequency, faith, assurance, love, perseverance, gratitude, and with moderate desires.

The main *objections* to prayer rest on the notion of an inexorable general law, or of the stability of nature, or of an inflexible God who has predetermined all things, or of a divine wisdom that will act without our asking, or on the notion that man is master of his own destiny. The difficulty of comprehending prayer lies in the difficulty of understanding the relation between the human and Divine Will. But, in spite of all objections, men pray on as by a universal instinct. The *reply* to the objections is that we pray to a living, loving Person, near at hand, knowing our thoughts, able to control all things—One who has declared himself a hearer of prayer, and who has made it a condition on which it seems good to him to put forth his power. The essence of the belief in prayer is that the Divine Mind is accessible to supplication, and that the Divine Will is capable of being moved. Prayer depends on God's will, but does not determine it. Man applies, God complies; man asks, God grants. Prayer has a subjective value. It is necessary to individual piety, produces solemnity, enlightens and quickens the conscience, teaches dependence, gives true views of God, and produces such a change in us as renders it consistent for him to change his course toward us. In the family, prayer intensifies and exacts devotion, secures domestic order, strengthens parental government, and promotes religion. And, objectively, the Bible and Christian history abound in examples of answered prayer.

The main arguments for *forms* of prayer are, that they have been of almost universal use; that they guide the worshippers without forcing them to depend on the moods of the leader; where they are used, all know what is to be said and done; they secure provision for unlearned ministers; secure dignity, decency, harmony, and guard against excessive show, arbitrary freedom, improper, absurd, extravagant, confused, and impious utterance, and against weariness and inattention; they unite the hearts and tongues of all worshippers, so that they do not worship by proxy; they unite different ages of the Church and preserve true doctrine and discipline. *Extemporaneous* (though not rash and unstudied) prayer is claimed to be more particular than general forms can be; it secures freedom, fervor, spontaneity, and adaptation to the circumstances; it is less formal and monotonous; suits itself to changes in language and opinions.

As to the *language* of prayer, it is urged that the tongue known to the worshippers ought to be used, so that all may understand and join in the service, and that worship may come from the heart. When some dead tongue is used, as Latin in the Western Church and Greek in the Eastern, it is retained because it was the original language of the ritual, or to guard against change in form and innovation in doctrine or worship, or because of its extensive use among the learned of different countries.

The ancient Greeks offered prayers and vows together. The worshipper raised his eyes and hands toward Heaven or toward the images of the gods. He stood, or if in deeper earnest he and at times all the assembly knelt. Suppliants wore garlands on their heads or necks, and carried boughs of olive or laurel twined with wool, with which they touched the knees or cheeks of the images. Libations of wine, water, or oil were poured out. The Romans covered their heads, bowed to the ground, moved completely round from right to left, as if to meet the god from whatever direction he might approach; then, with the right hand on the mouth, looked toward the East or toward the altars or images. In higher devotion they knelt or were prostrate, and laid hold on the altar. Public prayers were offered by the priest or magistrate. The Mosaic law took prayer for granted; the temple was "the house of prayer" where public prayer accompanied the sacrifices and where private prayer was offered. Those who were absent from the temple prayed toward it. The chief hours for the duty were 9 A. M., 12 M., and 3 P. M. To these were added the beginning and end of night and the time of eating. According to the degree of his fervor, the Jew stood, bowed, knelt, or prostrated himself. Free prayers were constantly offered, though forms were used with tithe-offerings and certain blessings. But Solomon's prayer at the dedication of the temple seems to have been the beginning of a liturgy, which at the time of Christ had developed into a set service before, during, and after the sacrifice. A similar liturgy was used in the synagogue, from which the petitions of the Lord's Prayer were probably drawn. Prayer was accompanied by almsgiving and fasting, and was made in conspicuous places, with many vain repetitions, by formalists who loved dis-

play. Among the early Christians prayer was the chief service, and was counted the main bond of unity. In their methods they followed Jewish customs largely. The pastor led the congregation, using both free prayer and forms. A strong liturgical tendency appears early in both the East and the West. Worship was first simple, then intricate, then regulated, then liturgical. Liturgies were made first by the bishops, then by the metropolitans. Early Christians knelt in ordinary prayer, but stood on the Lord's Day and from Easter to Whit-Sunday, in honor of Christ's resurrection. Prayer at all times and in all places was commended, though the temple and other places of meeting, the Lord's Days, occasional appointed days, morning and night, times of eating, times of success or distress, and crises of every kind were deemed peculiarly appropriate.

Prayers to and for the dead rest on the idea of a close intercommunion of the two worlds. They have entered into the worship of Egypt, India, China, Greece, Rome, and the Jews. In the Christian Church they date definitely from the time of Origen—prayers to angels from the time of Ambrose. Protestants repudiate all prayer except that to God or the Christ and the Holy Spirit. Paulus, an Egyptian monk, early used stones to count his prayers; Godiva of England (1040) used a necklace; in the thirteenth century medallions and rings with knobs were used. Rosaries date from the fifteenth century. The Calmucks inscribe prayers on wheels, and offer worship by whirling the disk around. The Chinese write prayers on paper and burn them before the idols or on the graves of their ancestors. (See WORSHIP.) ISAAC RILEY.

Pre-Adamites. See PRE-HISTORIC REMAINS.

Preb'endary, an ecclesiastic who is supported by an income called *præbenda* ("that which is to be furnished") out of the revenues of a cathedral or other church.

Preb'le, county of S. W. Ohio, bounded W. by Indiana. Area, 432 sq. m. It is somewhat uneven and has a fertile limestone soil. Tobacco, grain, wool, and live-stock are largely produced. The manufactures include metallic wares, lumber, lime, clothing, brick, flour, etc. Traversed by Dayton and Western and Cincinnati Richmond and Chicago R. Rs. Cap. Eaton. P. 21,809.

Preble, tp., Adams co., Ind. P. 996.

Preble, tp., Fillmore co., Minn. P. 670.

Preble, p.-v. and tp., Cortland co., N. Y., on Syracuse Binghamton and New York R. R. P. 195; of tp. 1150.

Preble, tp., Brown co., Wis. P. 1108.

Preble (EDWARD), b. at Falmouth (now Portland), Me., Aug. 15, 1761, son of Gen. Jedidiah. In 1777 he embarked in a privateer, and in 1779 entered as midshipman in the provincial navy, serving on board the Protector in the Penobscot expedition, when taken prisoner; upon his release he joined the sloop-of-war Winthrop as first lieutenant, with which he remained until 1782, greatly distinguishing himself by boarding with four men an armed English brig off Castine, and capturing her under fire. From Dec., 1782, until 1799 he followed the merchant service, when appointed a lieutenant in the navy, and in June of the same year promoted to be captain, and placed in command of the Essex; in 1803 he took command of the frigate Constitution, and sailed in command of the squadron sent against Tripoli; arriving at Tangier, he concluded peaceful negotiations with the emperor of Morocco; after which proceeded to Tripoli, which he subjected to repeated vigorous bombardments; in Sept., 1804, having been relieved by Com. Barron, he returned home, and received the thanks of Congress and a gold medal. D. in Portland Aug. 21, 1807.

Preble (GEORGE HENRY), U. S. N., b. Feb. 12, 1816, in Maine; entered the navy as a midshipman Oct. 10, 1835; became a lieutenant in 1848, a commander in 1862, a captain in 1867, a commodore in 1871; served in Florida against the Seminoles, and in the Mexican war participated in the capture of Alvarado and Tampico; in several actions with Chinese pirates in 1854–55, and complimented for his services by both the American and English naval commanders-in-chief in the East Indies; commanded the Katahdin at the taking of New Orleans in 1862, and the fleet brigade in the battles of Honey Hill, Tullifinny Cross-roads, and De Vaux's Neck in 1864. Referring to the brigade in his general order No. 65, Rear-Admiral Dahlgren says: "At Boyd's Creek and on the Tullifinny the artillery and infantry of the naval brigade vied with the veteran troops, and drew the frank and appreciative recognition of the general." Com. Preble is the author of *Our Flag*, and has made several valuable contributions to history. FOXHALL A. PARKER.

Preble (JEDIDIAH), b. at Wells, Me., in 1707; served as lieutenant-colonel in Gen. Winslow's expedition against Acadia 1755; became colonel 1758, brigadier-general 1759; was representative for Portland in the Massachusetts legislature twelve years, councillor 1773, judge of common pleas 1778, member of the State senate 1780, and was appointed major-general by the Massachusetts congress during the Revolutionary war, but declined on account of age. D. at Portland Mar. 11, 1784.

Preble (WILLIAM PITT), LL.D., b. at York, Me., Nov. 27, 1783; graduated at Harvard 1806; became a lawyer and a leader of the Democratic party; was U. S. district attorney 1813; settled at Portland 1818; was a leading member of the convention which formed the State constitution of Maine 1819; on the inauguration of the new State government was appointed a judge of the State supreme court 1820; was minister to the Netherlands 1829; held many other public offices; was the first president of the Atlantic and St. Lawrence R. R. 1847. D. at Portland Oct. 11, 1857.

Prec'edents [Lat. *præcedens*]. This term is used in the law of the U. S. and of Great Britain to denote those decisions of the higher courts which are regarded as establishing some legal rule, and which are therefore to be treated as authoritative, and are to be followed in the determination of subsequent causes depending upon analogous facts and requiring the application of similar principles. Notwithstanding the theory of Blackstone and other superficial writers, that the common law of England always existed in a complete condition, but known only in some mysterious manner to the judges, and that their function consisted merely in declaring it from time to time as occasions arose, it is an evident truth that the courts have actually created a very large part of the English and the American jurisprudence, and have been, in the exercise of this creative function, by far the most important and fruitful sources of legislation for the two countries. Their work has been accomplished by the constant practice of treating prior decisions, when made by competent tribunals, as precedents to be adopted and followed in subsequent cases; and this simply means that each former expression of the judicial will is in fact the official statement either of a general doctrine applicable to a great number of related circumstances, or of a special rule applicable only to certain particular circumstances. From a very early period down to the present time the superior courts, when rendering a judgment, have accompanied it with the reasons for the final conclusion thus reached; and these opinions, preserved in the books of reports, form a continuous series of precedents, and are the original depositories of the law as it has been wrought out by judicial legislation. It is important, however, to distinguish that element of a decision which constitutes the precedent from those portions of it which do not possess this peculiar and binding quality. The former consists in the legal rule necessarily involved in the simple adjudication made upon the particular facts of the case—that is, the rule which must have been enforced in order that such a determination upon those facts should have been made; the latter include the mere arguments, the illustrations, and the incidental expressions of opinion used by the court in reaching the final result. These features of a judgment may be correct or may perhaps be erroneous; they do not acquire any efficacy as precedents from the connection in which they are found. Although precedents are generally acknowledged and followed by the courts, since otherwise the law could not be developed in a uniform and consistent manner, yet their authoritative character is not absolute. Prior decisions, and even long series of similar judgments, are sometimes expressly overruled when they are found to be departures from true principles; they are more often evaded and gradually abandoned, until at length by a succession of new adjudications the incorrect doctrine which they announce is completely modified. This power of disregarding and overthrowing a former precedent is a necessary incident of the legislative function possessed by the superior courts, and the caution with which it is exercised simply shows that the judges are conservative, and often permit a wrong doctrine or rule to remain in force in order that the public confidence in the certainty and stability of the law should not be disturbed by frequent and sudden changes.

JOHN NORTON POMEROY.

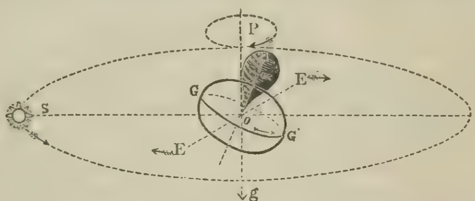
Precen'tor [Lat. *præcentor*], the leader, head, or director of a choir. More particularly, an officer holding such position in a cathedral, collegiate, or other large church. The office is not confined to laymen, but may be held by persons in holy orders who are qualified to perform its duties.

Preces'sion of the Equinoxes (see EQUINOX and EQUINOCTIAL POINTS), literally, the slow motion of the equinoctial points in the reverse direction to the earth's orbital motion, by which each semi-annual solar passage through those points is in advance of (*precedes*) the time

it would otherwise occur. This motion amounts to $50\frac{1}{10}$ seconds of arc per annum, and hence a period of 25,868 years is required for an entire revolution. "From the minute motions of the child's toy, the top, or of the *gyroscope*, to the grand phenomenon exhibited in the heavens —the *precession of the equinoxes*—there seems an incommensurable stride, yet as mechanical phenomena they are essentially identical. The earth is a rotating solid of revolution. It is *oblate*—that is, flattened at the poles—and protuberant around the equator. The ring of protuberant matter is more strongly attracted on the side nearest the sun or moon than on the more remote side; hence the tendency of solar or lunar attraction to *tilt* or pull down the equator into the plane of the sun's (or moon's) orbit. The result is just as in the case of the gyroscope, *gyration* around the direction of the disturbing force." (See GYROSCOPE.)

Were the directions of the sun's attraction upon the earth constant, the resulting gyration would be, as in the case of the gyroscope, *around that line of direction.* The direction, however, sweeps through an entire circumference in each annual revolution of the earth about the sun; at each instant there is an *elementary gyration* about this moving line; the *integral* (or actual result) is the slow motion of the earth's axis around the pole of the ecliptic, which is at the same time exhibited in the retrograde motion of the equator's intersection with the ecliptic.

The motions of an accurately made and finely-pointed "top" furnish the clearest ocular illustrations of precession.



Its spinning is always attended with gyratory motion of the axis of figure.* When nearly "asleep" (as it is termed) this gyration is extremely slow. In the figure an arrow represents the direction of the spinning rotation. The extremity P of the axis of figure (which may be called the *pole*) gyrates slowly about Q (*pole of the ecliptic*). If through the point O a plane perpendicular to O P be conceived (the *equator*), it will intersect the floor on which the top is spinning (ecliptic) in a line E E′ which will have the same angular motion as the axis O P. That the illustration should be perfect the sun's attraction on the earth should be the analogue of the gravity of the top; but gravity (indicated by the arrow *g*) acts downward (perpendicular to the floor), whereas the sun lies *in* the plane of the ecliptic (floor), and itself moves (relatively) about the object it attracts. In *all* its positions, however, it tends (just as gravity tends to pull down the top), with force fluctuating in intensity, but relatively small, to draw the equatorial protuberance G of the earth into the plane of the ecliptic,† other effects of its attraction being neutralized by the incessant change of direction of its action. Hence, as in the case of the top pulled downward by gravity, a gyration of the pole ensues, illustrated by the motion of P about Q. It is not, however, like its analogue, *uniform.* There are positions (the equinoxes) when the sun has no tilting action; others (the solstices) when the tilting effect is *maximum;* and the resulting *precessional* motion is *zero* and *maximum* at these points, respectively.‡ The moon, though its mass is very small compared to that of the sun, exerts, owing to its greater density and relatively small distance, a double influence in producing precession. The *combined* action of sun and moon produces the total mean annual precession of 50.1 seconds of arc already mentioned. But the moon moves in an orbit making a small angle (about 5°) with the ecliptic, and the precession *it* produces is about the axis *of its own orbit.* As this latter axis itself (from causes very analogous to those which produce the earth's precession) *gyrates* about the pole of the ecliptic in a period of $18\frac{2}{3}$ years, the phenomena of precession exhibit a minute periodical change in the inclination of the earth's axis called *nutation* (nodding), amounting in its aggregate to about 18 seconds of arc, the period of which is that of the revolution of the nodes of the moon's orbit ($18\frac{2}{3}$ years).

The longitude of the stars being counted on the ecliptic from the vernal equinox, it is affected by the precessional motion of the equinoxes. Hipparchus (140 B. C.), to whom the discovery of precession is attributed (though it appears to have been known before), observed that the stellar longitudes had increased about 2° in 160 years. In those times the first point of Aries and Libra corresponded to the vernal and autumnal equinoxes—of Cancer and Capricornus to the summer and winter solstices. There has since been a motion of 30°; the equinoxes are in Pisces and Virgo, the solstices in Gemini and Sagittarius. "The northern pole is now quite near the pole star, and is still approaching it. This approach will continue until the year 2120, when they will not be more than half a degree apart. This epoch passed, the pole will recede from Polaris, will pass the Little Bear to Cepheus, then over the borders of the Swan. In 12,000 years the bright star nearest to the N. pole will be Vega in Lyra, which will then play the part of pole star; Canopus in the southern sky will be equally found in the vicinity of the other pole."

Nutation was not discovered until A. D. 1747. Dr. Bradley detected it, and fixed its law and amount by observations prolonged, through a period of more than an entire revolution of the nodes of the moon's orbit, with the express view of determining some (at that time) puzzling irregularities in the apparent positions of the fixed stars. D'Alembert a few years subsequently gave us the theory which unites and makes one the so-long disassociated phenomena. He also deduced from *that* portion peculiar to the moon (*nutation*) an estimate of the comparative masses of the moon and earth ($\frac{1}{70}$th), which does not differ greatly from Laplace's determination founded on the moon's share in producing the tides ($\frac{1}{75}$th). More recent and exact determinations on the same basis (precession) reduce the estimate to $\frac{1}{81}$st.

The obliquity of the equator to the ecliptic causes, as is well known, the vicissitudes of the "seasons." The periods counted from equinox to equinox of spring and summer is greater by about eight days, owing to the ellipticity of the earth's orbit, than that of autumn and winter. Our winter solstice occurs when the earth is nearly (about $9\frac{1}{2}$°) from the perihelion or nearest point. From the precession of the equinoxes ensues a change in these relations, the cycle of which should correspond, and extend through 25,868 years. But the *form* of the orbit fluctuates, and the line of apsides (or major axis), moving *reversely* to precession and making a complete revolution in 110,000 years, abbreviates this period. At a date (B. C. 4089) nearly that assigned in the biblical chronicles to the creation (B. C. 4004) the passage of its perihelion by the earth was coincident with the autumnal equinox.§ A. D. 1248 the perihelion had reached the winter solstice, and it has now passed it $9\frac{1}{2}$°. The *cycle* of the seasons therefore occupies a period of about 21,000 years, and at intervals of one-half (or 10,500 years) the order of the seasons is reversed in reference to the principal points of the orbit. A French mathematician, M. Adhémar, on these facts bases a theory of "great deluges," the traces of which on the earth's surface in remote ages are so distinctly marked, attributing them to the vast accumulations of ice at the more remote pole during this long period, which breaks up when the relative positions are reversed. (See *Périodicité des Grands Déluges résultant du Mouvement graduel de la Ligne des Apsides de la Terre*, par le Capitaine le Hon, Paris, 1861.)

On the question of internal fluidity of the earth's substance in its relations to precession (*assuming* the crust to be perfectly rigid), the late William Hopkins of Cambridge, Eng., in a celebrated paper endeavored to prove the necessity of a solid crust (as opposed to the thin crust and internal molten fluid of geologists) of at least 800 or 1000 miles' thickness. The particular fallacy which vitiates his demonstration has been pointed out by the writer. (*Smithsonian Contributions*, vol. xix.)

On more substantial grounds Sir William Thomson has maintained that the close coincidence of *observed* with *cal-*

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* In the figure the lower extremity of the top is supposed to be *fixed* at a point O in the plane or surface on which it rests; hence, this extremity, and not the centre of gravity, as in article GYROSCOPE (Fig. 7), becomes the centre of motion instead of describing the curve represented in the figure cited. The apparent *gyration* is the same in either case.

† In the figure the earth, G G′, is sketched with its axis coincident with that of the top. The sun acts most powerfully on the *nearest* half of the equatorial protuberance; hence, whether situated on the side represented or the reverse, it will have the effect imputed; which will be *nil* at E E′ (the equinoxes) when the upper and lower limbs of the earth's protuberance are equally near. It must be observed, however, that the sun's attraction *draws* together the poles P and Q; whereas, the gravity of the top tends to *separate* them; hence, that the gyrations (or motion of the equinoxes E E′) should be the same, the earth's rotation must be reverse to that of its analogue.

‡ Owing to this inequality of action there is theoretically a slight semi-annual solar and semi-monthly lunar nutation. Both are unobservable.

§ At the vernal equinox of this date the sun, in *apogee*, and the perihelion of the earth's orbit, passed the equator in conjunction, and the longitude of the latter was zero. *In this sense* the perihelion coincided with the vernal equinox, as it is expressed by Prof. Forbes (*Encyc. Brit.*, 6th Dissertation, notice of "Lagrange").

culated precession demands, in the earth's crust, *not only* solidity, *but* a rigidity "several times as great as that of iron throughout 2000 or more miles of thickness;" an argument abandoned by its author and by the writer. (Cf. *Smithsonian Contributions*, No. 310, vol. xx.)

As the phenomena of the "gyroscope" furnish the "most convincing proof of the absolute truth and adequacy to explain all purely mechanical phenomena" of the received (Newtonian) laws of dynamics, so do the analogous phenomena of precession and nutation furnish, along with confirmation of those laws, one of the strong proofs of the universality and perfect exactness of the Newtonian law of gravitation. J. G. BARNARD.

Pre'cious Met'als. This term is in common use to distinguish the uncommon, highly-valuable metals, such as gold and silver, from the common, easily-obtainable metals, such as iron, copper, and lead. Gold and silver have been prized through all ages as ornaments and as money. Platinum, which has also been used as money, may be included, as also palladium and the other metals of the platinum group. The precious metals do not rust and waste away by exposure to the air, and they do not oxidize in open fires. Hence, they are also known as "noble metals," in distinction from "base metals," which turn to dross when similarly heated. There are also many metals known to chemists which are both rare and valuable, but which do not exist in a native or uncombined state, and easily revert to their earthy condition. To these the term "precious metals" is not applied.

W. P. BLAKE.

Precious Stones, or **Gems, Natural and Artificial.** The term *gem* includes natural and artificial products whose beauty, rarity, and durability fit them for objects of personal ornament.

The *diamond* is the hardest known substance, being classified as 10 in the scale of hardness of minerals. Unaffected by chemicals, infusible, and only combustible after long exposure to a high temperature, it is the least destructible of gems, and being at the same time one of the rarest and most beautiful, it stands foremost among precious stones. It is pure carbon, and is of all colors, and also colorless and black. It only shows its beauty when cut, and then, owing to its extraordinary refracting powers, it throws back a very large proportion of the light falling upon it, whence results the unusual lustre of a well-cut diamond. Diamonds are cut by first cleaving the stones, and then rubbing two of them together until they are roughly shaped, when they are carefully finished by grinding on a revolving disk of soft steel smeared with diamond-dust and oil. Three-fourths of all diamonds are cut in the well-known form of brilliants; others are cut in the rose form, a flat bottom and the upper surface covered with little facets and rising to a point; a very few come from the East as table or flat diamonds, with scarcely any lustre. A well-cut, perfect brilliant of the first water, weighing a ½ carat, is worth in New York at the present time about $50 gold; one of 1 carat (4 grains troy), $175; 2 carats, $550; 3 carats, $800. Larger diamonds are sold by agreement. A dull tint injures the value; a decided red, blue, or green adds immensely to it, but only as a rarity, and not in the ordinary market. The African diamonds lately discovered are frequently yellow, and being less lively command only a very low price. Diamonds lose $\frac{3}{10}$ths of their weight in cutting; hence the value of rough diamonds is estimated at one-half the above. Imperfect, thin, and black diamonds, called *bort*, are either crushed to powder or set in tools for dressing millstones and drilling rocks. Diamonds are found by washing alluvial deposits, chiefly in India, Brazil, Borneo, Australia, and South Africa. A diamond of 5 carats is a very large stone; above 100 carats few are known. The Koh-i-noor ("*Mountain of Light*"), uncut 793 carats, after twice cutting $106\frac{1}{16}$ carats, belongs to England, and is perhaps the finest diamond known. (See DIAMOND.)

Next in hardness to the diamond stand the members of the *sapphire* or *corundum* group, which are all composed of alumina. Foremost in value, exceeding even the diamond itself if larger than two or three carats, is the *ruby*. The best rubies are found in Siam, and stones of more than 10 carats are exceedingly rare. A ruby of 1 carat, if of the finest quality, is worth $150. The *sapphire* differs from the ruby in having a rich blue color. It occurs more abundantly and of larger size than the ruby or diamond, and while a sapphire of 1 carat is worth $100, one of much larger size would command a far less price in proportion than a large diamond. Asteriated rubies and sapphires, cut so as to show a six-pointed star, command a higher price as fancy stones. Other varieties of sapphire, different in color, and known as Oriental emerald, Oriental amethyst, Oriental topaz, and Oriental aquamarine, are of rare occurrence and little comparative value.

Chrysoberyl, composed of glucina and alumina, stands next to corundum in hardness. Although a very lustrous yellow stone, it is now rarely worn, but a variety known as chrysoberyl cat's-eye, or cymophane, is quite esteemed. The *spinel*, a compound of alumina and magnesia, hardness 8, is of all colors, but the pink or red variety, the Balas ruby, is the only one generally seen. Being a fine stone, it is sometimes sold for true ruby. *Topaz* (Brazilian topaz), silico-fluoride of alumina, varies from colorless to deep yellow, and sometimes is blue (Brazilian sapphire). Cut as a deep brilliant, it makes a handsome stone, but is quite cheap. The deep yellow topaz carefully heated assumes a permanent fine pink color, making a handsome stone called Brazilian ruby. *Emerald*, silicate of alumina and glucina, hardness 7.5 to 8, is a rich green stone, generally cut flat, and presenting a fine appearance when surrounded by brilliants. An emerald without a flaw is a *rara avis*, and a perfect stone of 1 carat has been sold in New York for $200, or more than a diamond. Ordinarily, the emerald ranks next to the ruby in value, but in this country at present it is next to the diamond. The finest emeralds are found in New Granada. *Beryl*, or aquamarine, is a pale green or blue stone of the same composition as emerald, but of trifling value. *Zircon*, silicate of zirconia, hardness 7.5, is a very lustrous stone, and the white varieties are sometimes sold as diamonds, but it is rarely met with. *Tourmaline*, silicate of alumina, magnesia, iron, etc., with a little boracic acid, hardness 7–7.5, occurs of all colors, and is of small value. The pink variety, called also Brazilian ruby (see *Topaz*), is sometimes mistaken for the burnt topaz. *Garnet*, comprising several varieties, silicates of alumina, lime, magnesia, with iron and manganese, hardness 6.5–7.5, although at times a very handsome stone, is so abundant as to be of comparatively little value. Fine red garnets, cut in tables, were once extremely fashionable. They are now often met with cut *en cabochon*, with curved faces, like a flat drop of tallow, and pass under the name of carbuncle. Fine garnets not unfrequently pass for rubies among the inexperienced.

Quartz, silicic acid with various coloring-matters, hardness 7, is known under different names. Clear and white, it is rock-crystal, a stone of some beauty, but very cheap. Yellow crystals are called cairngorms or false topazes. Amethyst (ἀμέθυστος, "not inebriating"), supposed to be a charm against intoxication, when set with diamonds or pearls, although cheap, is a handsome stone. It is the only stone that should be worn with mourning. Cat's-eye quartz, chrysoprase, plasma, chalcedony, onyx, sardonyx, carnelian, jasper, agate, and bloodstone are all varieties of quartz, distinguished by various markings. The last named is a favorite stone for rings, and tradition relates that the red spots arose from the blood which fell upon it at the foot of the Cross.

Opal, softer than quartz and differing from it in containing water, is one of the most precious gems. Its blending of soft hues and changing fire imparts to it a strange beauty which defies imitation. Opals are always cut *en cabochon*, and show their finest color on a warm day, but are liable to lose much of their brilliancy by contact with dust and dirt, and then cannot be restored. They come from Hungary and Mexico.

Turquoise, hydrated phosphate of alumina, when of a fine azure-blue color, is of high repute, and shows well in contrast with gold and diamonds or pearls. It is found in Persia. The turquoise was frequently given as a *gage d'amour* under the belief that its color would fade if the giver proved unfaithful. In reality its color is very liable to change in damp air.

Lapis-lazuli, a deep-blue silicate and carbonate of alumina, lime, and iron, with some sulphuric acid; *malachite*, hydrated carbonate of copper; *labradorite*, a feldspar showing changeable colors; *amber*, a fossil hydrocarbon; and *coral*, carbonate of lime secreted by living polyps in the ocean,—are frequently used as ornaments, although not commonly considered gems.

Pearls, carbonate of lime with organic matter, found in the shells of pearl-oysters and of certain mussels, are, when fine, among the most beautiful and valuable of gems. The best are found about Ceylon, Persia, and other Eastern coasts, and inferior ones on the tropical coasts of Central and North America. A perfect pearl must be round, pure white, translucent, lustrous, and free from flaws. Such a pearl of 1 grain in weight is worth $1.20, of 5 grains $25. Larger ones increase very rapidly in value.

Artificial gems of all kinds except opal can now be made so perfectly that by the eye alone even the most expert dealer cannot always detect the imitation. They are composed of vitreous pastes variously colored with metallic oxides. By applying physical tests as to hardness, specific gravity, optical and electrical properties, however, any gem can be identified and almost any fraud readily detected.

A very ingenious deception consists in filling a genuine stone of poor color—for instance, a pale ruby—with a paste which imparts a fine color to the whole, while the surface of the genuine stone is still presented to the file. Similarly, a pale stone or a simple piece of rock-crystal is faced with a slice of a genuine stone, or a stone genuine throughout, but of unequal color, is so cut as to appear of fine color. Pearls are very well imitated by the scales of certain fishes. H. B. CORNWALL.

Precoc'ity [Lat. *præcox*, "ripe before the time"], a rapid and abnormally early development of the mental powers, sometimes associated with a correspondingly early ripening of the functions of the body (called *prœotia*). The popular belief that precocious infants are usually destined to early decay of mental and physical powers, resulting in speedy death, idiocy, or at the best in mediocrity, is well founded, as can be established by abundant proofs. But there are exceptions to the rule. No doubt precocity is often associated with diseases of the nervous system, with scrofulous symptoms, and with rickets, but not a few instances can be adduced of precocity associated with apparently good health. Precocious children should be restrained from following their intellectual bent, and their physical culture should be encouraged.

Predestina'tion, in theology, the doctrine according to which God has foreordained from eternity and unchangeably whatever takes place, was first defined and debated during the controversy between PELAGIUS and ST. AUGUSTINE (which see). In the Roman Catholic Church the JANSENISTS (which see) became the champions of predestination. It was generally adopted by the earliest Reformers, but while in the Reformed Church it received a very strict and explicit development by Calvin (see CALVINISM), to which the Arminians (see ARMINIANISM) opposed a milder explanation, it was for some time entirely given up by the Lutheran Church until Schleiermacher revived it in a mitigated and somewhat mystical form.

Predicate. See LOGIC, by PROF. W. D. WILSON, LL.D., L. H. D.

Pre-em'ption [Lat. *præ*, "before," *emere*, "to buy"], the act of one belligerent in seizing upon the sea, and taking at a price, certain articles not strictly contraband intended for importation within the territory of his foe. (See INTERNATIONAL LAW.) T. D. WOOLSEY.

Pre-emption, p.-v. and tp., Mercer co., Ill., on Edwards River. P. 1161.

Pre-exist'ence, the doctrine that the human soul has had an existence in some past and nearly or quite forgotten state of being. This was the doctrine of the Pythagoreans and other transmigrationists; also of Plato, Philo, Origen, and many other ancients. The doctrine was condemned in 543 by the Council of Constantinople. It is defended by Kant, Schelling, and the younger Fichte, and among theologians by Julius Müller and Dr. Edward Beecher. Another theory assumes that all human souls were created at the time of the creation of man, and that the soul joins the body at the moment of conception.

Pre'fect [Lat. *præfectus*], the title of many officers and magistrates of ancient Rome. The *præfectus urbi* was the warden of the city, and was anciently an officer of great dignity and importance, but his duties varied much at different periods, and at times were almost nominal. The prætorian prefects commanded the imperial body-guard. The *præfectus annonæ* was an extraordinary magistrate of great importance who presided over the corn-market and the distribution of public charity. In modern France, a prefect (*préfet*) is an important official, the chief of police in each department, and a kind of justice of the peace.

Pre'gel, a river of Prussia, formed near Insterburg, East Prussia, by the confluence of the Angerap and the Pissa, flows westerly 90 miles to the Kurisches Haff. It is navigable for its whole course from Insterburg.

Pregnancy. See JURISPRUDENCE, MEDICAL, by PROF. JOHN ORDRONAUX, M. D., LL.D.; and OBSTETRICS, by PAUL F. MUNDÉ, M. D.

Pre-historic Man. See PRE-HISTORIC REMAINS.

Pre-historic Races. See PRE-HISTORIC REMAINS.

Pre-historic Remains. See AMERICAN ANTIQUITIES and CAVE, by PROF. J. S. NEWBERRY, M. D., LL.D., M. N. A. S.; ARCHÆOLOGY; KITCHEN-MIDDENS; PALEFITS; and MAN, by PRES. M. B. ANDERSON, LL.D.

Prel'ate [*prælatus*, "placed before"], a term applicable to all ecclesiastics of high rank, as well as some of the inferior dignitaries of the papal court. Prelates of the Great Mantle are the lowest in rank; those of the Small Mantle, of higher rank. In the Roman Catholic Church they have mostly the title of "monsignore."

Pre'lude [Lat. *præludium*; Ger. *Vorspiel*, a "preamble"], in music, an introductory strain or other movement intended to announce and prepare the hearers for a composition or performance immediately following. Pianoforte pieces, fantasias, sonatas, transcriptions, etc. are often thus preceded by a brief extempore effusion or prelude. Preludes also of considerable length and richness of thought are often written for the organ and other instruments, and are played as independent compositions.

Premise. See LOGIC, by PROF. W. D. WILSON, LL.D., L. H. D.

Premium. See INSURANCE, by J. WILDER MAY, and LIFE ASSURANCE, by PROF. J. H. VAN AMRINGE.

Premonstraten'sian Monks and **Nuns,** or **Norbertines,** were established at Prémontré, near Laon, in France, in 1120, by St. Norbert, afterward archbishop of Magdeburg (1080–1134). They followed the rule of St. Augustine, and were in part canons regular. The order (which had become very powerful and widespread) was divided in 1573 into two congregations, the new one having a stricter observance. In 1630 the whole order received the stricter rule; it is not very large, but it has convents of monks and nuns in continental Europe.

Prence (THOMAS), b. in England in 1601; was one of the Leyden Pilgrims; arrived at Plymouth, Mass., in 1621; was one of the first settlers at Nansett or Eastham; was chosen governor in 1634, 1638, and continuously from 1657 to his death; was assistant 1635–37 and 1639–57, and distinguished for religious zeal and the promotion of education. D. at Plymouth Mar. 29, 1673.

Pren'tice (GEORGE DENISON), b. at Preston, Conn., Dec. 18, 1802; graduated at Brown University 1823; was admitted to the bar in 1829; edited the *Weekly Review*, Hartford, Conn., 1828–30, and from 1830 to his death was editor of the *Louisville Journal*, which he made one of the leading Whig newspapers of the country; author of many fugitive poems, and of a *Life* of Henry Clay (1831); *Prenticeana* (1859), a collection of his witticisms, has gone through several enlarged editions. D. at Louisville, Ky., Jan. 22, 1870. His *Life* has been written by G. W. Griffin.

Pren'tiss, county of N. E. Mississippi. Area, 425 sq. m. It is nearly level and very fertile. Live-stock, cotton, and corn are important products. Is traversed by Mobile and Ohio R. R. Cap. Booneville. P. 9348.

Prentiss, p.-v. and tp., Penobscot co., Me. P. 387.

Prentiss (BENJAMIN MAYBERRY), b. at Bellville, Va., Nov. 23, 1819; removed with his parents to Missouri, and in 1841 settled at Quincy, Ill., where he learned the trade of rope-maker. In the war with Mexico he was adjutant of the 1st Illinois Vols.; captain subsequently, and distinguished at Buena Vista. Returning to Quincy, he was defeated for Congress in 1860. At the outbreak of civil war he was appointed colonel 7th Illinois Vols., and soon after brigadier-general of three months' troops. Appointed brigadier-general of U. S. volunteers May, 1861, he commanded in S. Missouri; at the battle of Shiloh, in Apr., 1862, while in command, he was surprised and captured with most of his division; released in October, and made major-general of volunteers Nov. 29, 1862. Member of court-martial to try Gen. Fitz John Porter Nov., 1862–Jan., 1863. Commanded at Helena, Ark., July 4, 1863, when he defeated Gen. Holmes, who attacked that place.

Prentiss (CHARLES), b. at Reading, Mass., Oct. 8, 1774; graduated at Harvard 1795; began in the same year the publication at Leominster of *The Rural Repository*; issued *A Collection of Fugitive Essays in Prose and Verse* (1797); afterward edited political, literary, and theatrical papers at Georgetown, D. C., Baltimore, Richmond, and Washington; visited Europe 1804; was for some years reporter of debates in Congress; published at Brookfield, Mass., *The Life of Gen. Eaton* (1813) and the *Life of Robert Treat Paine* (1812). Prentiss was one of the first Americans who relied for support exclusively upon his pen. D. at Brimfield, Mass., Oct. 20, 1820.

Prentiss (GEORGE LEWIS), D. D., b. at Gorham, Me., May 12, 1816; graduated at Bowdoin College 1835; was assistant in Gorham Academy 1836–37; studied theology at the universities of Halle and Berlin in Germany 1839–41; was settled over the South Trinitarian church, New Bedford, Mass., in Apr., 1845; became pastor of the Mercer street Presbyterian church, New York City, in Apr., 1851; resigned on account of ill-health in the spring of 1858, and went abroad for two years; on his return gathered a new congregation on Murray Hill (the Church of the Covenant), and was installed its pastor in the spring of 1862, and resigned in Apr., 1873, in order to accept a call to the Skinner and McAlpine professorship of pastoral theology, church polity, and mission-work in the Union Theological Seminary. During the civil war of 1861–65 he was an ardent champion of Union principles. Besides numer-

ous sermons and addresses, he has published *A Memoir of Sargent S. Prentiss* (2 vols., 1855) and *A Discourse in Memory of Thomas Harvey Skinner, D. D., LL.D.* (1871).—His wife, ELIZABETH PAYSON PRENTISS, youngest daughter of Dr. Edward Payson, b. in Portland, Me., Oct. 26, 1818, was married in Apr., 1845. Her three *Susy* books first brought her into notice as a writer. *Stepping Heavenward* (1869) has had a sale of more than 50,000 copies in the U. S., while many thousands have been sold also in Canada, Great Britain, and Australia. *Flower of the Family*, *The Percys*, and *Fred, Maria, and Me*, have all been translated into German, the two former into French. Among her more recent works are *Urbane and his Friends* (1874) and *Hymns and Songs of the Christian Life* (1873). Most of her books have been republished in England.

R. D. HITCHCOCK.

Prentiss (HENRY E.), b. in Maine Feb. 12, 1809; graduated at the U. S. Military Academy, and entered the army as second lieutenant of artillery July, 1831, but remained at the academy as assistant professor of engineering until 1833, and resigned in 1835 to practise law, settling at Bangor, Me., where he became an extensive lumber-dealer and manager. When ordered to Mobile, Ala., in 1833, he performed the journey on foot, and on resigning in 1835 walked the entire distance from Mobile to Bangor. D. at Bangor, Me., July 2, 1873.

Prentiss (SAMUEL), LL.D., b. at Stonington, Conn., Mar. 31, 1782; began the practice of law at Montpelier, Vt., 1803; achieved an eminent position at the bar; was chief-justice of the State supreme court 1829–31, U. S. Senator 1831–42, and U. S. district judge from 1842 until his death, at Montpelier Jan. 15, 1857.

Prentiss (SARGENT SMITH), b. at Portland, Me., Sept. 30, 1808; graduated at Bowdoin College 1826; went to Natchez, Miss., as a teacher 1827; was admitted to the bar 1829; removed in 1832 to Vicksburg, where he acquired great reputation, especially as a jury-lawyer; was elected to the State legislature in 1835; was sent to Congress 1837, but unseated by the casting vote of J. K. Polk, the Speaker; was returned in 1838 by an overwhelming majority; opposed the repudiation of Mississippi bonds; removed in 1845 to New Orleans. D. at Longwood, near Natchez, July 1, 1850. He was one of the most gifted men this country has produced. Senator Crittenden of Kentucky once said of him: "It was impossible to know Mr. Prentiss without feeling for him admiration and love. His genius, so rich and rare, his heart, so warm, generous, and magnanimous, and his manners, so graceful and so genial, could not fail to impress those sentiments on all who approached him. Eloquence was part of his nature, and over his private conversation, as well as his public speeches, it scattered its sparkling jewels with more than royal profusion."

R. D. HITCHCOCK.

Prenz'lau, town of Prussia, province of Brandenburg, on the Ucker, has a fine Gothic church of the thirteenth century, tanneries, breweries, and manufactures of stockings, hats, paper, and tobacco. Pop. 14,442.

Prepara'tion. In music, dissonances, especially sevenths, are said to be prepared when either their higher or lower term—*i. e.* the root or the dissonant interval—has formed a component part of the chord immediately preceding, and thus rendered the entrance of the dissonant chord more easy and natural. (See MUSIC.)

Preposi'tions are so named because in Latin, whence we have the word, they occur *before* the words which they influence; whence also the Greek name *prothesis*. They are not inflected, and in English they are simple, such as *in, out, at, by, for, on, up;* and compound, of which we have examples in *above, around, about, below, between.* Latin prepositions are prefixed in *ad-mit, ex-pose, in-duce, pro-pel, sub-merge;* and English ones are suffixed in *there-by, where-in, through-out.* Turkish has "postpositions," instead of prepositions, for both of which terms "perithesis" has been proposed. (Haldeman, *English Affixes*, p. 191.) Pott published a volume on the prepositions in 1859.

S. S. HALDEMAN.

Pres'burg, one of the finest towns of Hungary, on the northern bank of the Donau, near the frontier of Lower Austria. From 1541, when the Turks conquered Buda, it was the capital of the country, until Joseph II., in 1784, once more transferred this dignity to its old possessor. It has a fine cathedral, built in 1090, but the splendid royal castle, which from a cliff on the bank of the Danube overlooks the city, was destroyed by fire in 1811, and has remained a ruin. Its educational and benevolent institutions are numerous and good; its manufactures of chemicals, leather, tobacco, and gold and silver ware extensive, and its transit-trade in corn and wine active. P. 46,540.

Pres'byter [Gr. πρεσβύτερος, "elder"], the title of an officer in the Christian Church, given at first on account of age, length of service, or dignity. It was a Jewish-Christian name, and came from the synagogue. In the New Testament the words "presbyter" and "bishop" are interchangeable. In each early church there was a board of presbyters. Their duties were to superintend the church order, discipline, and doctrine, to teach, preach, visit the sick, receive strangers, and preside at the meetings. They were appointed by the apostles or their representatives, or may have been elected or nominated by the people. They were ordained with prayer and the laying on of hands.

Clement (earliest of the Fathers), 96 A. D., makes no distinction between presbyters and bishops, and says they were appointed first by the apostles, then they were nominated by the whole college of presbyters, the church consenting. Ignatius, 115 A. D. (Syriac), speaks of bishops as distinct from presbyters. Irenæus, about 182–188, speaks of the episcopate in the congregational sense, and in some places distinguishes between bishops and presbyters. In Tertullian (160–240?) bishops and presbyters are kept distinct. Cyprian (200–258) says bishops are successors of the apostles, and all authority resides in them. They only can ordain. All bishops are equal, and are related to the whole Church, though laboring in their own dioceses. The Church of the apostles was plastic, appearing to have no inflexible order, and the growth of the episcopate was natural, even if the government had been presbyterian, just as within the last century the Methodist Episcopal Church has adopted the episcopate on account of its convenience and effectiveness. In places where the apostles had lived the chief of their successors were likely to inherit their authority. Hilary (350) shows that persecutions brought the strongest into prominence. In times of heresy, or under the need of regular instruction and government, or to make manifest the unity of the Church and to serve as the vehicle of tradition, the ablest teacher gained enlarged authority. And as the office of president or bishop grew in importance, men sought it and magnified it through ambitious motives, or in conformity to the centralizing and imperial tendencies of Church and State both for defence and aggression.

Special dignity, though at first apparently no superior authority, was attached to the bishops of Jerusalem, Rome, Antioch, Alexandria, Ephesus, and Corinth. Metropolitan dignity came to the chief men of the provincial synods. At the Council of Nice the patriarchate appears, and after a time the bishop of Rome secured the primacy. The episcopal form of government is found among three-fourths of the estimated 335,000,000 Christians in the world.

The episcopalian form of church government claims that there were three ecclesiastical orders among the Israelites—the high priest, priests, and Levites; three during the time of our Lord—Christ, the apostles, and the Seventy; three while the apostles lived—apostles, presbyter-bishops, and deacons; and three appointed for the Church permanently—bishops, presbyters, and deacons; that the New Testament interchange of "bishop" and "presbyter" ceased at the death of the apostles, the name apostle was used only for the Twelve, and the title bishop was appropriated to those whom the apostles had appointed to take their places as overseers of the churches and to inherit all that was possible of their office, or to those who with the apostolic sanction were chosen by the board of presbyters as their presiding officers; that bishops were always presbyters, and something more; that the power to ordain and confirm belongs alone to the bishops; that the three orders must have been appointed, or at least sanctioned, by Christ and the apostles, for the system appears fully developed in the second century; that Timothy, Titus, and others like them were diocesan bishops; that bishops, like apostles, are officers of the universal Church; that apostolic succession is that by which the apostles have transmitted their authority through an unbroken line of persons called to fill their place.

The presbyterian form rests on the parity of the clergy. It claims that there has been no continuance of an office that was from its nature for a temporary purpose; that the apostles were called to be eye and ear witnesses; that when they died their office ceased; that the titles presbyter and bishop in the New Testament both belong to the same office—presbyter is a title of age or dignity, bishop of office or duty; that every presbyter-bishop has authority to ordain, and that they are equal among themselves; that Timothy and Titus were not diocesan bishops, but representatives of the apostles for a peculiar, temporary duty, as evangelists and messengers; that if the apostles had appointed men to the diocesan episcopate, they would not have taken the inferior name of presbyter; that the true apostolic succession has been kept up through the Church

simply by the officers of one generation approving of those who were to follow; that bishop-presbyters have authority only in single churches or as their representatives; that the episcopate grew up from natural causes, without any divine institution; that the very small jurisdiction of the early bishops—as, *e. g.*, in North Africa—shows that they were over parishes rather than dioceses.

Since Calvin especially, a distinction has been made between teaching and ruling elders—a difference of duties, and in some sense of dignity, but not of authority. It rests on the New Testament distinction between "governments," "ruling," etc., and other gifts, and between those who (1 Tim. v. 17) "rule well" and those who "labor in word and doctrine;" though this may refer to the distinction not between those who rule and those who teach, but between those who are zealous and those who are not, the emphasis being on the word *labor.*

(See Schaff's and Neander's *Church Histories;* Hooker's *Works;* S. Miller, *Letters concerning the Constitution and Order of the Christian Ministry,* and *Presbyterianism the truly Primitive and Apostolical Constitution of the Church of Christ;* G. T. Chapman, *Sermons upon the Ministry, Worship, and Doctrines of the Protestant Episcopal Church; Commentaries on Phil. i. 1,* and *The Pastoral Epistles;* Prof. R. D. Hitchcock, *Origin and Growth of Episcopacy, Amer. Pres. and Theol. Rev.,* 1867, p. 133.) Isaac Riley.

Presbyte'rian Church. I. *Name.*—The distinctive title "Presbyterian," as descriptive of one division of the Church of God, is derived from the Greek word Πρεσβυτέριον, used in both the Septuagint and the New Testament to designate a body of officers to whom was committed the government of the Church. At its earliest appearance in the Septuagint the term is used to designate a council of elders, as, *e. g.*, in Lev. iv. 15, where is recorded a direction to the "elders of the congregation," as representing the people, to "lay their hands upon the head of the bullock before the Lord." In later writings the term is used to designate the officers of the synagogue. The title and the duties it implies were retained under the new dispensation, as the Christian Church was the outgrowth of the Jewish. Hence the name is the key to the system.

II. *Constitution.*—The visible Church is held to be an organized association of the people of God. Every such association must have its official representatives; and since an ecclesiastical organization is of necessity widespread, it must provide both for particular congregations and for congregations as related to each other. In the Presbyterian Church, as it now exists, a particular congregation is generally organized by some recognized authority, but is complete in itself. It elects its own officers, which are—(1) a pastor, (2) a bench of elders, (3) a board of deacons. A pastor, once elected, is installed by the ecclesiastical body called presbytery, with which the congregation is connected. In case no pastor is installed, an ordained minister may have charge of the congregation, subject to the oversight of the presbytery. The elders are elected by the people and ordained by the presiding minister or by presbytery. To them is committed the spiritual oversight and government of the congregation. Their number is determined by the wishes of the people; it is seldom less than three or greater than twelve. The *office* is for life, but in some congregations the term of active service is limited by vote. The board of deacons is also elected by the congregation, and its members are "set apart" by solemn ceremony, as are the elders. Their duty is to care for the poor of the congregation and for such temporal interests as may be committed to them. They have no governmental control. In many congregations in America pecuniary affairs are managed by a board of trustees, also elected by the people, but not ordained. In Scotland and in some parts of the U. S. the duties of trustees are discharged by the deacons; this is, in fact, most harmonious with the constitution of the Church. Governmentally, there are in the Presbyterian body four "judicatures," styled in order the session, the presbytery, the synod, and the General Assembly. The *session* consists of the bench of elders above described. Of this judicatory the pastor or minister in charge is *ex-officio* a member and its moderator. The *presbytery* consists of all the ministers or "teaching elders" (as they are sometimes distinctively called) and one "ruling elder" from each congregation in a limited district. Each minister in that district is, if received by vote, a permanent member of the presbytery. The ruling elders act at particular meetings, being elected by the sessions for that purpose. The duties of this body are "to receive and issue appeals from church sessions and references brought before them in an orderly manner; to examine and license candidates for the holy ministry; to ordain, install, remove, and judge ministers; to examine and approve or censure the records of church sessions; to resolve questions of doctrine or discipline seriously and reasonably proposed; to condemn erroneous opinions which injure the purity or peace of the Church; to visit particular churches for the purpose of inquiring into their state and redressing the evils that may have arisen in them; to unite or divide congregations at the request of the people, or to form or receive new congregations; and in general to order whatever pertains to the spiritual welfare of the churches under their care." (*Form of Gov.*) The *synod* consists of all the ministers and one elder from each congregation within a larger district, which must embrace at least three presbyteries. It stands to the presbyteries within its bounds in the same relation as each presbytery stands to its churches. It is empowered to receive and issue appeals from the presbyteries, to examine their records, to form or divide or unite these lower bodies, and generally to take proper oversight of presbyteries, sessions, and people under their care. The *General Assembly* consists of an equal delegation of ministers and elders from each presbytery. For the proportion and the functions of this judicatory see General Assembly.

Thus, the constitution of the Presbyterian Church is seen to be based upon the principle of representation. The will and the rights of the people are respected and guarded throughout. As related to the Church at large, the duties committed to the presbytery are the most important of all, yet they are duties in which each congregation and, representatively, each member of the Church has a share. The analogy between the constitution of the Presbyterian Church and that of the Jewish Church is evident. It is much closer than that of flower to seed. The Jewish synagogue had its rabbi, corresponding to the "minister" of to-day. It had its bench of elders, who watched over and ruled the flock, and who, with the rabbi, formed a court with the power of discipline and excommunication. It had its lower officers, corresponding to the deacons. It also admitted the right of appeal from its decisions in certain cases to the "great synagogue" at Jerusalem. It was but natural that the Christian Church should adopt the principal ideas of that church order to which it succeeded.

III. *History.*—Conformably to the view just stated, the history of the Presbyterian Church begins even before the apostolic age. The congregations of the apostolic Church were organized associations of the people of God, now assuming the title of Christians. The officers of these congregations were ordained elders. Appeals went up from one body of ecclesiastical rulers to another. Ordinations to the ministry, as in the case of Timothy, were performed by the "laying on of the hands of the presbytery." The whole visible Church was regarded as one body, and the decrees of the assembled apostles and elders at Jerusalem were, when sent down to the congregations, received as authoritative. It is claimed but by few that the present order of the Presbyterian Church is *precisely* that of the apostolic age; few claim a *jure divino* authority for the system; yet its principles are believed to have undergone little change. It is difficult to trace the historic line of development from the apostolic age downward. It is, however, well known that the Church of the Waldenses is very ancient, and has been from the first a Presbyterian body. The line does not, however, become distinct until we reach the Reformatory period of the sixteenth century. Modern Presbyterianism dates in Switzerland from the time of John Calvin, and in Scotland from that of John Knox. It can be shown that "all the Reformed churches in France, Germany, Holland, Hungary, Geneva, and Scotland were thorough Presbyterians, not only in principle, but also in practice." The Presbyterian Church became fully established in Scotland in 1560, when the first General Assembly was held. Since that period, in fact, the Presbyterian Church in Scotland has held the same relation to the state that the Episcopal Church has held in England since the reign of Henry VIII. It has, however, been divided into groups by subsequent events. In 1733, during the reign of Queen Anne, an act was passed vesting in certain individuals the power to nominate pastors for vacant churches. This led to a secession from the Established Church and the formation of the "Associated Presbytery." In 1752 another secession for the same reason occurred, and the "Relief Presbytery" was organized. In 1847 these two bodies became one under the title of the "United Presbyterian Church," and consisted then of more than 600 congregations. In 1843 nearly 500 ministers of the Established Church gave up their "livings" and formed the "Free Church of Scotland." Besides these principal groups, there is at present another, known by the name of the "Reformed Presbyterian Church," and claiming to represent Presbyterianism as it was before the Revolution. The Presbyterian Church in Ireland is an offshoot from that of Scotland, but has a General Assembly of its own. In England the first presbytery was formed at Wandsworth, a village near London, Nov. 20, 1572. There are now two Presbyterian bodies in England, one of which,

bearing the general title of "Presbyterian Church of England," is self-governed, but affiliated with the Free Church of Scotland; whilst the other, the "United Church," is a branch of the United Presbyterian Church of Scotland. Steps have been taken to make these two bodies one.

In Switzerland the Church remains substantially as it was organized by Calvin. In Germany the elements of Presbyterianism still exist in the "Reformed Church." In the Netherlands, Presbyterianism, brought from Switzerland in the time of William, prince of Orange, found a congenial soil, and at this time four-fifths of the Protestants of the Netherlands are Presbyterians. The historic members of this Church in France are the Huguenots, baptized by blood in the massacre of St. Bartholomew. In Austria, Hungary, Transylvania, Russia, many Presbyterians have found a home.

The Presbyterian Church in America owes its origin and cast principally to Scotland, although it has spread from three centres—established by the Dutch in New York, by the Scotch in Virginia, and by the Huguenots in Carolina. The first Dutch church was formed in New Amsterdam as early as 1619. Scotch Presbyterians settled on the Elizabeth River, Va., between the years 1670 and 1680. It is uncertain when their first church was formed, though it is known that a Presbyterian church was organized by Francis Makemie at Snow Hill, Md., in 1684. The Huguenots, banished from France by the Revocation of the Edict of Nantes in 1685, established their churches in this country at about this period. The first presbytery in America was formed in 1705, and was called the Presbytery of Philadelphia. The first synod, composed of four presbyteries, was formed in 1717. The first General Assembly met in Philadelphia in 1789, there being then twelve presbyteries and four synods. In 1837 the General Assembly was divided because of disagreement on certain questions of church polity and method. In 1869 the Church, thus divided, was happily reunited, and the first General Assembly of the reunited Church was held May, 1870, in the same city and under the roof of the same congregation which welcomed the Assembly of 1789. This is the outline of the history of the principal Presbyterian body in America. But, as in Scotland, there are several groups of Presbyterians in this country. At the time of our civil war the Presbyterians of the South became distinct, and, notwithstanding various overtures looking toward a reunion, so remain, having a large and influential membership, a vigorous and active ministry. The less prominent groups are these: (1) the United Presbyterian Church, formed in 1858 by a union of two bodies of Scotch affiliations known as the "Associate" and the "Associate Reformed" churches; (2) the Reformed Presbyterian Church, whose first presbytery was formed in 1774; (3) the Associate Reformed Synod of the South, originally one of the synods of the "Associate Reformed Church," alluded to above; (4) the Cumberland Presbyterian Church, which became a distinct body in 1810, and whose field is principally in the South and South-west; (5) the Reformed (German) Church, 1819; (6) the Reformed (Dutch) Church, dating from early in the seventeenth century, and having 10,000 adherents when New York was surrendered by the Dutch to the English. It has many strong congregations and two colleges and theological seminaries. All these different groups are practically one in doctrine and in polity. In the Dominion of Canada, Presbyterianism has had, until recently, more of a colonial character. A synod in connection with the Church of Scotland was formed about the year 1830. In 1861 the Canada Presbyterian Church was formed by a union of bodies representing the Free and the United churches of Scotland. Its first General Assembly was held in 1870. There has been also a separate synod in Lower Canada, but in May, 1875, these bodies were happily united, so that there is now but one Assembly. The united Church has 700 ministers and 1000 congregations.

IV. *Doctrines.*—These are practically embodied in the standards adopted by the famous Westminster Assembly, convened in London 1643 by order of the British Parliament. As to their local coloring, they are Calvinistic. Their principal points are: (1) God in three Persons, Father, Son, and Holy Ghost, these three "the same in substance, equal in power and glory." (2) Man morally depraved by nature. (3) Jesus Christ an atoning Saviour. (4) Justification by faith in the Redeemer. (5) Regeneration and sanctification by the Holy Ghost. (6) Eternal happiness in the other world for "believers," eternal suffering for the finally impenitent. (7) God in all his acts and purposes, including those of "election," sovereign—man in all his acts free. To the articles of the "confessions" of the various branches of the Church all officers are required to subscribe at their ordination. Nothing, however, is usually required for membership in a particular congregation except repentance from sin, faith in the Lord Jesus Christ, and an unreserved consecration to God. Thus, whilst this Church is strict in its instructions, it is one of the most liberal of all in its conditions of Christian fellowship.

V. *Federal Relations.*—In 1872 a movement was made in this country toward bringing the scattered families of Presbyterianism into at least a federative union. This movement was responded to in other lands. The result was a council held in London July, 1875, to agree upon a constitution of confederation, the first meeting of said confederation to be held at Edinburgh in 1876 or 1877. This union, wisely formed and heartily sustained, is expected to promote in a great degree the fellowship and the efficiency of the Church throughout the world.

VI. *Statistics.*—Rev. J. M. Porteous, author of a prize essay on *The Government of the Kingdom of Christ* (Edinburgh and London, 1873, 2d ed.), gives the following:

National branches.	Churches.	Ministers.	Members.	Population adherent.
Scotland	2,711	2,841	843,455	3,218,613
England	1,268	1,017	135,037	664,685
Ireland	566	656	116,656	[illegible]
America, U. S.	9,163	8,235	857,461	3,050,714
Canada	651	604	65,203	471,946
West Indies, etc.	54	27	5,188	20,752
Africa, W. and S.	228	198	17,803	71,212
Australia	418	330	38,661	177,922
China and Japan	20	62	1,418	2,000
India	37	114	1,836	11,145
Syria	5	17	50	500
Belgium	10	10	500	12,500
Holland	1,826	1,826	2,096,146	2,100,000
Scandinavia	....	....	3,030	
Austria	2,050	2,050	1,912,153	2,000,000
Italy, Spain, etc.	50	50	1,000	3,000
Russia				
France	1,060	721	630,000	1,000,000
Switzerland	....	....	1,567,003	1,567,003
Germany	....	....	18,415,876	18,900,000
Piedmont	16	16	26,920	30,000
Total	20,133	18,774	26,735,396	33,860,230

The following table will show the relative strength of the different families of the Presbyterian Church in America in the year 1874:

Churches.	Communicants.
Presbyterian Church in the U. S. (Northern)	495,634
Presbyterian Church in the U. S. (Southern)	109,956
Cumberland Presbyterian Church	99,832
United Presbyterian Church of North America	75,452
Synod of Reformed Presbyterian Church, O. S.	9,725
General Synod of Reformed Presbyterian Church, N. S.	8,487
Associate Reformed Presbyterian Church of the South	5,758
Welsh Presbyterian Church	9,101
French Evangelical Church	——
Canada Presbyterian Church	49,315
Church of Scotland in Canada and Lower Provinces	21,786
Presbyterian Church of Lower Provinces	18,802
Reformed Church in the U. S. (German)	134,792
Reformed Church in America (Dutch)	64,150

Z. M. Humphrey.

Presbyterianism. See Presbyterian Church.

Pres'cot, town of England, in Lancashire, has manufactures of watches, watch-tools, files, and pottery. P. 6066.

Pres'cott, county of E. Ontario, Canada, bounded on the N. by Ottawa River and on the E. by the province of Quebec. It is associated with Russell co. for judicial purposes. Area, 475 sq. m. Cap. L'Orignal. P. 17,647.

Prescott, port of entry of Grenville co., Ont., Canada, on the St. Lawrence, opposite Ogdensburg, N. Y., with which it is connected by steam ferry-boats. It is on Grand Trunk Railway, 112 miles above Montreal, just above the junction of St. Lawrence and Ottawa Railway, of which the extensive car and locomotive works are situated here. Prescott has an active trade and 1 newspaper. Fort Wellington, a British fort, is near by. P. of sub-district, 2617.

Prescott, p.-v., cap. of Yavapai co., Ara., the military head-quarters of the State, has a fine public school, 1 church, and 1 newspaper. Principal occupation, gold and silver mining and grazing. P. 668.

T. J. Butler, Ed. "Weekly Miner."

Prescott, p.-v. and tp., Hampshire co., Mass., on Athol and Enfield R. R. P. 541.

Prescott, v. and tp., Faribault co., Minn., on Southern Minnesota R. R. P. 532.

Prescott, p.-v., Pleasant Valley tp., Pierce co., Wis., 25 miles below St. Paul, at the confluence of Lake St. Croix and Mississippi River, has a graded school, 5 churches, 1 bank, 1 newspaper, 3 hotels, and several mills. P. 1138.

M. B. Kimball, Ed. "Clarion."

Prescott (Oliver), M. D., b. at Groton, Mass., Apr. 27, 1731; graduated at Harvard 1750; studied and practised medicine; was a colonel of militia before the Revolution; appointed brigadier-general for the county of Middlesex 1776, and major-general of State militia 1778; served as a member of the board of war and of the supreme executive council; was influential in the suppression of the Shays rebellion, and was judge of probate for Middlesex co. from 1779 until his death at Groton, Nov. 17, 1804.

Prescott (Oliver), M. D., son of Gen. Oliver, b. at Groton, Mass., Apr. 4, 1762; graduated at Harvard 1783; studied medicine with his father; was surgeon of the expedition against the Shays rebellion 1787; frequently a member of the legislature; settled at Newburyport 1811; obtained an extensive medical practice; published a *Dissertation on the Natural History and Medicinal Effects of the Secale Cornutum or Argot*, and contributed valuable articles to the *N. E. Journal of Medicine and Surgery*. D. at Newburyport Sept. 26, 1827.

Prescott (Richard), b. in England about 1725; served in the British army in Germany during the Seven Years' war, attaining the rank of colonel of the 7th Foot 1772; came with that regiment to Canada, where he held the local rank of brigadier-general 1773; surrendered to the American invading army on the St. Lawrence Nov. 17, 1775; was exchanged for Gen. Sullivan Sept., 1776; participated in an expedition against Rhode Island Dec., 1776; remained in command of Newport; was surprised and captured at a country-seat on the island by a party under Lieut.-Col. Barton; was exchanged for Gen. Lee; resumed the command of the Rhode Island station until the evacuation of Newport, Oct. 25, 1779; was noted for his brutal treatment of American prisoners; became major-general Aug., 1777, and lieutenant-general 1782. D. in England in Oct., 1788.

Prescott (Robert), b. in Lancashire, England, in 1725; served in the British army in the expeditions against Rochelle (1757) and Louisbourg (1758); was aide-de-camp to Gen. Jeffrey Amherst in the campaign against Crown Point and Ticonderoga 1759; was with Wolfe at Quebec; participated in the capture of Martinique 1761, in the battle of Long Island and other engagements near New York 1776, and in the battle of Brandywine 1777; was sent with Gen. Grant against the French West Indies, with the rank of brigadier-general, 1778; became major-general 1781, lieutenant-general 1793; captured in 1794 the islands of Barbadoes and Guadaloupe, of which he became civil governor; succeeded Lord Dorchester as governor of Lower Canada 1796; was recalled 1799, and became full general 1798. D. near Battle, Sussex, England, Dec. 21, 1816.

Prescott (William), brother of Gen. Oliver, b. at Groton, Mass., Feb. 20, 1726; served in the expeditions against Cape Breton (1754) and Acadia (1756), attaining the rank of captain; became a farmer in the town of Pepperell, where he inherited a considerable landed estate; commanded a regiment of minutemen 1775; took part in the battle of Lexington, and commanded in that of Bunker Hill (according to the usual account); resigned from the army 1777, but took part as a volunteer in the campaign against Burgoyne in the same year, and sat in the Massachusetts legislature for several years. D. Oct. 13, 1795.

Prescott (William), LL.D., son of Col. William, b. at Pepperell, Mass., Aug. 19, 1762; graduated at Harvard 1783; taught school for some years; studied law at Beverly with Nathan Dane; settled at Salem; served in both houses of the legislature; twice declined a seat on the supreme bench of Massachusetts; removed to Boston 1808; was a delegate to the Hartford Convention 1814; a member of the governor's council for some years; judge of common pleas for Suffolk co. 1818; a member of the State constitutional convention of 1820. D. at Boston Dec. 8, 1844.

Prescott (William Hickling), D. C. L., son of Judge William and grandson of Col. William, the hero of Bunker Hill, b. at Salem, Mass., May 4, 1796; removed to Boston 1808; prepared for college at the private classical school kept by Rev. Dr. J. S. J. Gardiner; entered Harvard College as a sophomore 1811; suffered in the following year an injury to his left eye which rendered his subsequent studies through life a matter of extreme difficulty and delicacy; graduated 1814, taking high rank in classics and in general literature; spent several months (1815–16) at St. Michael's in the Azores Islands with his maternal grandfather, whose name he bore, who was U. S. consul on that island; visited England, France, and Italy 1816–17; founded a literary and social club at Boston (June, 1818), for which he edited several numbers of a short-lived periodical, *The Club-Room* (Feb.–July, 1820); married Miss Susan Amory May 4, 1820; devoted several years to an elaborate course of study of ancient and modern history and literature, performed with the disadvantage of being able to use his eyesight but a short time daily, and being therefore forced to employ a reader; published in the *North American Review*, as fruits of his researches, several elaborate and well-written studies upon Italian and French poetry and romance; selected Jan. 19, 1826, the subject of his first historical work, to which (residing alternately at Boston, Pepperell, and Nahant) he gave the patient labor of ten years, procuring from Spain extensive materials, both printed and in MS.; published Dec. 25, 1837 (dated 1838) his *History of the Reign of Ferdinand and Isabella, the Catholic* (3 vols.), which was soon translated into French, Spanish, Italian, German, and Dutch, and recognized both at home and in England as the most meritorious historical work produced in the U. S.; added to his reputation by the *History of the Conquest of Mexico* (3 vols., 1843), a brilliant work which had a popularity even greater than its predecessor; completed his cycle of Spanish-American history by the *Conquest of Peru* (3 vols., 1847); published a volume of *Biographical and Critical Miscellanies* (1845); was welcomed with great distinction by the literary circles of London, Edinburgh, Paris, Brussels, and Antwerp in the summer of 1850, receiving the degree of D. C. L. from Oxford University; published 2 vols. of a *History of the Reign of Philip the Second* in 1855, and a third in 1858; edited Robertson's *Charles the Fifth* in 1857, with a supplement on the life of the emperor after his abdication; and was actively at work upon his *Philip the Second*, which was intended to comprise 6 vols., when his labors were cut short by death at Boston Jan. 28, 1859. He had also written brief biographies of his friends John Pickering and Abbott Lawrence. A new edition of his complete works, superintended by his last secretary, John Foster Kirk, was published at Philadelphia in 1874–75 in 15 vols. By general consent, Prescott is associated with Irving at the head of the American authors of the nineteenth century, yet so diffident was he in regard to his literary merits that, although he had printed for his own convenience four copies of his *Ferdinand and Isabella*, he long hesitated to give it to the public, and was induced to publish only by the earnest solicitations of his friends, chief of whom through most of his life was the historian of Spanish literature, George Ticknor, author of the *Life of W. H. Prescott* (1864). Prescott's relations with Irving and Motley in regard to a possible competition in the same historical field were highly creditable to him and to them, Mr. Irving having abandoned in his favor a projected history of the conquest of Mexico, and Mr. Motley having received from Prescott substantial encouragement to prosecute his *Rise of the Dutch Republic*, notwithstanding the close relations of that subject with the history of Philip II. In private life Prescott is represented as one of the most lovable of men, and few have had such attached friends. The difficulties under which he labored from impaired eyesight, and the necessity of writing with his curiously-contrived "noctograph," furnish a strong title to the admiration and affectionate interest of his countrymen. (See the *Proceedings of the Massachusetts Historical Society in Memory of W. H. Prescott*, Boston, 1859, and for literary criticism the able and elaborate article in S. A. Allibone's *Dictionary of Authors*.)
Porter C. Bliss.

Prescrip'tion [Lat. *præscriptio*], in law. In its widest sense this term denotes the acquisition of property in any kind of subject-matter by use and the lapse of time, but in the English and American law it is confined to such acquisition of incorporeal rights and interests—those denominated by Blackstone incorporeal hereditaments. This method of acquiring property is recognized by every enlightened system of jurisprudence, and is based upon the plainest principles of public policy. It was found in the Roman law as early even as the Twelve Tables, which fixed the lengths of time that must elapse at one year for movables, and two years for immovables; but these periods were gradually increased until, in the codification of Justinian, they were established at three and thirty years. In accordance with the doctrines of the common law, incorporeal hereditaments alone could be acquired by prescription, and they embraced all those interests which are said to issue out of land, the most important being rents, commons, and the numerous class of rights to the use of land and water which are now termed "easements." The theory maintained by the old judges based the notion of prescription upon the assumption that a grant had once been made and lost; and this particular species of conveyance was confined to the class of incorporeal interests and estates above mentioned. The theory itself was undoubtedly a mistaken one, but it explains the limitations which the ancient law placed upon this mode of acquiring property. To constitute a legal prescription several elements are requisite, and these relate both to the nature of the user and to the length of time during which it has continued. In the first place, the user of the right or interest in ques-

tion must have been open, notorious, peaceable, and adverse—that is, under a claim of right, and not in subordination to the right of the one who owns the soil. In the second place, this user by the claimant himself, his ancestors, or predecessors, must, at the common law, have been for a period of time beyond the memory of man, or, in the language of the old books, it must have lasted for a time "whereof no memory is to the contrary." This rule did not imply that the claimant must actually prove so long an enjoyment; it simply required the jury to find the existence of such fact, which they might do from a user lasting for a comparatively few years only if there was no evidence to the contrary. Modern statutes have changed this provision of the English law, and have established the period of thirty years as the duration of the adverse enjoyment which shall ripen into an absolute right. The same doctrine of prescription has been adopted in all its essential features by the several States of this country. The only material change is in the length of time during which the adverse user and enjoyment must continue in order that the title shall become perfect; and this has generally been fixed by statute, in analogy with the period required for acquiring an estate in lands by adverse possession, at twenty years. The title to an easement or other incorporeal right acquired by prescription is, from the very nature of the case, an absolute one, corresponding to the estate in fee arising from an adverse possession of lands continuing for the number of years fixed upon by statute. JOHN NORTON POMEROY.

Prescription [Lat. *præ*, "before," and *scribere*, to "write"], in medicine. A prescription is a written formula for the compounding and dispensing of medicines. Previous to the present century physicians dispensed their remedies, and the prescription was chiefly a record for the guidance of an assistant, who performed the manual work, and for the preservation of valuable or standard curative combinations. But with the separation as distinct vocations of physicians and apothecaries the prescription has become the medium of communication between them, the written instructions of the former to the latter. The ingredients of a prescription are necessarily designated in Latin; inasmuch as both the nomenclature of botany and of chemistry predetermines the names of vegetable and mineral remedies in that language, their technical names are the only ones by which they can be definitely known and correctly prepared. The enumeration of the several articles is preceded by the symbol ℞, an abbreviation of Lat. *recipe* ("take"). This symbol has also been regarded as a modification of the sign ♃, the symbol of Jupiter, with which the ancients prefaced their prescriptions to propitiate the gods and ensure a favorable action of their drugs. The several component parts of a prescription should be enumerated in the order—(1) of their chemical relation and pharmaceutical combination; (2) with reference to the object sought by each. The chief therapeutic or remedial agent should be prominent; co-operating remedies and those producing other and secondary effects, termed *adjuvantia*, receive the second position; articles intended to modify or correct the action of the preceding, termed *corrigentia*, come next; and, lastly, substances liquid or solid intended to secure definite quantity or consistency, to ensure solubility and uniform subdivision of doses, and variously known as the *vehicle*, *excipient*, or *menstruum*. The latter term arose from the superstition of ancient chemists and alchemists that dissolvents acted best at the time of the lunar changes. The quantities of the components are expressed by symbols. (See PHARMACY and PHARMACOPŒIA.) The prescription terminates with the abbreviation M. of Lat. *misce* ("mix"). Appended to the prescription the physician usually adds instructions of the dose and time and method of taking. These are usually in Latin, which the apothecary translates and transcribes on the label of the dispensed medicine. But the custom is growing of restricting the use of Latin to the prescription proper, and stating the direction for use plainly in English.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Presentation. See PURIFICATION OF THE VIRGIN.

Presentation Nuns, an order of Roman Catholic ladies devoted to the work of instructing poor children and to the care of aged women. They were first established in 1777 at Cork, Ireland, by Honora Nagle (1728–84); received papal approbation 1791; were cloistered 1805; first came to the U. S. in 1854; have more than 50 houses in Ireland.—There is also an order of religious of the PRESENTATION OF MARY, whose mother-house is at Bourg in the diocese of Viviers, France. Its especial work is the education of young ladies. It has houses in Canada.

Preserva'tion of Food is an art which in modern times has received an immense development by the invention of more appropriate methods. Drying, salting, and smoking were the oldest methods known to mankind by which flesh and fish were preserved; to fruits were first applied the methods of drying and making into preserves, either jellies or jams. Pickling—that is, cooking and then immersing in some liquid which prevents fermentation and decomposition—seems to be of a more recent date; fruit was generally kept in brandy; flesh in a strong brine mixed with vinegar; fish in olive oil or melted lard. Pickling with vinegar was for a long time the only method by which vegetables, such as cucumbers, cabbages, etc., were preserved. The two methods which at present have acquired great commercial importance are those of canning and freezing. By the former, articles of food, flesh, fish, fruit, and vegetables, are prepared for eating in different ways, and then packed in air-tight cans; by the latter, they are kept in refrigerators at a temperature either below the freezing-point or a little above it. Both methods have been applied with great success, given rise to an immense trade, and conferred innumerable benefits on mankind, and yet they both seem capable of further development.

Preservation of Timber. No subject connected with national economy needs, and should have at this time, more earnest and anxious attention than this. The rate at which the forest-lands of America are denuded and the rapid rise in cost of timber are subjects which cannot be viewed without great and reasonable alarm by any one having an interest in or a regard for the future of the American people. All successful and efficient devices for rendering timber more durable are positive aids in arresting the progress of this wasting malady—remedies which, if they can be applied on a scale sufficiently large and wide, may even work an absolute cure. It is therefore greatly to be desired that the American people should sufficiently awaken to the vital importance of this great public matter to lead to some adequate provision for its *public* investigation. Hitherto, it has been left altogether in the hands of speculators in patent rights, with the natural result of great public dissatisfaction, discouragement, and even occasional skepticism as to the utility—or, at any rate, the economy—of chemical preparation of wood for the attainment of durability. It is certain, however, that the employment upon this problem of an adequate amount and quality of disinterested scientific skill and labor would tell a different tale. The complete preservation, even for centuries, of woods of a quite perishable kind, through accidents of nature, is among the familiar facts. But the resources of chemical science are nearly as wide as those of Nature herself, and accidental conditions, *if thoroughly understood*, may be reproduced and made perpetual.

Decay of wood proceeds from agencies both internal and external. *Cellulose*, which constitutes the great bulk of woody tissue, is by itself an exceedingly imperishable substance, but appears, when in contact with fermenting or putrefying nitrogenous matters, to be capable of entering into decomposition like its isomeres and congeners sugar and starch, forming humus-like substances, devoid of coherence. (See HUMUS.) The ferments in this case are the albuminoid matters, chiefly LEGUMINE (which see), which exist in the wood. It is evident that these should not enter into fermentation or putrefaction if perfectly devoid of moisture, and hence *perfect* seasoning of the wood is a powerful preservative. This process, however, is exceedingly consumptive of time and expensive; being nugatory, moreover, in case the wood is to be exposed to moisture. It has been thought that this internal destructive agency is best antagonized by the use of chemical agents which combine with the legumine and form imputrescible compounds. Other internal destructive agencies arise from the eggs of insects deposited in the wood or under the bark. This may be sometimes, though not always, remedied by stripping off the bark; impregnation with agents poisonous to the destroying worms is surer. External destructive agencies are many, the most powerful being when the wood is exposed to simultaneous action of air and moisture, which engender and foster a number of destructive processes. Under sea-water, and between high and low tide, the *teredo* is another destructive agent. In tropical countries *ants* are enemies of timber structures. Contact with *iron* also destroys cellulose rapidly, through a slow combustion set up between the carbon of the cellulose and the oxygen of ferric oxide.

Our scope allows little more than a brief statement of a few of the more prominent methods of treatment for rendering wood durable that have been practised and met with more or less approval. First among these we may allude to

The Method of Kyan.—Impregnation with a solution of *corrosive sublimate*, bichloride of mercury. This was the first method experimented with in the U. S., and great expectations were entertained regarding it. It is founded on the known property of corrosive sublimate to form insol-

uble compounds with albuminoid bodies. According to Col. Cram, U. S. engineers, kyanized railroad ties of chestnut, laid in 1838 near Baltimore, were sound after eleven years, the same untreated having rotted in seven years; but he also states that kyanized Michigan white oak ties had rotted after twenty years. It appears, therefore, that moisture probably removes the corrosive sublimate in time. It is stated, moreover, that the men employed in the operation became salivated, and the process has now been generally condemned.

The Methods of Boucherie.—Impregnation with *sulphate of copper,* also with *chloride of calcium.* Sulphate of copper has much preservative power, and is cheaper and far less dangerous to handle than corrosive sublimate. It is, however, removed gradually from the wood by moisture. Chloride of calcium renders the wood *fire-proof,* adding also great strength and toughness. The latter substance has never been sufficiently or fairly experimented with, considering its cheapness and the enormous advantages it holds out. Dr. Boucherie was also the author of a method of making the preservative liquids penetrate the tree while still standing. Notches are cut in the trunk near the roots, and caoutchouc bags holding the solutions bound on. The tree sucks up the liquid through the evaporation from the leaves above.

The Method of Burnett.—A solution of *chloride of zinc.* This agent, like *corrosive sublimate,* operates by combining with the fermentescible albuminoids, but is much cheaper and not noxious. It has come into use in the U. S. much more largely than any other, and large establishments exist for "burnettizing" timber, as it is called. For many uses burnettized timber is no doubt very valuable.

The Method of Bethell.—The impregnation of the wood with heavy oils of coal-tar, called in England "creosote oil"—in the U. S. "dead oil." This method has been largely used in Europe, and apparently with much success, even against the salt-water *teredo,* which other methods do not resist. The oil was forced into the pores of the timber in a strong receiver by a pressure of 13 or 14 atmospheres.

The Method of Seeley.—This is an improvement on that of Bethell, of American origin. Considering the fact that Bethell's mode of operation must necessarily be uncertain and imperfect by reason of the air and moisture remaining in the pores of the wood, Dr. Charles A. Seeley of New York devised the following method: The wood is immersed in the oil—a crude *carbolic acid* being used, which is believed to be much more efficient than the common dead oil —in a closed tank, and the temperature raised to 300° F. The air and moisture are thus expelled from the timber, which is then suddenly introduced into a bath of *cold* carbolic acid. By this very ingenious process an absolute impregnation is accomplished. This method has been employed in this country since 1868 on the St. Clair Flats Ship Canal, Mich., and elsewhere.

There are numerous other methods; indeed, it would be difficult to mention any cheap chemical agent which *has not* at some time or other been proposed for the preservation of wood. Our knowledge of the whole subject remains, nevertheless, largely empirical; and, as before remarked, it is more than time that a great and systematic scientific investigation were entered into which shall exhaust the subject of wood-preservation, and reduce it to one of the established arts of civilization, which may then be so regulated and enforced by legislation as to control that fatal consumption of our forest treasures which now rages throughout the land. HENRY WURTZ.

Presho, county of S. Dakota. Area, about 1600 sq. m. It has Missouri River on the N. E. boundary, and is intersected by Medicine Creek and White River. It was formed since the census of 1870.

President. See CONSTITUTION OF THE UNITED STATES.

Pres′ident, p.-v. and tp., Venango co., Pa., on Allegheny River and Oil Creek and Allegheny River R. R. P. 618.

Presi′dio, county of W. Texas, bounded on the S., and partly on the W. and E., by the Rio Grande, which separates it from Mexico. Area, 9000 sq. m. It is dry and mountainous, and affords pasturage for stock where there is sufficient water. Gold-quartz and copper ores have been observed, but the resources of the county are but little developed. Cap. Fort Davis. P. 1636.

Presidio del Norte, v. (PRESIDIO P. O.), Presidio co., Tex., on the Rio Grande, opposite the fort of the same name in Chihuahua, Mexico. P. 439.

Presque Isle, county of Michigan, bounded N. E. by Lake Huron. Area, 640 sq. m. It is densely timbered, and has been but recently settled. Cap. Rogers City. P. 355.

Presque Isle, p.-v., Aroostook co., Me., 40 miles N. W. of Houlton, has an academy, 3 churches, 2 newspapers, 1 grist and 1 saw mill, 1 steam shingle-factory, and a starch-factory. P. 970. DANIEL STICKNEY, ED. "SUNRISE."

Presque Isle, v., Rogers tp., Presque Isle co., Mich., on Lake Michigan, has a lighthouse. P. 66.

Press. See PRINTING, by W. S. PATERSON.

Pressensé′, de (EDMOND), D. D., b. at Paris Jan. 7, 1824; was educated in Paris, Lausanne, Halle, and Berlin; became pastor of the chapel Taitbout, Paris (Evangelical or Independent Protestant), 1848; received the doctor's degree from Breslau 1863; an eloquent and earnest preacher, his whole energies have been devoted to the maintenance of the freedom of the Church from state interference and from dependence upon state aid, and to the presentation of Christianity as the means of solving the important moral and social questions of the day. After the proclamation of the Republic he was elected a member of the French Assembly, and was a strong supporter of Thiers. Among his principal works are *Conférences sur le Christianisme dans son Application aux Questions sociales* (1849), *Catholicisme en France* (1851), *Histoire des Trois Premiers Siècles de l'Église* (1858–61), *L'Église et la Révolution française* (1864), *Jésus Christ, son Temps, sa Vie, etc.* (1866).—His wife, a Swiss lady, is the author of several religious and educational works. Several of M. de Pressensé's volumes have been translated into English.

Press, Freedom of the, liberty of publication unrestrained by any official authority. As it is necessary, however, that this liberty of publication, like any other liberty, shall be followed by a corresponding responsibility, certain regulations must be provided for, such as the placing of the name and residence of the printer, publisher, or author on any publication; but such regulations, so long as they are laid down only for the purpose of establishing the necessary responsibility, while the definition and application of this responsibility are left to the decision of public opinion and its legal organs the courts, do not affect the freedom of the press. Formerly, however, it was thought necessary to define by law the responsibility of publication by excepting certain subjects altogether from public discussion, and to subject all works before publication to the inspection of a censor. The pope was the first inventor of such an instrument, and the Inquisition and the Jesuits the first to handle it. In 1496, Alexander VI. established a regular censorship. In 1515, Leo X. increased its power and enlarged its jurisdiction. The famous *Index Librorum Prohibitorum* was sanctioned—that is, officially opened—by the Council of Trent in 1562, and subsequently continued by the papal curia. The Roman Catholic clergy developed at that time great energy in Italy, Spain, France, Germany, and England in order to suppress all free discussion of religious subjects. Cardinal Chieregati demanded of the Diet of Nuremberg in 1522 that all books published without ecclesiastical permission should be seized and burnt, and the penalties imposed for reading or owning heretical books were very severe, as the annals of the Inquisition can testify. The secular governments were not slow in following the lead of the popes, and the censorship became one of the most effective, but also one of the most fatal, means which royal power could employ to stay the movements of the people. Perhaps it was nowhere exercised with such a barbarity and arbitrariness as in England. The unfortunate writers had their right hand, their nose, or their ears cut off. But England was, nevertheless, the first country in which freedom of the press was actually established, and it is still one of the countries in which this liberty is best understood and most advantageously practised. The censorship, established by Henry VIII., was first transferred from the Star Chamber to Parliament by the Long Parliament, and then abolished by the Commons in 1693. In Germany it was introduced as a law of the empire in 1529 by the Diet of Spires, but existed only in a loose form, different states at different times—such as Prussia under Frederick the Great—being exceedingly liberal. The Congress of Vienna promised to abolish it, but the Diet of 1819 re-established it in a more stringent and rigorous form than ever. Thrown aside in 1849, it reappeared in 1854, but with the dissolution of the old *Bund* in 1866 and the establishment of the German empire in 1870 it finally vanished, though on this point the state of affairs is still somewhat unsettled. In France freedom of the press was introduced in 1793, 1814, 1830, 1848, and 1871, but restrictive measures against newspapers and pamphlets were each time found necessary after the lapse of a very short period. The only country in Europe in which a censorship still exists in full vigor, though by no means illiberal, is Russia. The Constitution of the U. S. forbids its introduction.

Pressing to Death. See PEINE FORTE ET DURE.

Prester John. See JOHN, PRESTER.

Pres'ton, town of England, in Lancashire, on the Ribble, at the head of its estuary. It is an old town, well and substantially built, but without any remarkable edifices. It is important only as a manufacturing place. Breweries, distilleries, and malting establishments, iron and brass foundries, tanneries, ropewalks, and glassworks are in operation, but the principal branch of manufactures pursued here is cotton, no less than 90 mills being in operation and employing 27,500 hands. P. 85,427.

Preston, p.-v., Waterloo tp. and co., Ont., Canada, on Galt and Guelph branch railway, 3 miles from Galt, has good water-power and building-stone, and has manufactures of various kinds. Its mineral spring is quite celebrated. P. of sub-district, 1408.

Preston, county of West Virginia, bounded N. by Pennsylvania and E. by Maryland. Area, 750 sq. m. It is traversed by Cheat River and Baltimore and Ohio R. R. It is mountainous, but very fertile. Live-stock, grain, and wool are important products; lumber and leather are the principal articles of manufacture. Coal abounds and good iron ore is mined. Cap. Kingwood. P. 14,555.

Preston, tp., Sumter co., Ala. P. 1562.

Preston, p.-v. and tp., New London co., Conn., on Thames River. P. 2161.

Preston, p.-v., cap. of Webster co., Ga. P. 186.

Preston, tp., Richland co., Ill. P. 1083.

Preston, tp., Union co., Ill. P. 629.

Preston, p.-v. and tp., cap. of Fillmore co., Minn., near Southern Minnesota R. R., has 1 weekly newspaper. P. 1498.

Preston, p.-v. and tp., Jasper co., Mo. P. 1174.

Preston, tp., Platte co., Mo. P. 1692.

Preston, p.-v. and tp., Chenango co., N. Y. P. 957.

Preston, p.-v. and tp., Wayne co., Pa. P. 1400.

Preston, tp., Adams co., Wis. P. 161.

Preston, tp., Trempealeau co., Wis. P. 955.

Preston (ALEXANDER R.), M. D., b. in Washington co., Va., Dec. 8, 1805; received his medical degree from Transylvania University, Lexington, Ky., 1827; first practised at Bellefonte, Ala.; then returned to Virginia, and settled in Abingdon; subsequently attended lectures in both the University of Pennsylvania and Jefferson Medical College, Philadelphia; also represented his county in the legislature, and was president of the Abingdon Medical Society at his death, Mar. 5, 1874. PAUL F. EVE.

Preston (ISAAC TRIMBLE), b. in Virginia in 1793; graduated at Yale College 1812; studied law under Judge Tapping Reeve at Litchfield, Conn., and under William Wirt; was a captain in the war with England; became an eminent lawyer at New Orleans, La., and a judge of the supreme court of Louisiana. D. at New Orleans, from the effects of a steamboat accident on Lake Pontchartrain, July 5, 1852.

Preston (JAMES P.), b. in Virginia in 1775; studied 1790–95 in William and Mary College; became colonel 12th Infantry 1812; colonel 23d Infantry 1813; was disabled for life at Chrystler's Field by a wound; governor of Virginia 1818–19; long the postmaster of Richmond, Va. D. at Smithfield, Va., May 4, 1843.

Preston (JOHN S.), b. near Abington, Va., Apr. 20, 1809, brother of W. C. Preston; studied at Hampden-Sidney College, the University of Virginia, and the Cambridge (Mass.) Law School; married a daughter of Gen. Wade Hampton 1830; became a wealthy planter and leading orator of the extreme States Rights school, residing chiefly in Columbia, S. C.

Preston (MARGARET **Junkin**), b. about 1835, daughter of Rev. George Junkin, and wife of Col. J. T. L. Preston, professor in the Virginia Military Institute, is author of *Silver Wood, a Book of Memories* (1856), *Beechenbrook, a Rhyme of the War* (1866), *The Young Ruler's Question* (1869), and other writings in prose and verse, chiefly upon topics connected with the civil war. Her translation of the *Dies Iræ*, which appeared in 1855, has been highly commended.

Preston (THOMAS SCOTT), b. at Hartford, Conn., July 23, 1824; graduated at Trinity College, Hartford, 1843; entered the Protestant Episcopal ministry 1846; became a Roman Catholic 1849, a priest 1850; was appointed vicar-general and chancellor of the diocese of New York and parish priest of St. Anne's, New York; author of *Ark of the Covenant* (1860), *Life of St. Mary Magdalene* (1861), *Sermons for the Seasons* (1864), *Life of St. Vincent de Paul* (1866), *Christian Unity* (1866), *Purgatorian Manual* (1867), *Reason and Revelation* (1868), *Christ and the Church*, etc.

Preston (WILLIAM), b. at Louisville, Ky., Oct. 16, 1816; studied at the college at Bardstown, Ky., and at New Haven; graduated at the Cambridge Law School 1838; practised law at Louisville, Ky.; served as lieutenant-colonel in the Mexican war; was a Whig member of the Kentucky constitutional convention of 1850, of the State legislature 1850–51, and of Congress 1851–53; became a Democrat on the dissolution of the Whig party; took part in the convention which nominated Buchanan for the Presidency; was minister to Spain 1859–61; endeavored to induce the State of Kentucky to secede from the Union, which object was claimed to have been accomplished by a convention assembled at Russellville; proceeded to Richmond as a commissioner to negotiate the admission of Kentucky into the Southern Confederacy; became a brigadier-general in the Confederate army and aide-de-camp to his brother-in-law, Gen. A. Sydney Johnston; participated in the battle of Shiloh and in Bragg's invasion of Kentucky.

Preston (WILLIAM BALLARD), b. in Virginia about 1810; was a Whig member of Congress 1847–49, secretary of the navy in the administration of Pres. Taylor 1849–50, and a senator in the Congress of the Confederate States. D. in Montgomery co., Va., Nov. 14, 1862.

Preston (WILLIAM CAMPBELL), LL.D., b. at Philadelphia Dec. 27, 1794, son of Hon. Francis Preston of Virginia; graduated in 1812 at the South Carolina College; studied law under William Wirt and in Edinburgh; came to the bar in 1820, and in 1822 settled at Columbia, S. C.; entered Congress in 1824; U. S. Senator 1834–42; president of South Carolina College 1845–51; founder of the Columbia Lyceum; an able parliamentarian, legislator, and public speaker, and long a prominent expounder of free trade and the States Rights doctrine. D. at Columbia, S. C., May 22, 1860.

Preston (WILLARD), D. D., b. at Uxbridge, Mass., May 29, 1785; graduated at Brown University 1806; practised law several years at Providence; afterward studied for the ministry; was pastor of a Presbyterian church at St. Alban's, Vt., 1811–16, at Providence 1816–20; became president of the University of Vermont 1825; removed to Georgia for his health 1829; preached for a time at Milledgeville and other towns; became in 1831 pastor of a church at Savannah, where he remained until his death, Apr. 26, 1856.

Prestonburg, p.-v., cap. of Floyd co., Ky., on W. fork of Big Sandy River. P. 179.

Preston Corners, v., Preston tp., Chenango co., N. Y. P. 102.

Preston Hollow, p.-v., Rensselaerville tp., Albany co., N. Y. P. 284.

Preston Lake, tp., Renville co., Minn. P. 198.

Prestonpans', v. in Haddingtonshire, Scotland, is famous as the place where, on Sept. 21, 1745, the Pretender routed the royal troops under Cope.

Pres'tonville, v., Carroll co., Ky. P. 239.

Prestwich (JOSEPH), F. R. S., b. at Clapham, near London, England, Mar. 12, 1812; educated at University College, London; engaged in business pursuits in that city, but devoted much time to geological researches; was the first to show on geological evidence the contemporaneousness of man with the fossil Mammalia; received medals from the Geological Society 1849, the Royal Society 1865, and the Institute of Civil Engineers for his contributions to science published in their respective periodicals; has been repeatedly appointed by the government on scientific commissions; was president of the Geological Society 1870–72, vice-president of the Royal Society 1870–71, and became professor of geology at Oxford University June 29, 1874.

Presump'tions [Lat. *præsumptio*], in law. In its technical sense, as a word of legal nomenclature, this term denotes the inferences or conclusions that particular facts exist or have existed, derived by the law—that is, by force of a legal rule—from the existence of certain other facts which have been established in an independent and satisfactory manner; if the existence of facts *a* and *b* has been sufficiently proved by ordinary evidence, and the law, as a consequence thereof, and without the aid of any further proof, thereupon infers that facts *c* and *d* also exist, this conclusion is a presumption. The presumptions contained in our law are based partly upon the general experience of mankind, and partly upon motives of public policy; and their admission is absolutely necessary to an orderly and enlightened administration of justice. It is plain from the foregoing definition that the phrase "presumptions of fact," which is sometimes used to describe the inferences drawn from evidentiary or probative matter—not

by the operation of any legal rule, but by the ordinary processes of reasoning—is a misnomer. The very distinguishing feature in this class of cases is the absence of all presumptions; the mind is left free to act, and the reason pursues its logical methods, and thus reaches its results unaided and uncontrolled by any requirement or rule of the law. The correct classification of presumptions is twofold—"conclusive" (*juris et de jure*), and "rebuttable" (*juris, primâ facie*). Conclusive presumptions are those legal inferences from existing facts which, from motives of public policy, the law does not suffer to be contradicted or overthrown by any evidence. Rebuttable or *primâ facie* presumptions are those legal inferences drawn from existing facts which may be controverted and destroyed by opposing evidence, but which are effectual and conclusive until thus rebutted. The number of the former class is comparatively small, and the progress of the law in improvement is marked by a transformation of many conclusive into rebuttable presumptions. The number of the second class is very large, and without their existence an enlightened administration of justice would be impossible. JOHN NORTON POMEROY.

Pretender (THE OLD AND THE YOUNG), the names given by writers and other supporters of the Brunswick dynasty to the son and grandson of James II., the lineal heirs to the throne of England, which they respectively attempted to recover by means of the "Jacobite" insurrections in Scotland in 1715 and 1745. (See articles JAMES FRANCIS EDWARD STUART and CHARLES EDWARD.)

Preven'tion of Cruelty to Animals, Society for the. So late as 1865 there existed no statutory laws in any part of the U. S. for the protection of animals from cruelty. Until about that period they were regarded by the common law simply as property. Deeply impressed with the injustice and immorality of such neglect, Mr. Henry Bergh of New York at that time initiated a reform, the result of which is that at present thirty-two States of this Union have enacted similar laws to those of New York, and have chartered numerous societies, all of which have accepted and adopted the seal of the first or parent one. The movement inaugurated by him was begun by preparing a circular addressed to the citizens of New York in the following words: "The undersigned, sensible of the cruelties inflicted upon dumb animals by thoughtless and inhuman persons, and desirous of suppressing the same, alike from considerations affecting the moral well-being of society, as well as mercy to the brute creation, consent to become patrons of a society having in view the realization of these objects." Approving of this appeal, seventy of the leading citizens of New York appended their signatures to it; which document is carefully preserved by the society. Incorporating these names in the draft of a charter, the next step was to go to the legislature and ask for its adoption, which was promptly granted, and at the following session the first statutory laws were enacted. That the enforcement of these acts in the beginning was attended with much difficulty and some danger will readily be imagined when it is remembered that they seemed to invade the fundamental principle of property and ownership. Time and reflection have, however, dissipated this prejudice almost entirely, assisted, doubtless, by the discretion and forbearance of those to whom the exercise of authority has been confided. That the institution is productive of great moral as well as material results no reasonable person will deny. Its restraining influence over the passions of the violent and unreflecting is shared alike by mankind and the lower animals; and now that its benign operations are recognized, it is a source of wonder that it had not been organized before. HENRY BERGH.

Pre'vesa, town of European Turkey, eyalet of Janina, on the Gulf of Arta, has a good harbor, though it is not accessible to large vessels. P. 5000.

Prevost' (AUGUSTINE), b. at Geneva, Switzerland, about 1725, of an English father and French mother; entered the British army, serving under Wolfe at Quebec and in the war of the American Revolution; attained the rank of major-general in consequence of his capture of the fort at Sunbury, Ga., Dec., 1778; defeated Gen. Ashe at Brier Creek Mar., 1779; was foiled in an attempt to capture Charleston May, 1779, and successfully defended Savannah against the Americans Oct., 1779. D. at Bernett, Eng., May 5, 1786.

Prevost (GEORGE), son of Gen. Augustine, b. at New York May 19, 1767; entered the British army in youth; served in the West Indies; was made major-general and a baronet 1805; lieutenant-governor of Nova Scotia 1808; was second in command at the capture of Martinique, and in June, 1811, was appointed to the chief civil and military command of British North America, with the rank of lieutenant-general. In this capacity he had to provide for the defence of Canada against American invasion during the second war with England, and acquitted himself with credit, though defeated at Plattsburg Sept. 11, 1814, after which he returned to England. D. Jan. 5, 1816.

Prévost' (PIERRE), b. at Geneva Mar. 3, 1751; was made professor there of philosophy in 1793, of natural science in 1810. D. Apr. 8, 1839. He was the inventor of the theory relating to radiant heat, called Prévost's theory of exchanges, and wrote *De Calorique rayonnant* (1809), besides other works.

Prevost-Paradol' (LUCIEN ANATOLE), b. at Paris Aug. 8, 1829; became professor of French literature in Arx in 1855; was a frequent contributor to various Parisian journals, and wrote *Révue de l'Histoire universelle* (1854), *Du Rôle de la Famille dans l'Education* (1857), *Essais* (3 vols., 1859–63), *Quelques pages d'Histoire contemporaine* (4 vols., 1862–66), *La France nouvelle* (1868). In 1870 he went as ambassador to Washington, where he committed suicide July 19, 1870.

Priacanth'idæ [from *Priocanthus;* Gr. πρίον, "saw," and ἄκανθα, "spine"], a family of fishes of the order Teleocephali and sub-order Acanthopteri, distinguished by their very large eyes and small rough scales. The body is oval and compressed; the scales small, closely adherent, and roughly ctenoid; the lateral line continuous with the back; the head compressed and scaly to the jaws; the opercula armed; the mouth with a large oblique lateral cleft; teeth villiform on the jaws as well as palate; gill-openings continuous below; branchiostegal rays seven; dorsal fin single, with its spinous portion longest; anal armed with three spines; pectorals with branched rays; ventrals each with a spine and five rays; the skeleton has 9 + 13 vertebræ. Over twenty species are known from different tropical seas, in all of which some species are found. They are generally of a reddish color, and in addition to the large eyes are readily recognizable by the peculiarly rough scales which extend on the snout and jaws. THEODORE GILL.

Pri'am was the last king of Troy, the husband of Hecuba, and the father of Hector, Paris, Cassandra, etc.

Price, tp., Monroe co., Pa. P. 259.

Price (BONAMY), b. in the island of Guernsey May 22, 1807; graduated at Worcester College, Oxford, 1829; became assistant master at Rugby School 1831, and professor of political economy at Oxford University 1868. Prof. Price is a distinguished representative of free-trade doctrines, which he presented to the American public in 1874 in a series of lectures. Author of *The Principles of Currency* (1869) and of many articles in reviews and magazines.

Price (RICHARD), D. D., LL.D., F. R. S., b. at Tynton, Glamorganshire, Wales, Feb. 22, 1723; educated at Talgarth and Coward's academy in London; became a Presbyterian minister; was chaplain to a Mr. Streatfield at Stoke Newington 1743–56, and pastor of churches at Hackney and Newington Green for the remainder of his life, acting also for some time as professor of mathematics in the Hackney academy. D. in London Apr. 19, 1791. Author of many papers in the *Philosophical Transactions*, and of numerous theological, economical, and political publications, among which were *A Review of the Principal Questions and Difficulties in Morals* (1758), *Observations on Reversionary Payments, Annuities, etc.* (1769), *An Appeal to the Public on the Subject of the National Debt* (1772), *The Nature and Dignity of the Human Soul* (1776), *Observations on the Nature of Civil Liberty, Principles of Government, and the Justice and Policy of the War with America* (1776), *Additional Observations, etc.* (1777), *An Essay on the Present State of Population in England and Wales* (1779), and *Observations on the Importance of the American Revolution* (1784). William Pitt was much indebted to Dr. Price's publications for his financial projects, especially that in regard to a sinking fund. The pamphlets on American affairs forcibly and eloquently advocated the claims of the colonists to an ample redress of grievances, and 60,000 copies of the first pamphlet on this subject were sold in a few months. It was reprinted at Boston, and led to an invitation from the American Congress, through Dr. Franklin, to settle in America (1778). Yale College conferred on him in 1783 the degree of LL.D. Dr. Price's various writings on the doctrine of chances, annuities, and the duration of life entitle him to a high place among the founders of the science of vital statistics, and his financial publications give him similar rank in regard to political economy. In religious opinions he was a precursor of the Unitarian movement, agreeing in many things with his friend Dr. Priestley, with whom, however, he maintained an epistolary controversy upon the doctrines of materialism and philosophical necessity, published by the latter in 1778. (See his *Memoirs*, by his nephew, William Morgan, F. R. S., 1815.)

Price (RODMAN M.), b. in Sussex co., N. J., Nov. 5, 1816; educated at Princeton College; studied law; became purser in the U. S. navy 1840; was the first person who exercised judicial authority as alcalde under the American flag in California; was appointed navy agent on the Pacific coast 1848; was member of Congress from New Jersey 1851–53, governor of that State 1854–57; was instrumental in founding the New Jersey Normal School, and was a delegate to the "Peace Congress" of 1861.

Price (STERLING), b. in Prince Edward co., Va., in Sept., 1809; settled in Charlton co., Mo., 1830; served in the legislature; was member of Congress 1845–47; colonel of Missouri volunteers in the Mexican war; captured Taos, N. M.; commanded at the battle of Canada, N. M., Jan. 24, 1847; was made brigadier-general July 20, 1847, and appointed military governor of Chihuahua; gained the battle of Santa Cruz de Rosales Mar. 16, 1848; was governor of Missouri 1853–57; became a leader of the secession party; presided over the State convention of Feb., 1861; was appointed major-general of the State forces by Gov. Claiborne F. Jackson, and endeavored to precipitate the withdrawal of Missouri from the Union; was foiled in his purpose by the promptness and loyalty of F. P. Blair and Nathaniel Lyon in compelling the surrender of the State Guard at St. Louis; withdrew to Boonville and Carthage; recruited an army of nearly 10,000 men, and being joined by McCullough with 5000 from Arkansas, defeated Lyon and Sigel at Springfield Aug. 7; quarrelled with McCullough, who withdrew his forces; captured Lexington, with 3000 prisoners, after a four days' siege, Sept. 20, for which he was thanked by the Confederate congress; was soon forced to retreat into Arkansas; was appointed major-general in the Confederate service Mar., 1862; took part in the battles of Pea Ridge, Iuka, and Corinth; was in command of the department of Arkansas 1863–64, when he entered into a combination with Vallandigham and other Northern sympathizers, founding the secret organization known as Knights of the Golden Circle, of which he was "grand commander," and to which nearly 25,000 Missourians had associated themselves; invaded Missouri Sept., 1864, advancing with nearly 20,000 men as far as Pilot Knob, but failed to rally the Knights to his standard on account of the vigilant measures taken by Gen. Rosecrans in the discovery and repression of the plot; presented himself before Jefferson City and pushed westward to the Kansas border, but being closely pursued by Pleasonton and Curtis, had to retreat to Arkansas, thereby terminating in disaster a movement which had been expected to result in the conquest of Illinois and other loyal States. After the war Gen. Price went to Mexico, obtained from the archduke Maximilian a grant of lands near Córdova, and founded a colony of ex-Confederate officers; but the downfall of Maximilian having involved that of the colony, he returned to Missouri early in 1867 in poverty and broken health, and d. at St. Louis Sept. 27, 1867.

Price (THOMAS), b. at Pencaerelin, Brecknockshire, Wales, Oct. 2, 1787; became curate of Llangenny 1812, vicar of Cwmdu 1825, and subsequently perpetual curate of Tretower until his death, at Cwmdu Nov. 7, 1848. Skilled in music and drawing, he was an enthusiastic investigator of Welsh history, literature, and antiquities; author of a *History of Wales* (in Welsh, 1836–42), and numerous essays collected in 2 vols. of his *Literary Remains* (1854–55), edited, with a *Memoir*, by Jane Williams.

Price (UVEDALE), BART., b. at Foxley, Herefordshire, England, in 1747; was educated at Oxford; published a translation of Pausanias (1780), and won celebrity by his *Essay on the Picturesque* (1794) as applied to the art of landscape-gardening. Made a baronet in 1828. D. at Foxley Sept. 11, 1829.

Price'town, p.-v., Salem tp., Highland co., O. P. 117.

Prich'ard (JAMES COWLES), M. D., b. at Ross, Herefordshire, England, Feb. 11, 1786; resided in youth at Bristol, where he received an excellent education under private tutors; displayed an early predilection for the study of the varieties of mankind; studied medicine at Bristol, London, and Edinburgh; pursued a course of mathematics and theology at Trinity College, Cambridge, and other special studies at St. John's and Trinity colleges, Oxford; commenced practice as a physician at Bristol in 1810, and received medical appointments at the Clifton Dispensary, St. Peter's Hospital, and the Bristol Infirmary. In 1813 he published his chief work, *Researches into the Physical History of Mankind*, which was much enlarged in the 2d (1826) and 3d eds. (5 vols., 1836–47). Dr. Prichard then applied himself to philology, and produced his standard treatise on *The Eastern Origin of the Celtic Nations* (1831). In 1843 he issued his *Natural History of Man;* became in 1845 commissioner in lunacy; was for many years president of the Ethnological Society, and published several works on medical subjects. D. at London Dec. 22, 1848. Dr. Prichard was a leader in the science of comparative philology, and is regarded as the greatest of modern ethnologists. His *Natural History of Man* appeared in a 4th ed. in 1855, ably edited and enlarged by Dr. Edwin Norris, and his work on the *Celtic Nations* was edited by Dr. R. G. Latham in 1857.

Prick'ly Ash, or **Toothache Tree,** the *Xanthoxylum Americanum*, a large prickly shrub found in most parts of the U. S., and belonging to the Rutaceæ. The leaves have the smell of lemons. The bark is aromatic and stimulant, and is used as a remedy for toothache, for rheumatism, and other diseases. *X. Carolinianum*, the Southern prickly ash, has a more southern range. It becomes quite a large tree. Its bark is extremely pungent, and is armed with curious prickly warts. *X. Floridanum* and *X. pterota* grow also in Florida. China, Japan, South America, and the West Indies abound in species of this genus, nearly or quite all aromatic, pungent, and medicinal.

Prickly Heat, a popular name for eruptive skin diseases, occurring in hot weather and characterized by itching and sensations of stinging. In India there is quite a formidable variety of lichen called by this name. A popular remedy is the use of saline cathartics, which doubtless are sometimes advantageous. Frequent bathing and the avoidance of exposure to the sun's rays are recommended.

Prickly Pear, a name given the cactuses of the genus *Opuntia*, especially to *O. vulgaris*, a native of many places in the U. S. from Massachusetts southward and westward. It is naturalized extensively in the Old World. Its fruit is smooth and eatable, but not so good as that of *O. Ficus Indicus*, which is prickly. Some of the numerous species are used for forage in Mexico. The erect kinds are serviceable hedge-plants. One species is the official emblem of Mexico. Some prickly pears support the cochineal insect.

Prid'eaux (HUMPHREY), D. D., b. at Padstow, Cornwall, England, May 3, 1648; educated at Westminster School; graduated at Christ Church, Oxford, 1672; published a Latin account of the Arundelian marbles, *Marmora Oxoniensia* (1676); became rector of St. Clement's, Oxford (1679); prebendary of Norwich 1681, archdeacon of Suffolk 1688, and dean of Norwich 1702. D. at Norwich Nov. 1, 1724. Author of a *Life of Mahomet* (1697), once very popular, and of *The Connection of the History of the Old and New Testaments* (4 vols., 1715–18), which is still found useful.

Prideaux (JOHN), b. in Devonshire, England, in 1718; entered the British army at an early age; took part in the battle of Dettingen 1743; served in America against the French; became colonel of the 55th Foot Oct. 28, 1758, and brigadier-general May 5, 1759; was in command of the expedition sent against Fort Niagara in the summer of that year; effected a landing July 7, and prepared for a regular siege, but was killed in the trenches by the accidental bursting of a gun July 19, 1759. The fortress surrendered four days later to Sir William Johnson, the successor of Prideaux in command.

Pride of China. See CHINA, PRIDE OF.

Prie'go, town of Spain, province of Cordova, is beautifully situated in the Sierra Morena, and has some tanneries, potteries, and silk manufactures. P. 8502.

Priess'nitz (VINCENT), b. at Gräfenberg, Austrian Silesia, Oct. 5, 1799, of peasant parents; became the inventor of hydropathy and the founder of the Gräfenberg water-cure, which he administered till his death, Nov. 28, 1851. (See HYDROPATHY.)

Priest [Gr. πρεσβύτερος, "elder"]. In all nations of antiquity among whom a system of worship received any considerable development there existed also a system of priesthood, to whose care that worship was more especially committed. The priest stood in a sort of mediatorial relation between God and man, and under the Hebrew legislation this was divinely recognized and received the emphatic sanction of divine appointment. In earliest times the functions of the priest appear to have been discharged by the head of the family, who, as the recognized superior of all its members, was the fittest person to appear for them before God. Hence came what is called the "patriarchal priesthood." As the family multiplied into the tribe the duties of its head became too numerous for the proper discharge of the priesthood, as well as often incongruous, and persons were specially selected to fill the office, as in the case of Jethro, "the priest of Midian." When the tribe became a nation a class of men was set aside for the same purpose, although the monarch often remained at the nominal head of the priesthood thus established, as was the case in Egypt. Among the most ancient nations, India, Egypt, and the Hebrews, the priesthood was hereditary, and in the two

former constituted a class distinctly separated in their whole life from the rest of the nation, and in Egypt endowed with large landed estates and great wealth. Among the Hebrews, on the contrary, the priests were only allowed cities necessary for their residence, and were cut off from other inheritance in land among the tribes of Israel. They were only in so far a caste as was necessary for the discharge of their duties, and in all other respects were on the same footing as their fellow-citizens, it being especially noteworthy that all were entirely equal before the law. Their support was provided for by a tithe from the Levites of the tithes received by them from the whole body of the people, and also by assigned portions of most of the sacrifices. As there was no provision in the Hebrew law for the enforcement of the payment of the tithes, their income was dependent upon the general fidelity of the people. The especial function of the Aaronic priesthood was to come near to God—themselves of the people, yet specially sanctified on their behalf to approach God and obtain from him pardon and blessings for their brethren. Hence, their chief characteristic must be holiness, which was set forth in the Levitical law in every possible symbolical way, as well as directly commanded. The first of all their duties was the offering of sacrifice, thus "making atonement for the people." No sacrifice could be offered or incense burned without their intervention. They had also, as naturally connected with this, the general care of the sanctuary and the multitudinous duties flowing from this; and, as being themselves especially trained in the Law, to them was assigned the duty of teaching it to the people. They had, however, little or nothing of the *pastoral* relation toward the people; their duties were almost wholly official. Their qualifications were—Aaronic descent, perfect physical formation, and during their ministrations freedom from legal uncleanness and abstinence from wine and intoxicating drinks. There was no limitation of age. In marriage they were only restricted to virgins or widows of one of the tribes of Israel. When largely multiplied, in the time of David and Solomon, they were divided into twenty-four courses, which were placed on duty each one week in turn. When on duty, like the Egyptian priests, they wore linen robes and were unshod. The whole order culminated in the high priest, whose office was also hereditary, and who by the magnificence of his official robes was marked as very much elevated above his brethren. He was peculiarly the appointed mediator as a type of the promised Redeemer to come, and alone once in every year entered the Holy of holies. He could marry only a virgin within the priestly family. Later there was a "second priest" or vice high priest. The whole Hebrew priesthood, having its main function in the "making of atonement," necessarily ceased with the coming of Christ. Consult Kalisch, *Preliminary Essay to Lev. viii.*; Küper, *Das Priesterthum des alten Bundes.* FREDERIC GARDINER.

Priest'ley (JOSEPH), LL.D., b. at Birstal-Fieldhead, near Leeds, England, Mar. 24, 1733 (N. S.), was son of a cloth-dresser; lost his mother at the age of six years; was adopted by an aunt, Miss Keighley, by whom he was placed at a free grammar school; completed his education at the Presbyterian academy at Daventry (afterward Coward College, and now united with New College, London); obtained by private study a good knowledge of the classics and modern languages, to which he added Hebrew and the rudiments of Chaldaic, Syriac, and Arabic; rejected some points of the Calvinistic theology before entering college, but was ordained in 1755 assistant minister to an Independent congregation at Needham-Market, Suffolk; left that post in 1758 on account of having discarded the doctrine of the atonement and adopted Socinian (*i. e.* Unitarian) views; taught a private school at Nantwich, Cheshire, 1758–61, making there numerous experiments in physics, and writing his first published work, *The Scripture Doctrine of Remission* (1761); was teacher of languages and literature in an academy at Warrington 1761–67, during which period he married Miss Wilkinson; wrote several small treatises on grammar and educational method; made the acquaintance of Dr. Richard Price and of Dr. Franklin, and prepared, at the instance of the latter, his *History and Present State of Electricity, with Original Experiments* (1767), which procured him the degree of LL.D. from the University of Edinburgh and an election as member of the Royal Society; was pastor of Mill-Hill Chapel, Leeds, 1767–73; made there important researches in pneumatics and chemistry, which he gave to the world in his *Directions for Impregnating Water with Fixed Air* (1772) and *History and Present State of Discoveries relating to Vision, Light, and Colors* (2 vols., 4to, 1772); engaged to accompany Capt. Cook as chaplain on his second voyage, which he was prevented from doing on account of objection being made to his theological views; published his *Institutes of Natural and Revealed Religion* (3 vols., 1772–74), which he had begun eighteen years before; was from 1773 to 1780 librarian and literary companion to the earl of Shelburne, whom he attended in 1774 in a tour on the Continent; made in that year the discovery of oxygen (called by him dephlogisticated air), soon followed by that of nitrous, carbonic, and sulphurous oxide and other gases, besides many ingenious contributions to theoretical chemistry set forth in his *Experiments and Observations on Different Kinds of Air* (3 vols., 1774–77); published *An Examination of Dr. Reid's Inquiry into the Human Mind* (1774), *Hartley's Theory of the Human Mind* (1775), *A Harmony of the Evangelists*, in Greek (1777), *Disquisitions relating to Matter and Spirit* (1777), *The Doctrine of Philosophical Necessity* (1777), and *A Free Discussion of the Doctrines of Materialism and Philosophical Necessity in a Correspondence between Dr. Price and Dr. Priestley* (1778). The three latter works excited much controversy and elicited many replies, in which the author was, with some reason, accused of materialism; but it must be admitted that his doctrines, as has been well observed, tend quite as much to spiritualize matter as to materialize spirit. In 1780, Dr. Priestley retired from the service of Lord Shelburne with a life-pension of £150, became minister to the principal Independent congregation at Birmingham, and addressed to an eminent Frenchman his *Letters to a Philosophical Unbeliever*, in which he contended strongly for the doctrines of a revelation and a resurrection, which were followed by his celebrated *History of the Corruptions of Christianity* (2 vols., 1782), *History of Early Opinions concerning Jesus Christ, compiled from Original Writers, proving that the Christian Church was at first Unitarian* (4 vols., 1786), *Familiar Letters to the Inhabitants of Birmingham* (1790), *General History of the Christian Church* (2 vols., 1790), and *Letters to Burke, occasioned by his Reflections on the Revolution in France* (1791). The latter treatise procured him an honorary citizenship in the French republic, and was the cause of a riot at Birmingham (July 15, 1791), in which Dr. Priestley's house was pillaged and his library, manuscripts, and scientific apparatus scattered through the streets, he himself escaping personal violence by opportune flight. For three years he resided at Hackney as the successor of Dr. Price, instituted a suit for compensation for his losses, in which he was successful after nine years' delay, and in 1794 removed to the U. S., where his sons already resided. Arriving at New York June 4, he settled on his son's farm at Northumberland, Pa., where he passed the remainder of his life, wrote replies to Volney and Paine and several other works of little comparative importance, the most elaborate being *Notes on all the Books of Scripture* (Northumberland, 4 vols., 1803). He declined a professorship in the University of Pennsylvania, but occasionally preached at Philadelphia, and delivered there two series of *Discourses relating to the Evidences of Revealed Religion* (1796–97). D. at Northumberland Feb. 6, 1804. His autobiographical *Memoirs*, with a continuation by his son, appeared in 1806, and a collection of his *Theological and Miscellaneous Works* (26 vols., Hackney, 1817–32) was edited by John Towell Rutt, vols. i. and ii. being composed of his *Life and Correspondence.* Statues of Dr. Priestley have been erected at Oxford (1860) and at Birmingham, the latter on Aug. 1, 1874, the centennial of the discovery of oxygen. This anniversary was celebrated by a gathering of American chemists at Northumberland, Pa. A bibliography of Dr. Priestley's productions, prepared at Washington (1875), gives the titles of more than 300 separate publications. In character Dr. Priestley was irritable and somewhat vain, but he was unquestionably actuated by high motives and had the courage of his opinions. PORTER C. BLISS.

Priests of the Oratory. See ORATORY, CONGREGATION OF THE.

Priests of the Mission. See LAZARISTS, PAULISTS, PASSIONISTS, REDEMPTORIST FATHERS.

Priloo'ki, town of European Russia, government of Poltava, on the Udai, has 8771 inhabitants, who are mostly employed in the cultivation and manufacturing of tobacco.

Prim (JUAN), count of Reus and marquis of Castillejos, b. in Reus, Catalonia, Spain, Dec. 6, 1814; entered the Spanish army in boyhood; obtained rapid promotion during the first Carlist war; became colonel in 1837; was soon afterward elected to the Cortes, where he became prominent as a leader of the Progresistas against the administration of Espartero, was accused of conspiracy 1842, when he took refuge in France; headed insurrections in the following year at Reus; materially aided in the overthrow of Espartero by Narvaez, and in effecting the return of Queen Maria Cristina, who rewarded him with the title of count, the rank of general, and the military command of Madrid; fell into disfavor in the following year on account of his failure to act with energy against the rebels of Cata-

lonia; was accused of treason Oct., 1844, tried, and sentenced to six years' imprisonment; was soon pardoned; acted a short time as governor of Puerto Rico; served as a volunteer in the Turkish army on the Danube 1853–54; published an account of his experiences in the East; was commander-in-chief in the war against Morocco 1859–60, gaining a great military reputation and the title of marquis; was made commander of the Spanish contingent in the allied intervention in Mexico 1861, but soon withdrew his forces from that enterprise, much to the displeasure of Napoleon; visited the Army of the Potomac on his way back to Spain; successfully defended his conduct in the Cortes, denouncing the ambitious plans of the French emperor; was banished from Madrid Aug., 1864; devoted himself thenceforth to the overthrow of Isabella, for which object he entered into various combinations and headed several unsuccessful insurrections, especially that of Jan., 1866, in Aragon and Catalonia, but ultimately succeeded in organizing the movement which in Sept., 1868, through the aid of Serrano and Topete, resulted in the flight of the queen to France; was welcomed with enthusiasm at Madrid; became commander-in-chief, marshal, minister of war, and head of the cabinet in the new provisional government; conducted several negotiations for founding a new dynasty in Spain; furnished the pretext for the Franco-German war of 1870–71 by his offer of the crown of Spain to Prince Leopold of Hohenzollern, and in the autumn of 1870 obtained from the Cortes the election of the Italian prince Amadeus, duke of Aosta. On the day that the new king landed at Barcelona (Dec. 28) Prim was attacked by assassins in a street of Madrid, and received eight balls in his body, and d. two days later (Dec. 30, 1870). His memory was magnificently honored by the new king, and a fine monument was erected in 1875 over his remains in the Atocha church at Madrid.

PORTER C. BLISS.

Pri'mate [Lat. *primus*, "first"], originally, in the ecclesiastical system of the Roman Catholic Church and the Church of England, the first in rank of the archbishops in a country. Thus, in England the archbishop of Canterbury was long primate, but at present the archbishop of York is styled "primate of England," while Canterbury takes the higher title of "primate of all England." The Anglican archbishop of Dublin has the title of "primate of all Ireland," and the Anglican and Roman Catholic archbishops of Armagh are both called "primate of Ireland." Five or six French prelates are called primates, but the archbishop of Lyons is "primate of primates." Again, the archbishop of Braga is primate of Portugal, although inferior in rank to the patriarch of Lisbon. These facts indicate that the office of primate has to some extent become a titular one, or at least a mere indication of a comparatively unimportant precedence.

Pri'mates [Lat. *primus*, "first"], an order of monodelph mammals including man, the monkeys, and the lemurs. These are all externally distinguished by the fore as well as hind limbs being completely or almost entirely exserted outside of the common integument, and thus distinguished from the ordinary quadrupeds, in which the proximal joints are enclosed therein; the members have also generally five digits, developed on the hands as well as feet; the innermost or first of the hand or fore foot being the thumb, which is, however, frequently suppressed, and the corresponding and innermost digit of the foot being thickened and generally opposable like the thumb to the other digits, only in man assuming parallelism with them; this great toe is always furnished with a depressed nail; the teeth are not distinctive, being modified according to several types; they are, however, at least in one stage, incisors, canines, and molars; of the incisors there are in each jaw generally four, and never more, although they may be reduced to two, or all in the upper jaw may be suppressed; the clavicles are always completely developed and co-ordinated with the development of distinct shoulders and their distance from each other; the brain has a large cerebrum, which completely overlaps the olfactory lobes in front, and behind more or less covers the cerebellum: on the interior surface of each hemisphere behind a peculiar sulcus (the so-called calcarine) exists, which is co-ordinated with the development of a raised portion (the hippocampus minor) within the posterior corner of the ventricle by which the posterior lobe of the cerebrum is traversed. The order as thus distinguished includes two sub-orders —(1) Anthropoidea, comprising the families Hominidæ (man), Simiidæ (the large tailless apes), Cercopithecidæ (the Old-World monkeys, baboons, etc.), Cebidæ (the common New-World monkeys), and Mididæ (the marmosets, etc.); and (2) Prosimiæ, with the families Lemuridæ, Tarsidæ, and Daubentonidæ. The order, as thus limited and defined, is the result of studies of recent zoologists. Linnæus, who framed the name, embraced under it, in addition to the forms above indicated, all the Cheiroptera and *Galeopithecus*. By Cuvier and his numerous followers the true Primates were differentiated into two orders—Bimana (including man) and Quadrumana (including the monkeys and lemurs). The naturalness of the association of man with the monkeys is now almost universally conceded, and the main question in dispute at the present time is whether those forms (the anthropoids) should be associated with the lemuroids in a single order, or the two distinguished as independent orders. The differences between them are certainly great, and the recent discovery by Alphonse Milne-Edwards of the peculiarities of their placentas adds greatly to the arguments in favor of their separation, and the question is a very evenly balanced one. (See further the names of the sub-orders and families.) THEO. GILL.

Prime (BENJAMIN YOUNG), M. D., b. at Huntington, L. I., Dec. 20, 1733; graduated at Princeton 1751; was tutor there 1756–57; studied medicine at Leyden, Holland, where he also devoted much time to the acquisition of languages; settled as a physician at New York 1764; published a volume of poems, *The Patriotic Muse* (London, 1764); wrote political songs and ballads which were widely circulated during the war of the Revolution, and *Columbia's Glory* (1791), a poem on the Revolution. D. at New York Oct. 31, 1791. In 1838 a volume entitled *Muscipula Cambryomachia* was printed at Newburg, containing poems, translations, and miscellanies by Dr. Prime in several languages, including Hebrew.

Prime (EDWARD DORR GRIFFIN), brother of Dr. S. I. Prime, b. at Cambridge, N. Y., Nov. 2, 1814; graduated at Union College 1832 and at Princeton Seminary 1838; was pastor of a Presbyterian church at Scotchtown, N. Y., 1839–51; became associate editor of the New York *Observer* 1853; was American chaplain at Rome 1854–55; resumed his editorship 1855, and became one of the proprietors 1865. Author of *Around the World* (1871), a record of extensive travels, and editor of *Forty Years in the Turkish Empire, or Memoirs of Rev. William Goodell, D. D.* (1875).

Prime (NATHANIEL SCUDDER), D. D., son of Dr. Benjamin Young, b. at Huntington, L. I., Apr. 21, 1785; graduated at Princeton 1804; preached several years on Long Island; was pastor of a Presbyterian church at Cambridge, Washington co., N. Y. 1813–30; became principal of the Mount Pleasant Female Academy, Sing Sing, N. Y., 1830, of a similar institution at Newburg 1835, and subsequently taught and preached at several other places. D. at Mamaroneck Mar. 27, 1856. Author of a *Treatise on Baptism* and a *History of Long Island* (1845).

Prime (SAMUEL IRENÆUS), D. D., son of Dr. N. S. Prime, b. at Ballston, N. Y., Nov. 4, 1812; graduated at Williams College 1829; studied theology at Princeton; was ordained to the ministry of the Presbyterian Church, and preached several years, but on account of ill-health withdrew from the pulpit in 1840, when he became editor of the New York *Observer*, the leading religious paper of his denomination—a post he has since retained; has several times visited Europe, and has published some 40 vols., chiefly anonymous. Among his books are *Travels in Europe and the East* (2 vols., 1855), *Letters from Switzerland* (1860), *The Bible in the Levant* (1859), *Memoirs of Rev. Nicholas Murray* (1862), *The Alhambra and the Kremlin* (1873), and a *Life of Samuel F. B. Morse* (1874).

Prime (WILLIAM COWPER), brother of Samuel Irenæus, b. at Cambridge, N. Y., Oct. 31, 1825; graduated at Princeton 1843; became a lawyer in New York; wrote for the *Journal of Commerce*, of which he became in 1861 editor and one of the proprietors; travelled in the East 1855–56, and has published *The Owl Creek Letters* (1848), *The Old House by the River* (1853), *Later Years* (1854), *Boat-Life in Egypt and Nubia* (1857), *Tent-Life in the Holy Land* (1857), and *Coins, Medals, and Seals, Ancient and Modern, Illustrated and Described* (1860; new ed. 1864), besides a monograph on the origin of the familiar hymn "O mother dear, Jerusalem" (1865), and an edition in fac-simile of Albert Durer's *Little Passion* (New York, 1868).

Prime Mov'er. The term "prime mover" is employed to designate machines the office of which is to transform the energy expended in some natural source of power into useful or available work. For example, a quantity of water falling from one level to another represents an expenditure of energy due to the force of gravity, equivalent in foot-pounds to the product of the weight of the water multiplied by the height of fall in feet. In falling without obstruction or resistance the velocity of the water continually increases, and the accumulated energy represented by the living force is usually dissipated in the shock at the bottom of the fall. To render this source of power available, a water-wheel may be introduced, which, receiving the im-

pulses of the falling particles, causes a portion of the work to be transformed into useful work, and the water reaches the bottom of the fall with its energy diminished by precisely the quantity which has been so transferred or transmuted into the work absorbed by the water-wheel.

While prime movers generally have the characteristics of other machines in many respects, yet only a few machines can be classed as prime movers. The definition of a machine given by Ampère, and adopted by Poncelet, Willis, and other writers, is "an instrument by means of which the directions and velocities of given motions are changed;" forces being left out of consideration, because few machines, except the prime movers, are dependent in their construction on the nature or source of the power which drives them. Prime movers are exceptions to this general rule, because their construction and the arrangement of their parts are necessarily dependent on the nature or source of the energy which is to be utilized, their office being primarily that of receiving, transforming, and transmitting power from some natural source, by which means they drive or move other machines. This distinctive feature of this class of machines involves important considerations in the application of scientific principles to their construction. While the "principles of mechanism," based on the science to which Ampère gave the name "kinematics," or science of motion, suffice for the combination of parts of nearly all other machines, the construction of the various prime movers demands the application of nearly the whole range of the physical sciences, and notably of the fundamental theorems of the science of dynamics. Questions of *economy of power* are to be studied mainly in the construction of prime movers, and they are to be regarded from these considerations as something more than mere machines; they are "motors."

The sources of energy in nature which are made available for useful purposes by the aid of prime movers are heat, the energy of falling water, the motions of the atmosphere, and electricity or magnetism. The latter being, however, regarded as referable to heat, and the second and third sources mentioned being manifestations of the force of gravity, the ultimate sources of available energy may be considered to be *heat* and *gravitation*. As regards *muscular* energy, men and animals may be regarded as prime movers—perfect exhibitions, in this respect, of the imperfect results of human efforts in artificial constructions.

The heat-engine, under the form of the steam-engine, holds the first place in importance among all the prime movers. In the investigations and experiments connected with economy in its use and its adaptation to various purposes, especially to the propulsion of steamships, it has engaged the attention of scientific men, practical engineers, and artisans to a greater extent than all others combined; and the developments arising from its use have given rise to a special branch of engineering science. The use of the water-wheel in the form of the turbine, the second prime mover in importance, has been greatly extended through the new facilities afforded for its construction by steam machinery and the arts and industries developed by it. Hot-air engines, gas-engines, and electro-dynamic engines are prime movers more restricted in their applications, but they possess respectively peculiarities which render them advantageous under certain conditions. The windmill is another prime mover which in favorable localities is of great value. Water-engines, in which the construction of the apparatus is nearly identical with some form of the steam-engine, the pressure upon the piston being produced by a head of water, are also "motors" in common use.

W. P. Trowbridge.

Prime Num'bers. A whole number is said to be prime when it cannot be exactly divided by any other whole number except 1. Two numbers are prime with respect to each other when they cannot both be divided by any whole number except 1. Thus, 2, 3, 5, etc. are prime numbers; 6 and 7 are prime with respect to each other. No rule has been found for discovering prime numbers by a direct process. A method of sifting out numbers not prime was described by Eratosthenes, and for that reason is generally known as Eratosthenes's sieve. The method is as follows: Since every even number is divisible by 2, we may omit or sift out all such numbers, and remembering that 2 itself is prime, we write down the series of odd numbers up to any limit, say up to 99: 1, 3, 7, 11, 13, 17, 19, etc. etc. We begin with the first prime number after 2, which is 3, and counting from it, we strike out every third number, because all such numbers are divisible by 3, and therefore are not prime. We then begin with 5, and counting from it we strike out every fifth number, because all such numbers are divisible by 5. We then begin with 7, and counting from it, we strike out every seventh number. The remaining numbers are prime. In this way we find that the prime numbers less than 100 are 1, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, and 97. The operation of sifting may be extended to any series of whole numbers, but beyond a certain limit the operation becomes tedious. In applying the method just described it is to be remembered that if a number cannot be divided by a prime number less than its own square root, that number must be prime. Thus, in the case supposed we need not go farther than 7, because 7 is the greatest prime number less than $\sqrt{100}$. From the nature of the process of Eratosthenes it is evident that the number of prime numbers in a given interval will be less the higher that interval commences. The number of prime numbers up to 10,000 is 1230; the number between 10,000 and 20,000 is 1033; between 20,000 and 30,000 it is 985; and so on. Many tables of prime numbers have been published of greater or less extent; those of Burckhardt extend to the number 3,036,000. The highest number that has been shown to be prime is $2^{31}-1=2,147,483,647$; this was found by Euler. Tables of prime numbers may be used for factoring. To resolve a given number in all its prime factors, we commence by dividing successively by 2 as many times as possible, then by 3, and so on till we see from the table that the quotient is a prime number; then will all the divisors used, together with the last quotient, be the required prime factors.

The following are some of the properties of prime numbers: (1) If a number cannot be divided by any prime number less than its own square root, it is a prime number. (2) All prime numbers except 2 are of the form $4n \pm 1$; those of the form $4n+1$ are each equal to the sum of two squares. (3) All prime numbers greater than 3 are of the form $6n \pm 1$. The converse of the 2d and 3d propositions is not true. (4) If n is a prime number, the expression $1+1 \times 2 \times 3 \ldots (n-1)$ is divisible by n. (5) If n is a prime number, and if r is any number not divisible by n, then will the remainder after dividing r^n by n be the same as that after dividing r by n. (6) The supposition remaining the same as before, the expression $r^{n-1}-1$ is divisible by n.

W. G. Peck.

Primitive Wesleyans. See Methodism, by Abel Stevens, A. M., LL.D.

Primogen'iture [Lat. *primus*, "first," and *genitura*, "birth"], or the right of the eldest son to inherit the real estate of his father to the exclusion of his brothers and sisters, who inherit only part of the personal property the father may have accumulated, originated in Europe with feudalism. Vague traces of it can be found in antiquity and in the Eastern nations. Wherever there was a monarchy, there was at least an attempt at establishing the law of primogeniture in the royal family. But it did not receive its full development until feudalism became the general state of society.

Prim'rose [*prime-rose*, from its early flowering], a genus of handsome flowering herbs, largely European, of the order Primulaceæ and genus *Primula*. The true primrose is *P. grandiflora* of Europe. *P. officinalis* is the cowslip, of which the polyanthus is a cultivated form, all of these running into many varieties. The birdseye primrose (*P. farinosa*) belongs to a humbler division of the genus. This and the related *P. Mistassinica* are indigenous also to the northern parts of North America. *P. auricula*, the parent of the auriculas of the gardens, is a native of Southern Europe. The Chinese primrose (*P. Sinensis*), now one of the commonest house-plants, represents a different section of the genus, to which *P. cortusoides*, a choice Siberian species now coming into cultivation, also belongs. Two very handsome species of recent introduction, which are much thought of, are *P. Japonica*, Gray, from Japan, and *P. Parryi*, Gray, from the Colorado Rocky Mountains. The evening primroses are species of *Œnothera*, of a wholly different natural order, and took the name from a very superficial likeness of the corolla to that of the true primrose.

Asa Gray.

Primrose, p.-v. and tp., Dane co., Wis. P. 1015.

Primula'ceæ [from *Primula*, the typical genus], a natural order of oxogenous gamopetalous herbs widely distributed over the world, but chiefly in the cooler parts of the northern hemisphere. The order is readily characterized by having stamens of the same number as the lobes of the corolla, and opposite them on the tube or throat a single style and stigma, and a one-celled ovary with a free central placenta, bearing several or numerous ovules. To this must be added the herbaceous character, to distinguish them from the Myrtinaceæ, tropical trees or shrubs which have a similar floral structure. Except a slight acridity, Primulaceæ are nearly inert plants, of no economical importance beyond the beauty of their blossoms. Besides the Primrose (which see) and its near allies, the *Cyclamen*, our beautiful *Dodecatheon*, and one

species of *Anagallis* are familiar in ornamental cultivation. ASA GRAY.

Prince [Lat. *princeps*], a title which sprang from that of the Roman PRINCEPS SENATUS (which see). It became a title of the Roman emperors, and from them passed to mediæval and modern sovereigns. There are also sovereign rulers who have no higher title than prince. Nobles of the blood are in general called princes, whether they officially bear this or some inferior title. In continental Europe there are also princes who are not related to sovereign families (called in Germany *Fürst*, and not *Prinz*). Strictly, all English nobles of higher rank than viscount are entitled to be styled princes, but in practical use princes of the blood are the only ones so designated.

Prince, the north-westernmost county of Prince Edward Island, Dominion of Canada. It is exceedingly fertile and well cultivated. Chief town, Summerside. Cap. Princeton. P. 28,302.

Prince (HENRY), b. in Maine about 1814; graduated at the U. S. Military Academy, and became brevet second lieutenant of infantry Sept., 1835, captain 1847; engaged in the Florida war and war with Mexico; brevet captain and major for Contreras, Churubusco, and Molino del Rey, being severely wounded at latter; returned to duty 1850, and employed on Coast Survey until 1855, when appointed paymaster with rank of major; appointed brigadier-general of volunteers Apr., 1862, he participated in the battle of Cedar Mountain, Aug. 9, 1862, where captured and held prisoner until December; subsequently served in North Carolina, Virginia, Tennessee, and South Carolina. Returned to duty as paymaster Aug., 1866.

Prince (OLIVER H.), b. in Connecticut; moved to Georgia in early youth; studied law, and was admitted to the bar; was one of the first settlers in Macon, and one of the five commissioners who laid out that city; was the author of many humorous sketches; one of these, giving an account of a Georgia militia muster, was republished in several foreign languages; he was also author of *Prince's Georgia Digest*, a work compiled with great ability; was U. S. Senator 1828–29; was lost at sea in the wreck of the steamer Home on the coast of North Carolina Oct. 9, 1837, aged about fifty years. A. H. STEPHENS.

Prince (THOMAS), b. at Sandwich, Mass., May 15, 1687; graduated at Harvard 1707; visited the West Indies and the island of Madeira; went to England 1709; preached for several years at Combs, Suffolk, and elsewhere; returned to Massachusetts 1717; was ordained colleague of Rev. Dr. Joseph Sewall, pastor of the Old South church, Boston, Oct. 1, 1718; devoted many years to the collection of materials for the civil and religious history of New England, and gathered a valuable library, which he bequeathed to the Old South church. D. at Boston Oct. 22, 1758. When the Old South church was desecrated by British soldiery during the war of the Revolution, documents in the Prince library were stolen or destroyed. Of the remainder, still of extreme value, and now forming part of the Boston Public Library, a catalogue was published in 1868. Prince was eminent as a preacher and as a man of learning, published twenty-nine single sermons and many occasional writings, and undertook a work valuable from its extreme accuracy of detail, *The Annals of New England*, of which, however, only vol. i. (1736) and part of vol. ii. (1755) appeared, extending only to 1633. Many MSS. of Prince, including a *Diary*, remain unedited, but will probably be issued by the Prince Society of Mutual Publication, established at Boston, June, 1858.

Prince Ed'ward, a fertile county of Ontario, Canada, consisting of a peninsula and several small islands in Lake Ontario, having the Bay of Quinté on the N. Area, 334 sq. m. Cap. Picton. P. 20,336.

Prince Edward, county of Central Virginia. Area, 300 sq. m. It is a pleasantly diversified region, with picturesque scenery and a rich soil. Tobacco and grain are leading products. Good Triassic coal is mined to some extent. Traversed by Atlantic Mississippi and Ohio and Richmond and Danville R. Rs. Cap. Farmville. P. 12,004.

Prince Edward Island [named in 1798 in honor of Edward, duke of Kent, father of Queen Victoria], an island in the Gulf of St. Lawrence, constituting, since 1873, a province of the Dominion of Canada, British North America. It extends from lat. 45° 50′ to 47° 20′ N., and from lon. 62° to 64° 20′ W. It is crescent-shaped, the concavity toward the N. by E. Length, nearly 130 miles; average breadth, 34 miles. An isthmus 4 miles wide joins the western part to the principal body of land; 24 minor islands belong to the province. There are numerous bays, harbors, and promontories. Northumberland Strait, on the S. and W., separates it from the mainland of Nova Scotia and New Brunswick. The area of the island is 2131 sq. m., or 1,365,400 acres. The soil is wonderfully fertile. The surface is generally level, with some low hills. There are very few rocks or stones of any kind readily accessible. Lagoons and lakes are rather numerous. The climate is mild for the latitude, and remarkably healthful. The soil is deeply underlaid by Silurian sandstone. The forests, once magnificent, are now greatly reduced. They consist of birch, elm, maple, ash, beech, pine, spruce, fir, hemlock, cedar, juniper or tamarack, poplar, and willow. There are some peat-bogs, which are easily converted into hay-fields. Vast quantities of sea-manure are everywhere accessible. The main island has only 52,252 acres of uncultivated land. The small islands have 5979 acres of cultivated and 400 of waste land. The waters surrounding the province teem with fish—mackerel, herring, cod, and many other species; the fisheries are consequently very important. The manufacturing interests (except shipbuilding) are not extensive, and but few valuable minerals are known to exist. Copper and bog-iron ore are found. The agricultural interests have been injured by the former system of great landed estates, but since 1854 the provincial government has been buying these estates as fast as possible, and measures have been taken by the local authorities to compel the sale of such lands. In most cases the purchased lands have been resold to small and well-to-do farmers. Wheat, oats, barley, rye, potatoes, buckwheat, and garden vegetables are raised. Cattle, horses, swine, sheep, and poultry are bred extensively. The island is divided into three counties—King's, Queen's, and Prince. There has been a system of public schools since 1821. The system at present includes grammar or higher schools, and secondary schools. Normal schools for the training of teachers have been established. There are three denominational colleges, Roman Catholic, Anglican, and Wesleyan—all at Charlottetown. During the summer the island is visited by regular lines of steamers and by thousands of fishing vessels. During the winter the island is not accessible except by ice-boats, which run from Cape Traverse to Cape Tormentin, N. B., 9 miles, carrying the mails. There is also a submarine telegraph.

History.—This island (the Isle St. Jean of the French) was discovered by the Cabots in 1497. It began to be settled by the French in 1715, who increased quite rapidly for many years. In 1764, having come under English rule, many of the French left the country, and the island was parcelled out among 67 grantees, who agreed to furnish a numerous colony of Protestant settlers (not English) for the colony. But though these conditions were never fulfilled, the great estates were not broken up, the proprietors being sustained in their claims by the British government. This has always been a source of much popular discontent. The Roman Catholic religion was never fully tolerated till 1830. There is now a Roman Catholic bishop of Charlottetown, and that body is more numerous than any other denomination. The province sends four senators to the Dominion Parliament. Cap. Charlottetown.

Population.—The population in 1745 was 800; in 1752, 1354; in 1763, 4100. Soon afterward the greater part of the French abandoned the country. P. in 1797, 4500; in 1827, 23,266; in 1833, 32,292; in 1841, 47,034; in 1848, 62,634; in 1855, 71,496; in 1861, 80,857; in 1871, 94,021. Of these, 40,442 were Roman Catholics, 52,317 Protestants of various denominations, and the remainder of other faiths than Christian. There were 323 Indians, to whom in 1861 Lennox Island, a valuable island in Richmond Bay, was ceded. CHARLES W. GREENE.

Prince Fred'ericktown, p.-v., cap. of Calvert co., Md., 5 miles from Chesapeake Bay, contains 1 church, a court-house, jail, and 1 newspaper. P. 64.
I. H. C. WILLIAMS, ED. "JOURNAL."

Prince George, county of S. E. Virginia, bounded N. E. by James River and N. W. by the Appomattox. Area, 300 sq. m. It is nearly level, well wooded, and has a light productive soil. Corn is a leading product. Traversed by the Atlantic Mississippi and Ohio R. R. Cap. Prince George Court-house. Pop. 7820.

Prince George Court-House, p.-v., cap. of Prince George co., Va.

Prince George's, county of Maryland, bounded N. E. and E. by Patuxent River, and W. by the Potomac and the District of Columbia. Area, 500 sq. m. It is one of the best farming counties in the State. It is rolling and has a rich loamy soil. Tobacco, corn, wheat, and rye are leading products. The shad and oyster fisheries are important. Iron ore, marl, tripoli, bole, and rich sulphide of iron are found. Traversed by Baltimore and Ohio and Baltimore and Potomac R. Rs. Cap. Upper Marlborough. P. 21,138.

Prin'ceps Sena'tus, an officer of the Roman senate. Under the kings he was the first in rank of the *decem primi*, was *custos urbis*, and was appointed for life by the

king. After 487 B. C. he was appointed by the curies, but not for life, and might be chosen from the *patres minorum gentium*, who could not before receive the office. It was afterward given to the oldest ex-censor, and became independent of the prefecture of the city. It still later might be given to any senator, but, though a title of great dignity, no power belonged with it, not even the presidency of the senate. Finally, the Roman emperors took the title, and with it assumed at will an authority over the acts of the senate.

Prince Ru'pert's Drops are formed by throwing melted glass into water. They have an elongated, tapering form. A smart blow upon the large end makes no impression, but if the smallest part be picked off the small end, the whole falls into powder.

Prince's Feather. See AMARANTH.

Prince's Met'al [named from Prince Rupert] is a kind of brass, nearly the same as pinchbeck; but the term is vaguely used for other alloys.

Prin'cess Anne, county of S. E. Virginia, bounded N. by Chesapeake Bay, E. by the Atlantic Ocean, and S. by North Carolina. It has extensive forests and a light productive soil. Corn and live-stock are leading products. Area, 350 sq. m. Cap. Princess Anne Court-house. P. 8273.

Princess Anne, p.-v. and tp., cap. of Somerset co., Md., on Eastern Shore R. R., 116 miles S. of Wilmington, Del., has 4 churches, 1 steam grist and saw mill, 2 hotels, and 1 newspaper. P. of v. 805; of tp. 4120.

C. W. FONTAINE, ED. "HERALD."

Princess Anne Court-house, p.-v., cap. of Princess Anne co., Va.

Prince'ton, p.-v., Blenheim tp., Oxford co., Ont., Canada, on Great Western Railway, 8 miles W. by S. of Toronto, manufactures lumber and shingles, and has 1 weekly newspaper. P. about 600.

Princeton, p.-v., cap. of Dallas co., Ark. P. 1142.

Princeton, p.-v., Colusa co., Cal., on Sacramento River. P. 132.

Princeton, p.-v. and tp., cap. of Bureau co., Ill., on Chicago Burlington and Quincy R. R., 105 miles W. of Chicago, has 1 high and 3 excellent public schools, 14 churches, a public reading-room, 3 newspapers, 3 banks, 4 hotels, 2 flouring-mills, 2 grain-warehouses, a bread cracker-factory, a foundry and machine-shop, a plough-factory, gasworks, and a manufactory of farm implements. P. of v. 3264; of tp. 4363.

C. N. WHITNEY, ED. "BUREAU CO. HERALD."

Princeton, tp., Cass co., Ill. P. 348.

Princeton, p.-v., Patoka tp., cap. of Gibson co., Ind., on Evansville and Chicago and Louisville New Albany and St. Louis R. Rs., 27 miles N. of Evansville, has excellent schools, 2 weekly newspapers, a grain-elevator, 1 bank, 2 flouring, 2 woollen, and 2 planing mills, 3 wagon, carriage, and plough shops, and 2 magnificent dépôts. P. 1847. A. J. CALKINS, ED. "CLARION."

Princeton, tp., White co., Ind. P. 851.

Princeton, p.-v. and tp., Scott co., Ia., on Mississippi and Wapsipinicon rivers. P. 498; of tp. 1197.

Princeton, p.-v., cap. of Caldwell co., Ky., on Louisville Paducah and South-western R. R., has a college and several good schools, 7 churches, 1 bank, 2 hotels, 1 newspaper, a woollen-factory, and 2 mills. It is located in a rich coal, iron ore, and lead-bearing section. P. 1012.

C. T. ALLEN, ED. "BANNER."

Princeton, p.-v. and tp., Washington co., Me., on St. Croix and Penobscot R. R. P. 1072.

Princeton, p.-v. and tp., Worcester co., Mass., includes Mount Wachusett, the highest mountain in Massachusetts. P. 1279.

Princeton, p.-v. and tp., cap. of Mille Lacs co., Minn., on Rum River. P. 662.

Princeton, p.-v., Morgan tp., cap. of Mercer co., Mo., on Chicago Rock Island and Pacific R. R., 402 miles from Chicago, has excellent schools, 2 churches, 2 newspapers, 1 wagon-factory, a fine flouring-mill, and 3 lumber-yards. Fine water-power and an abundance of good timber exist here. It was incorporated in 1857. P. 389.

W. L. ROBERTSON, ED. "ADVANCE."

Princeton, p.-b. and tp., Mercer co., N. J., situated on Delaware and Raritan Canal, and on a branch of Pennsylvania Central R. R., 49 miles S. W. from New York City and 11 miles N. E. of Trenton, is beautifully located upon an elevated ridge commanding a fine prospect; is noted as the scene of the battle of Jan. 3, 1777 (see PRINCETON, BATTLE OF), has numerous fine residences, and is the seat of the College of New Jersey (see NEW JERSEY, COLLEGE OF) and the preparatory school of the college. The Theological Seminary of the Presbyterian Church is located here. There are 9 churches, 2 banks, 2 hotels, 2 public and several private schools, and 1 newspaper, besides periodicals connected with the college and seminary. The Continental Congress assembled here June 30, 1783. P. of b. 2798; of tp. 3986.

C. S. ROBINSON, ED. "PRINCETON PRESS."

Princeton, p.-v., cap. of Mercer co., West Va.

Princeton, p.-v. and tp., Green Lake co., Wis., on Fox River and on Sheboygan and Fond du Lac R. R., has 1 newspaper and an active trade. P. 705; of tp. 1709.

Princeton, Battle of, an important engagement of the war of the American Revolution, though the numbers of the combatants and the total losses were relatively small. A week after the battle of TRENTON (which see), Lord Cornwallis marched against Washington and encamped near Trenton, with the intention of attacking the Americans on the following day. Washington, perceiving that he would fight to a disadvantage at Trenton, and learning that only three British regiments and a few dragoons remained at Princeton, made a bold night-march upon that place, surprised the enemy at daybreak (Jan. 3, 1777) in the vicinity of the college, and routed and dispersed them within twenty minutes, inflicting a loss of 200 killed and wounded and of 230 prisoners. The American loss was not above 30 men, but included Gen. Hugh Mercer, 2 colonels, 1 major, and 3 captains. This result was of immense value in reanimating the courage of the colonists, who had been disheartened by a series of reverses, and the action was the precursor of a well-combined series of operations by which the British were driven from the greater part of the two Jerseys.

Prince'town, port of entry, cap. of Prince co., P. E. I. (Dominion of Canada), on the N. side of the island, 38 miles from Charlottetown. Malpique harbor, 3 miles distant, is deep enough for ships of 1000 tons. P. about 400.

Princetown, tp., Schenectady co., N. Y. P. 846.

Prince'ville, v. (STANFOLD P. O.), Athabasca co., Quebec, Canada, is the site of Princeville College, established in 1862. P. of sub-district, 511.

Princeville, p.-v. and tp., Peoria co., Ill., on Peoria and Rock Island R. R. P. 424; of tp. 1335.

Prince Wil'liam, county of Virginia, extending W. and N. W. from Potomac River. Area, 350 sq. m. It is somewhat uneven, and the soil is naturally fertile. Corn is the principal product. Traversed by Alexandria Virginia Midland and Great Southern R. R. Cap. Brentsville. P. 7504.

Prin'cipal [Lat. *principalis*], in an organ, the name of one of the chief stops or sets of pipes. The principal is a metallic stop, and is tuned one octave above the diapasons—*i. e.* above the ordinary pitch—and hence it is sometimes called the "octave" stop. In tuning an organ of several stops it is found convenient to commence with the principal, as it stands midway in pitch between the diapasons and the fifteenth, and by the clearness of its tone furnishes the best standard for the adjustment of most of the other stops. The name probably arose from this priority of the stop in the tuning of an organ, and not from any quality in itself implying superiority or precedence.

WILLIAM STAUNTON.

Pringhar, p.-v., cap. of O'Brien co., Ia., has a court-house, 1 newspaper, a good hotel, and a land-office. P. about 60. A. H. WILLITS, ED. "PIONEER."

Prin'gle (THOMAS), b. at Blaiklaw, Teviotdale, Scotland, Jan. 5, 1789; met with an accident in infancy which rendered him a cripple for life; graduated at Edinburgh University; became clerk to the commissioners on the public records of Scotland; began in 1811 to publish occasional poems; became in 1817 co-editor with James Cleghorn of the *Edinburgh Monthly Magazine*, which soon took the name of *Blackwood's Edinburgh Magazine;* was at the same time editor of the *Star*, a semi-weekly newspaper, and of *Constable's Magazine;* joined a company of twenty-four persons, including his father and brothers, with whom he emigrated to South Africa 1820; taught school at Cape Town; became librarian to the colonial government, and successively edited two newspapers, which were short-lived on account of the censorship; returned to England 1826; became secretary of the Anti-Slavery Society 1827; published several volumes of poems and miscellaneous writings, including *African Sketches* (1834), and left a posthumous *Narrative of a Residence in South Africa* (1835). D. at London Dec. 5, 1834. The *Poetical Works of Thomas Pringle, with a Sketch of his Life*, by Leitch Ritchie, appeared in 1838. Some of his sketches and poems descriptive of life in South Africa have obtained great favor with the public.

Prings'heim (Nathanael), b. at Landsberg, Silesia, Nov. 30, 1823; studied botany; was professor at the University of Jena from 1864 to 1868, and commenced in 1857 the publication of the *Jahrbücher für wissenschaftliche Botanik.* His principal works are—*Ueber die Befruchtung und Keimung der Algen und das Wesen des Zeugungsactes* (1855), *Grundlinien einer Theorie der Pflanzenzelle* (1854), *Beiträge zur Morphologie der Meeresalgen* (1862), *Ueber den Gang der morphologischen Differenzirung in der Sphacelarien-Reihe* (1873).

Print'ing [Lat. *premere*, to "press"], or **Typography,** the art of combining movable type, and from their surface, through the medium of coloring-matter and paper, multiplying copies by pressure.

The word "printing" has a wide application, and comprehends many modes of reproducing surfaces in relief, intaglio, or plane, some of which are noticed in this Cyclopædia under the titles Anastatic Printing, Calico-Printing, Carpets, Engraving, Lithography, Nature-Printing, Paper-Hangings, Photography, Pottery and Porcelain Manufacture, Telegraph, Zincography, and others.

History.—From the earliest historic period some mode of engraving and producing impressions or devices has been known, but seems not to have advanced beyond the form of seals until the time of the Babylonians and Assyrians. Their buildings were built of burnt brick generally, which were stamped with an inscription according to the character of the edifice, and bearing the name of the reigning monarch. These impressions in many instances show clearly that the stamp was engraved in relief and applied to the plastic clay. The Assyrians, unlike any other nation of antiquity, employed terra-cotta for all the purposes of writing and the preservation of their literature. This was of a fine and compact clay, made in the form of hexagonal prisms, cylinders, and rectangular tablets, of a pale-yellow color, sometimes covered with a vitreous silicious glaze or white coating, but generally unpolished or unglazed. The prism or cylinder was used for historical documents, and the square tablets, varying in size from one to many inches square, were employed for literary, official, and other purposes. The recent discovery of the royal libraries at Nineveh and Kouyunjik has brought to light many thousands of these cylinders and tablets, which have restored to modern history much of the vast literature of the Babylonians and Assyrians. The tablets seem to have been prepared and kept moist, rolled up like paste, and unrolled when wanted, incised with a metal stylus (a specimen of which was discovered by Mr. George Smith at Kouyunjik), and baked in a kiln. In the case of official documents the witnesses or other parties impressed their oval seals on the wet clay, and to prevent enlargement a cylinder was run round the edges or across, leaving its impression in relief. In the libraries the tablets were arranged according to their subjects. Each subject was commenced on one tablet and continued on other tablets of the same size and form, the number sometimes amounting to over 100. Each series of tablets had a title formed of the first phrase in the subject, and at the end of every tablet was written its number in the work, with the title, and also at the end a catch-phrase consisting of the first line of the following tablet. The cylinders and prisms, however, have attracted much attention, as they show in many instances that they were impressed from an engraved surface, and that the Assyrians must have first prepared a stamp, probably on wood, in order to multiply a large number of the cylinders and prisms, as these seem to contain the more important proclamations and laws of the kingdom. All these different forms were covered with cuneiform letters, the wedge-shaped character of which seems to have arisen from the material employed and the method of incising used. The celebrated cylinders of carnelian, chalcedony, jasper, and other substances, hundreds of which are preserved in European museums, were the official and private seals by which the integrity of these documents was attested, and show that the Assyrians had attained great skill in engraving. It may be observed that it is singular the Assyrians stopped so short of printing, when all that was necessary was to impress a baked tablet or cylinder on moist clay, bake it hard, and use that as a matrix to impress thousands of moist clay tablets; and a mode, too, simpler than attained by any nation till the discovery of printing with movable type. The Egyptians also used stamps to impress the bricks used for their buildings. In the British Museum are specimens of these Egyptian stamps, one bearing the name and title of Amenophis III., which was found in a tomb at Thebes, and is of wood, of an oval shape, 5 inches long by 2¼ inches wide, half an inch thick, fitted to an arched handle; the hieroglyphic characters are engraved in intaglio, an impression from which would show the characters in relief. There is also a square stamp for bricks for the granaries of the temple of Phtha. The Egyptian stamps appear to have been used to mark the destination of the bricks. The Chinese have used a simple mode of printing from an early date. A work supposed to have been written during the reign of Woo-Wang (1169–16 B. C.) mentions the blackening of engraved characters, but is a probable allusion to some mode of making inscriptions more legible by blackening the letters. According to their chronicles, the early attempts of their present mode of printing were made about 50 B. C., but no great advance was made till the reign of Ming-Tsong (927–934 A. D.), when Foong-Taou printed copies of the classical books by taking impressions from stone plates, the letters being cut into them, which thus showed white on a field of black. This mode is still employed in Chinese lithographic printing. Foong-Taou then printed an edition of the nine *King*, or classical books, for the imperial college at Peking, from wooden blocks engraved in relief, which edition was completed in 952. This process of printing has been practised to the present time, and is as follows: A calligraphist writes the separate pages of the intended work on fine tracing-paper: an engraver glues them face downward on a thin plate of hard wood, called *li*, resembling that of the pear tree, and with a sharp instrument cuts away the surface around the characters, leaving them in relief; the printer, with two fine brushes in the right hand, one dry, the other containing ink, blackens the letters with the latter, and passes the former gently over the paper which has been laid on them. The Chinese paper, being thin and transparent, is printed on one side only, two pages side by side, separated by a line down the middle as a guide to the binder, who doubles and fastens the open leaves together at the back, the fold being the outer edge. In 1041 a Chinese blacksmith, Pi-Ching, formed cubes of porcelain paste, upon which he cut the most frequently-used characters, and baked them until hardened. These, being of different heights and thicknesses, were placed in a kind of cement, pressed down evenly, and printed from; but this process seems not to have extended after his time. Various attempts have been made to substitute separate characters for the engraved blocks, but it is rendered difficult because every word in Chinese requires a new character, instead of each word being composed of elements resolvable into the simple alphabet so well known to the Western nations. The Chinese characters represent ideas or complete words, of which it is estimated there are not less than 80,000. For printing the New Testament and other works of a limited number of words an assortment of separate types has been successfully used. The National Printing-office at Paris, the Imperial Printing-office at Vienna, and English type-founderies have made very complete collections of Chinese characters, that of Paris reaching 43,000. A printing-office in Peking has used movable types of cast metal since 1776. The Greeks were early acquainted with engraving on metal, their maps being cut with lines below the surface, but seem never to have multiplied copies from them. The ancient Romans made use of metal stamps, with characters engraved in relief, to mark their articles of commerce and brand cattle. The old Roman potters appear to have possessed separate stamps for letters, as some of their clay lamps show that the inscriptions were made by impressing each letter separately. The British Museum contains several Roman stamps with the letters engraved in relief, which seem to have been used to print the owner's signature on documents. Although the Romans had no mechanical mode of multiplying literature, yet they had a well-organized system of slave-labor, which enabled books to be written cheaply, and nearly every one could boast of having one or more volumes. With the decline of Roman civilization literature was despised by all ranks of society, and a passion for military glory alone occupied their minds. Even emperors and kings could not sign their names, and Theodoric, Justin I., and Charlemagne used stamps engraved in wood to impress their signatures to public and private documents. During the following centuries the taste for literature was cultivated by a few, the Church through her scribes fostered the transcription of the Bible, the classics were multiplied, and gradually the people acquired a thirst for knowledge which was but poorly supplied. With the introduction of the art of paper-making, about the beginning of the eighth century, epistolary correspondence increased, books were multiplied more rapidly, and with the endeavor to supply the people more cheaply with religious reading wood-engraving was invented, first to disseminate scriptural scenes, and finally illustrations and texts in a large number of pages, imitating the manuscripts of the period.

Block-Printing and Block-Books.—Toward the beginning of the thirteenth century wood was engraved upon in Italy, Sicily, and Spain to produce designs with the aid

of ink on fabrics of linen and silk. Playing-cards were produced by the same method, and afterward colored by hand or by means of stencil-plates. Old manuscripts of this time are in existence which have initial letters, and sometimes pictures printed, while the text is in handwriting. There is in the library of Upsal, Sweden, a curious volume known as the *Codex Argenteus*, or *Silvered Book*, a translation of the four Gospels, so-called because the letters are in silver on leaves of purple vellum, supposed to have been made not later than the sixth century. From the indentation on the other side of the leaf, and the turned letters found occasionally, it seems to have been made by the separate stamping of each letter upon the leaf. About the beginning of the fifteenth century single prints appeared, of a religious character, from Germany and Holland. These pictures, or image-prints, were made of many sizes, generally engraved in outline, and highly colored. The earliest known with date is that of St. Christopher carrying the infant Saviour upon his back across a river, and having a legend of two lines at the foot, with the date 1423, of which three copies are known to be in existence. It is about 8 by 11 inches in size, printed on paper, and in ink almost black, differing thus from other image-prints, which are generally in a dull or faded brown ink. There are many other image-prints which are referred to about the same date. Manuals of devotion followed, of a limited number of pages, generally containing pictures with a few words beneath or in the interior, some having the pictures on one leaf and the explanation or text on the other. The most notable of these were the *Biblia Pauperum*, or *Bibles for the Poor*, or rather books for indigent preachers, consisting of a series of rude engravings, each occupying a page, on one side of the leaf only, and divided into compartments having pictorial illustrations of the most remarkable incidents mentioned in the Pentateuch, the Gospels, and the Apocalypse, and accompanied with explanations in Gothic characters. The two pages facing each other were engraved on one block of wood, and the book put together in sections of two leaves, two pages of illustrations being followed by two blank pages. It is a folio, printed on paper, in ink of a dull or rusty-brown color, and contains forty pages, each engraving being 10 inches long and 7½ inches wide, without folios; but the first twenty pages are marked in alphabetical order from *a* to *v*, and the last twenty with the same letters having a dot before and after, as, .*a*. to .*v*. Its date is referred to about 1420. At least four distinct editions from wood, two Latin and two German, have been discovered. Of the first edition there are known to be fifteen copies, varying in slight particulars, but tending to prove a common origin. This is the type of all the block-books, of which other notable examples of an early date are the *Apocalypsis Johannis*, three works on the *Virgin Mary*, the *Enndtkrist* or *Antichrist*, *Ars Memorandi*, *Ars Moriendi*, *Speculum Humanæ Salvationis*, etc. Sotheby in his *Principia Typographica* (1858) describes twenty-one block-books, all distinct works.

The Discovery of Typography.—For four centuries solemn jubilees in honor of the invention of printing have proclaimed the name of Gutenberg, and yet the clouds which surround that discovery and veil the personality of the inventor are far from dissipated. In vain the importance of the benefit and the recognition of the benefactor have multiplied in all time research in France, Germany, and all civilized countries in order to penetrate the mysteries in which it seems that Gutenberg wished to conceal both his name and his works. In attempting to deprive Gutenberg of the merit of his different impressions, one would attribute the impression of the great Bible of 36 lines to Pfister of Bamberg, a fabricator of images (image-prints) rather than a printer; and to another printer still more obscure the grand edition of the *Catholicon* of Janua. Holland, without any positive proof, pretends that Coster is the inventor of the engraving and founding of the characters, and even of the press; and Corsellis would have us believe that Gutenberg stole from Coster his invention and his printing-materials to transport them from Harlem to Mentz. Notwithstanding the pretensions put forth by these, and the diverse claims of seven cities to the honor of the discovery of printing, the public voice has ever coupled with the art the name of Gutenberg; and the lawsuits he sustained against his associates, first at Strasbourg and then at Mentz, and the testimonies of his contemporaries, show him as the statues erected to his memory at Strasbourg and at Mentz represent him, leaning on his press, whence streams forth the light, and discovering the secret of printing by the founding of movable characters. The ancient witnesses and contemporaries clearly state that the first inventor of typography is John Gutenberg of Mentz, and the first work most befittingly accomplished was the Latin Bible. The keynote to the proof is perhaps the statement of John Schöffer, grandson of Faust, in the *avis* placed at the head of the folio edition of Titius Livius, printed by him in 1505: "It was at Mentz that first the admirable art of printing was invented in the year 1450; it was afterward improved and propagated for posterity by the capital and labors of John Faust and of Peter Schöffer." This succinct statement, made by the son of Schöffer, the son-in-law of Faust, establishes the facts that the invention of the typographical art was at Mentz; that it is due, before all others, to John Gutenberg; that the capital was furnished by John Faust; and that the improvements appertain to Peter Schöffer. John Gutenberg (his mother's name; also known as Hans Gansfleisch, his father's name) was born about 1400 at Mentz. About 1420 he removed to Strasbourg, and was a constable in 1436. Here he associated with himself André Dritzehen, a noble of birth like Gutenberg, Hans Riffe, and André Heilmann, all Strasbourgers, and prosecuted certain work with the greatest secrecy at the convent of St. Arbogaste. This association, with others who were successively initiated into the secret work, hoped to obtain considerable benefits from the fair of pilgrims to Aix-la-Chapelle in 1440 by the preparation of a work of considerable sale, of which the transcription occupied thousands of scribes—a hope which could only be realized by the Bible. In 1438 the association was dissolved by the death of Dritzehen, and the judgment pronounced on Dec. 12, 1439, fixed the regulation of the account in the contribution made in money of each associate. The authentic legal documents relating to the *procès* are carefully preserved at Strasbourg, and they make mention of the *press* and of lead and other objects necessary in the trade. In the experiments for printing indicated, Gutenberg must probably have passed through the following phases: Engraving of movable letters in wood, and then in lead; casting of these letters by means of matrices in sand, earth, lead, or tin; retouching after the casting of these characters; engraving of the letters on brass not tempered, then tempered after engraving, and striking of the letters in the matrices in copper; moulds, of which the mechanism was probably similar at first to those with which the ancients were familiar for casting medallions, and which were successively perfected, especially by Peter Schöffer; composition of drying ink, and the preparation of leather skins of a nature convenient to spread it upon the characters without smudging; and finally, the PRESS. Little is known from this time till 1448, when Gutenberg is found at Mentz, where he established his printing-office in his uncle's house. John Faust, being assured of the success of Gutenberg's work, engaged himself to supply money for its prosecution in 1450, but the material furnished was assigned to him in guaranty. This continued for about five years, when Faust called Gutenberg before the tribunal at Mentz to render an account, the legal documents in the case being still preserved at Mentz; and, after the auditing of the accounts, the larger part of the printing-office and of the impressions fell into his hands. Gutenberg, however, established himself at his mother's house, and appears to have done as much work as was afterward accomplished by Faust. It is believed that at this house he printed the *Catholicon* of Janua in 1460. Although depressed by his poverty, he was in high esteem with the public, and in 1465, Adolphe de Nassau accorded to him, by a diploma, the title of gentleman of his court, with an ample endowment. About this time Gutenberg associated with himself Dr. Conrad Homery, who after the death of Gutenberg (in Feb., 1468) succeeded to the possession of the materials, etc., engaging to employ them only in the town of Mentz, and grant its citizens the first right to the works he might print. The inscription placed in 1507 in the house occupied by Gutenberg says he was the first to make printing letters in *brass*, and from other allusions scattered in various early books this can only be taken to indicate the making of type, with melted metal, in brass moulds, and hence the invention of typography.

The works printed by Gutenberg appear to be the following: (1) A little vocabulary called the *Catholicon*, printed perhaps at Strasbourg, but of which no copy remains. (2) One or more editions of the *Donatus*, printed perhaps at Strasbourg, with the characters which served later for the Bible of 36 lines, of which several fragments are in existence. (3) The *Letters of Indulgences*, printed from 1454 to 1455. (4) The *Calendar of 1457*, printed with the characters of the Bible of 36 lines, of which one page is in the Imperial Library of Paris. (5) The *Appeal against the Turks*, which appeared in 1454, printed with the characters of the Bible of 36 lines, a copy of which is in the Library of Munich. (6) The *Bible* of 36 lines, three vols. folio, 2 columns to a page, of which the first essays, begun perhaps at Strasbourg, may have determined John Faust to associate with Gutenberg for the execution of that great

work. (7) The *Psalter* of Mentz. The misfortunes of Gutenberg, which might well have disheartened him, and the trials he sustained, have effectually preserved his fame and prove his title as the discoverer of typography, so well set forth by Ambroise Firmin-Didot in his *Nouvelle Biographie*, of which the above is an outline. Faust afterward associated himself with Peter Schöffer, and with the material obtained from Gutenberg printed off a considerable number of copies of the Bible to imitate those which were commonly sold as MSS., and he undertook to sell them at Paris. The low price and the uniformity of the copies excited surprise, the red ink with which he embellished his copies was said to be his blood, and he was adjudged to be in league with the infernals. To save himself from burning he revealed his art. A few years after the sacking of Mentz (1462) the pupils and the workmen of Faust and Schöffer were dispersed, the discovery was made public, and the art spread over Europe. Before 1500 printing-presses had been set up in 220 places, which were mainly occupied in producing classical works. From Mentz the art was transplanted to Haarlem and to Strasbourg; from Haarlem to Rome in 1466 by Sweynheym and Pannartz; to Paris in 1469; to England in 1474; and to Spain in 1475. Santander, in his *Dictionnaire bibliographique* (1805), gives a chronological table of 200 places where the art was practised during the fifteenth century, with the names of the printers and of the first productions of their presses. Of the various editions of books published in the sixteenth century, one-half were Italian, of which one-half were Venetian; one-seventeenth were English. (For the early establishment of newspapers in various places see JOURNALISM and PERIODICALS, and of the Bible for early editions see BIBLE.)

Printing in America.—The date of the introduction of printing into America is uncertain, but from the record of three early Spanish authorities it is believed that the art was introduced into Mexico by Viceroy de Antonio de Mendoza, probably after his arrival, in Oct., 1535. The first printer's name was Juan Pablos, and the first work printed the *Escala espiritual para llegar al Cielo* of San Juan Climaco, a translation from the Latin into Castilian by the printer himself, who was one of the religious settled there from Spain. This, then, was the first book printed in the New World, but no copy of it exists. The first book with date establishes the fact that a press was working in the City of Mexico in 1540. It is called *Manual de Adultos*, dated Dec. 13, 1540, a quarto in Gothic letter, printed by Juan Cromberger, whose imprint is also on several other books printed from 1540 to 1544. This Cromberger was a celebrated printer of Seville, and books bearing his imprint at this place also appeared both before and after the dates of the Mexican works. It is suggested, to reconcile all the statements brought to light, that Juan Pablos may have been at Seville in the employ of Cromberger, who was charged by Mendoza with the establishment of a printing-press in the City of Mexico, and who sent Juan Pablos over to conduct the business in the name and for the benefit of his master; that after Cromberger's death Pablos became the owner of the establishment, and was in this way, although not the first owner of a printing-press, entitled to the honor of calling himself the first printer of Mexico. The next press established in the New World was at Lima, Peru, about 1584, the earliest known book being the *Doctrina Christiana*, a quarto in the Quichua and Aymara languages, printed by Antonio Ricardo in Lima in 1584. Several other religious works of 1585 and 1586 by the same printer are also in existence. Between 1540 and 1600, before the introduction of the art into North America, there is recorded the issue of ninety-three works in the City of Mexico and seven in Lima. In 1639 the first press was erected in the house of the president of Harvard College, Rev. Henry Dunster, at Cambridge, Mass., through the efforts of Rev. Joseph Glover, who died while bringing the press and materials to this place. It was placed under the direction of Stephen Daye, by whom the first work issued was *The Freeman's Oath*, followed by *An Almanack* in the same year. Daye was succeeded by Samuel Green about 1649, under whom, in 1660–63, was printed the celebrated Indian Bible of Eliot, and other of his works in the Indian language. This press is still active, and known as the "University Press." The next press was established in Boston in 1674, after which printing gradually extended throughout the colonies. The following list gives the places and the time when the art was first introduced into the colonies, etc., of North America:

Cambridge, Mass.	1639	Annapolis, Md.	1726
Williamsburg, Va.	1681	Charleston, S. C.	1730
Philadelphia, Pa. (near)	1685	Newport, R. I.	1732
New York, N. Y.	1693	Halifax, N. S.	1750
New London, Conn.	1709	Woodbridge, N. J.	1751
New Berne, N. C.	1754	St. Louis, Mo.	1806
Portsmouth, N. H.	1756	Vincennes, Ind.	1808
Wilmington, Del.	1761	Natchez, Miss.	1808
Savannah, Ga.	1762	Michigan	1809
Quebec, Canada	1764	Kaskaskia, Ill.	1809
Albany, N. Y.	1771	Detroit, Mich.	1815
Westminster, Vt.	1781	Green Bay, Wis.	1831
New Brunswick, B. A.	1783	Little Rock, Ark.	1834
Falmouth, Me.	1785	Galveston, Tex.	1834
Lexington, Ky.	1786	Burlington, Ia.	1836
Knoxville, Tenn.	1793	Columbia, Or.	1847
New Orleans, La.	1794	San Francisco, Cal.	1848
Cincinnati, O.	1795	St. Paul, Minn.	1849

In 1775 the whole number of printing-houses in the British colonies was fifty. In the census of 1870 there were reported in the U. S. 2177 printing establishments employing 30,924 persons, of whom 2800 were females, paying in annual wages \$18,882,918, having in capital \$40,304,727, using material valued at \$24,729,407, and producing works of all kinds worth \$66,862,447. Only six States had over 100 printing-houses—Missouri 105, Illinois 130, Massachusetts 162, Ohio 187, New York 303, and Pennsylvania 318—the other thirty-six States and Territories having an average of exactly twenty-seven. In 1875 there were reported 7870 newspapers in the U. S., showing that there must be a very large number of printing-offices.

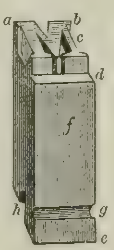
Early Printed Books.—It is interesting to note the peculiarities of the first printed works. An edition consisted of a limited number, for 200 or 300 was then esteemed a large impression. The size was either large or small folio, sometimes quarto. The leaves were without running title, direction-word, folios, or paragraphs. The character was a rude Gothic, mixed with secretary, imitating the handwriting of the time; the words were printed close together; abbreviations were numerous; the orthography was arbitrary; the sentences were distinguished only by the single or the double point, but subsequently the virgule (/) was used for the simple pause, answering to our comma. Capitals were not used, but titles and initial letters were left blank to be filled in by hand. In some works the embellishments surrounding the text were illuminated in colors, even gold and silver, and charged with saints, birds, flowers, etc. The printer's name, residence, and other information were either omitted or put at the end. The date was often omitted, sometimes obscurely indicated, or printed either at full length or by numerical letters, and sometimes in several ways together, as, "One Thousand cccc. and lxiiii.," etc., but always at the end. No variety of characters was used, a Gothic letter of the same size being used through the work. (See PUNCTUATION.)

Varieties of Type.—As already mentioned, the Gothic or old German text was used in the first printed works until 1465, when quotations in Greek characters were introduced into Cicero's *Offices*; but the first work in Greek type was the Greek grammar of Lascaris, printed by Paravisinus at Milan in 1476 in 4to. Many of the early printers prided themselves upon having superior fonts of Greek. The first work printed with Roman type was Cicero's *Epistolæ ad Familiares*, by Sweynheym and Pannartz, at Rome, in 1467. Italic type was invented by Aldus Manutius about 1500, who also introduced Roman type of a neater cut. The first Hebrew Bible was printed by two Jewish rabbins, named Joshua and Moses, in 1488, at Soncino in the duchy of Milan. The first book printed in the English language was a translation of *Le Recueil des Histoires de Troyes* of Raoul le Fèvre by Margaret, sister of Edward IV. of England, assisted by William Caxton, who also set up and printed it at Cologne in 1471. A few years after, Caxton set up his press in the monastery of Westminster Abbey, and in 1474 issued his *Game and Playe of the Chesse*, believed to be the first book printed with date in England. Toward the end of the sixteenth century various works were printed in Arabic, Armenian, Coptic, Persian, and Syriac type. Of late years complete fonts of nearly all written languages have been cast, and at the large printing-offices of Vienna, Paris, England, and America most of them may be had. The most complete collection is to be found at the Vienna Imperial Printing-office, which includes the difficult and rare languages of the Chinese, Hieroglyphic, Himyaritic, Assyrian, early Eastern inscriptions, and the Sanskrit series. This office has printed the Lord's Prayer in 206 languages and dialects in their appropriate characters. The National Printing-office at Paris has complete fonts for fifty-six Eastern languages and sixteen European languages which do not use the Roman character, the number of punches required being 361,000. American foundries can supply fonts for the more generally-known languages.

Type, the characters used in typography. The type itself is a thin metallic bar, like Fig. 1, which represents the letter M, and having the following characteristics: *c* is the face; *f*, the body; *g*, the nick; *a* to *b*, the width; *b* to *d*, the depth; *c* to *e*, the height to paper; *d*, the shoul-

der; from *d* to the face is called the beard; *h*, the groove left in dressing by cutting off the superfluous metal left by the mould, which leaves two parts for the bottom of the type, called the feet; the straight flat stroke of a straight letter is called the stem; the fine lines at the top and the bottom of a letter are the ceriphs; a projection over the body, as the top and the bottom of *f*, is a kern. This nomenclature is therefore similar to the names applicable to the human frame. Type are composed of type-metal, a composition of which the principal ingredient is lead. In the infancy of the art it was mixed with various hard metals to strengthen the lead and to bear pressure. The type-founders of the present day use alloys which each has determined will wear best, and they are generally trade-secrets. The alloy is, however, composed of certain proportions of lead, antimony, tin, and copper, so that the metal shall be hard, yet not brittle; ductile, yet tough; flowing freely, yet hardening quickly. This composition on solidifying expands slightly, thus ensuring the sharpness of the lines of the face; the antimony gives hardness, the tin toughness, and the copper tenacity. The proportion is 50 parts of lead, and equal parts of tin and antimony, with a little copper. Different sizes of type are made of varying qualities of metal, designated ordinary metal, hard metal, and extra-hard metal. Comparatively soft metal is used for spaces and large type, while small type is composed of hard metal. Type is made more durable by the electro-facing process of Dr. L. V. Newton, which deposits a thin film of copper over the face, as mentioned further on. Roman and Italic type are the letters most commonly employed in printing books in Europe and America, and these have undergone every change in form that taste or fancy could suggest, as will be noticed in the multitude of sizes, shades, and ornamentation exhibited in the display lines of books, papers, circulars, and posters. The various sizes of type have grown gradually into use, as the requirements of books and newspapers have dictated or the pride of punch-cutters has accomplished. Their names have generally been derived from the books upon which the type were respectively first employed. The following are the names of the thirteen usual sizes in the following languages:

Fig. 1.



Type.

English.	Dutch.	French.	German.	Italian.
1. Brilliant.				
2. Diamond.				
3. Pearl,	....	La Parisienne,	Perl,	Occhio di Mosca.
4. Agate.*				
5. Nonpareil,	Nonpareil,	La Nonpareille,	Nonpareille,	Nompariglia.
6. Minion.	....	La Mignonne,	Colonell,	Mignona.
7. Brevier,	Brevier,	Le Petit Texte,	Petit,†	Picolo Testo.
8. Bourgeois,	Bourgeois,	La Gaillarde,	Burgeois,	Gagliarda.
9. Long Primer,	Garmond,	Le Petit Romain,	Corpus,‡	Garamone.
10. Small Pica,	Dessendiaan,	La Philosophie,	Brevier,§	Filosofia.
11. Pica,	Mediaan,	Le Cicéro,	Cicero,	Lettura.
12. English,	Augustyn,	Le St. Augustin,	Mittel,	Silvio.
13. Great Primer,	Text,	Le Gros Romain,	Tertia,	Testo.

The following is a specimen of the sizes of type up to Great Primer, the numbers corresponding to the numbers and names above:

1.—abcdefghijklmnopqrstuvwxyz

2.—abcdefghijklmnopqrstuvwxyz

3.—abcdefghijklmnopqrstuvwxyz

4.—abcdefghijklmnopqrstuvwxyz

5.—abcdefghijklmnopqrstuvwxyz

6.—abcdefghijklmnopqrstuvwxyz

7.—abcdefghijklmnopqrstuvwxyz

8.—abcdefghijklmnopqrstuvwxyz

9.—abcdefghijklmnopqrstuvwxyz

10.—abcdefghijklmnopqrstuvwxyz

11.—abcdefghijklmnopqrstuvwxyz

12.—abcdefghijklmnopqrstuvwxyz

13.—abcdefghijklmnopqrstuv

These alphabets show clearly the difference in the depth and the thickness of the letters of the various fonts. Larger sizes, with a few exceptions, are named according to the number of pica lines in depth, as four-line pica, five-line pica, etc. Between nonpareil and minion there is a size in England known as emerald, but is used in America for the size of an ornamental border merely, under the name of minionette. Newspapers use minion, nonpareil, and agate extensively. Nonpareil was at one time called, from its extreme neatness and beauty, "silver type," a designation which has led some with more enthusiasm than knowledge to characterize works appearing in this character as books printed with type made of silver. Diamond is seldom used for entire works. The Oxford University Press issued in 1875 the "smallest Bible in the world," in English, printed on India paper, from diamond type, 72 lines long, including the head, 37 ems wide, containing 984 pages. The bound volume is $2\frac{5}{8}$ inches wide, $4\frac{3}{8}$ inches long, and half an inch thick. The American Bible Society issued in 1857 a diamond Bible, 72 lines long, 41 ems wide, containing 882 pages, which has the usual thin paper and leather binding. If presented in the English dress, it would be about a quarter inch wider and longer, but 100 pages thinner. Brilliant is rarely employed, except for references or side-notes to Bibles, etc. In 1874, Chatto & Windus of London issued *The Smoker's Textbook*, by J. Hamer, printed from brilliant type, 24 lines long and 20 ems wide (equal to 1 inch by $1\frac{1}{4}$ inches nearly), containing 155 words to a page, and 107 pages. The binding and paper make it $2\frac{1}{4}$ by $2\frac{3}{8}$ inches, and half an inch thick. Small as this type is, a type-cutter of Berlin has formed a type so minute as to be scarcely readable without a good magnifying-glass. More surprising still, as early as 1828, Henri Didot, of the Didot frères of Paris, had cut characters of almost microscopic fineness, with which he printed an elegant edition of Horace in 64mo, which was smaller than the liliputian editions by Janon of Sedan, France, or of Pickering of London, England, who issued some of the classics in type nearly like diamond.

* Or Ruby. † Or Jungfer. ‡ Or Garmond. § Or Rheinländer.

Height, Measurement, and Standard.—The height to paper, or the distance from the face to the feet of type, varies in the type made by the foundries of Europe and America, the height ranging from eleven-twelfths of an inch, or 0.9166 +, to over an inch, as in the Russian. Bruce's New York foundry makes it 0.92 inch, which is the standard adopted by American foundries. In measuring the thickness or width of type, the alphabet of lower case or small letters is calculated to make about thirteen ems, but foundries have no standard in this respect. The various fonts will measure from twelve ems to as high as sixteen ems to the alphabet, the same sized type being made to take in a larger number of words in the same space, or to spread out the words to fill a larger space, according to requirements. Book-compositors require fonts from pica to bourgeois to measure not less than twelve ems, and below bourgeois not less than twelve and a half ems; newspaper compositors require not less than thirteen ems; otherwise in either case extra compensation is allowed. The "standard of type" relates to the dimensions of the bodies of type and their relation to one another. The most exact standard is the French, in general use on the Continent, which divides pica, one-sixth of an inch deep, into twelve parts, called points, and conforms each size to a certain number of these points. The English and American standards vary, though generally, a pica being one-sixth of an inch, two nonpareils are equal to one pica, two pearls to one long primer, two diamonds to one bourgeois. The following table will give an idea of the proportions of type to space, etc., taking Bruce's standard of length, in which 201.58 lines of diamond are contained in a foot, every seventh size in the series being doubled, and every size being made 12.2462 per cent. smaller than the size following it:

Size.	Lines in a foot.	Ems in a pound.	Square inches in 1000 ems.
Pearl	179.59	800	4.55
Agate	160	690	5.29
Nonpareil	142.54	520	6.93
Minion	126.99	360	10.10
Brevier	113.13	290	12.60
Bourgeois	100.79	270	13.86
Long primer	89.79	200	18.20
Small pica	80	170	21.16
Pica	71.27	130	27.72

One pound of average type occupies 3.5 square inches, or 800 ems pearl, etc.

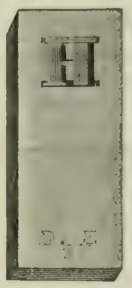
Type-Founding.—From the discovery of printing to the beginning of the seventeenth century printers cast their own type, when it became a distinct business from printing. Nuremberg contained the best punch-cutters, and supplied Germany with punches. Bodoni (1740–1813) of Italy, the Didots of France, and Breitkopf (1719–94) of Leipsic are the most distinguished names in the subsequent history of type-making. Great Britain imported type from Holland until about 1720, when William Caslon became an excellent letter-cutter. The Caslon foundry, established in 1718 in London, is still in existence, and contains the original punches which Caslon cut. Baskerville and Alexander Wilson are other noted names. About 1735, Christopher Saur (or Sower) began printing at Germantown, Pa., and

cast the type which he required, executing the second Bible printed in America, a quarto, in German, in 1743. Several unsuccessful attempts were subsequently made to establish type-foundries in America, among them one by Dr. Franklin. Binney & Ronaldson of Edinburgh commenced type-founding in Philadelphia in 1796, and, after a severe struggle and by State aid, were the first to establish a business, now known as the Johnson Foundry under MacKellar, Smiths & Jordan. Before the close of the century, David Bruce, from Edinburgh, established the same business in New York, and in 1813 the firm of David & George Bruce commenced the first stereotype-foundry in the U. S. There is evidence that at the beginning of the sixteenth century the apparatus for type-founding was much the same as up to the middle of this century. In devising a new font of type the first process is to make the model letter. Instead of cutting out the interior of the letter, a tool, called the counter-punch, is cut on steel to fit the hollow of the letter. The counter-punch is then struck on the end of a short bar of soft steel, which is the punch, and the outer edges of the letter are cut away. The punch is hardened, which then resembles Fig. 2, and is punched into a flat piece of cold-rolled copper like Fig. 3, which, after careful finishing, becomes the matrix, or mother-type. The letters on the bottom of the matrix indicate the size, double english, and the number of nicks, in this case one nick. Every letter requires a separate punch and a matrix. Matrices may also be made by electrotyping from the face of the type or an engraving. The matrix is now fitted to the mould to form the body of the letter. The hand-mould, used from the discovery of printing until recently, is composed of two parts, which fit exactly together. The external surface is of wood, the internal of steel. At the top is a shelving orifice, into which the metal is poured. The space within is of the size of the required body of the letter. The caster, holding the mould in the left hand, with a small ladle containing about a spoonful pours the metal into the orifice, then jerks up the mould higher than his head to expel air and condense the metal, lowers it, opens the mould, and casts out the type. The hand-mould is now seldom used, except to cast large metal or kerned type. The type, when first thrown out, has a piece of metal attached to its base, called the jet, represented at the bottom of the letter H in Fig. 4. In hand-dressing this jet is broken off by boys, the sides of the type are rubbed smooth on gritstone, and the type set up in long lines. They are then dressed and finished, a groove (Fig. 1, h) made in the foot of the type to remove the piece of the jet remaining, and, after examination with a microscope to pick out bad letters, are ready for use.

FIG. 2.

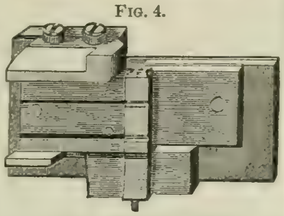
Punch.

FIG. 3.



Matrix.

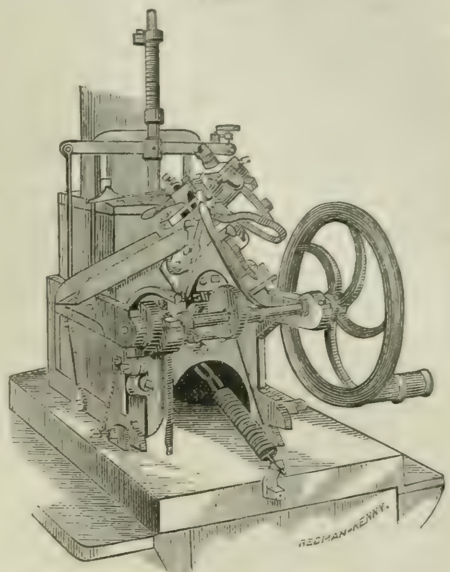
FIG. 4.



Half of Machine-Mould.
(*De Vinne.*)

Type-casting Machines.—About 1826, William M. Johnson of Long Island, not a founder, conceived the idea of casting type by machinery, but it resulted unfavorably, the type being light and porous. After several attempts by others, David Bruce, Jr., of New York, after years of study and experiment, patented the only thoroughly successful type-casting machine Mar. 17, 1838. Subsequently improved, it is now in general use in American foundries, and was slowly adopted, with modifications, by European founders. This machine is represented in Fig. 5. It consists of a small melting-pot to hold the metal, which is kept warm by a gas-jet or small furnace. In the interior of the pot is arranged a forcing-pump and valve for admitting the metal under the piston, and also for preventing the return of the metal into the mass in the pot when the piston is depressed, and thus securing the full force exerted upon the piston being transmitted by the piston to the molten metal under it, and forcing it through a narrow channel leading from the bottom of the chamber in which the piston works to the outside of the pot, where a nipple is inserted, with a small hole through it, communicating with the narrow channel. Against this nipple the mould in which the type is formed is pressed at the moment at which the piston descends, and it receives the molten metal that forms the type. The type-mould, of steel, is composed of two parts, each fitting the other with great exactness. Fig. 4 represents one-half of this mould, containing a letter just cast, which shows the nicks in the letter formed by wires in the other half-mould, and the jet of surplus metal attached to the bottom of the type. The face of the letter is shown without the matrix, Fig. 3, which is properly adjusted when in position, and the mould closed. A mould is made for each size of type, and is immovable in the direction of its depth (b to d, Fig. 1), but may be adjusted to suit the varying width (a to b, Fig. 1) of any letter when a matrix is in position, thus ensuring the same length for every type cast in each font. It is therefore only necessary to change the matrix for every character, instead of having a mould and matrix for the different letters. One-half of the mould is attached to an oscillating arm, which carries the mould to and from the nipple in the melting-pot. The other half of the mould is attached to another arm, which is connected to the first arm, so that the two halves open and shut upon each other. The machine operates as follows: The piston being raised in the chamber of the pump, and the chamber being supplied with metal through the valve, the mould is brought against the nipple; the valve closes to prevent the metal being forced back into the pot; the piston descends and forces the metal through the narrow channel into the mould; the mould recedes, the halves separate, and the type is cast out. A blast of cold air is directed upon the mould to keep it cool. The type are hand-dressed as before. This machine is worked by turning a small crank-wheel. It may also be worked by steam. David Bruce in 1868 introduced an apparatus adapted to the type-casting machine to receive the type as fast as cast, and break off the jet or stem of metal by a consecutive operation. The machine of Johnson & Atkinson of London, Eng., is worked by steam, and the type are dressed automatically. A double line of grooves is placed side by side. At the end is a reservoir of molten metal heated by gas, to which the mould is brought; a jet of metal is thrown into the mould, which then opens, and deposits the type on a travelling apparatus in the groove. As the groove fills it is impelled along, and in its progress the shanks are taken off. At the end the position of the type is reversed by the machinery into the returning groove, in which it is rubbed, dressed, has the bottoms planed, and the nicks cut. On arriving at the exit end of the groove it is received into a type-founder's stick, and with others of the same letter is ready for packing. The London Type-Founding Co.'s machine is heated by gas, the mould is cooled by a stream of cold water, and the type when made travel into small chambers, where they are planed, smoothed, nicked, and grooved, ready for use. Several machines were introduced at an early date into the U. S. to rub and dress type automatically. The most recent improvement is the type-casting machine of J. A. T. Overend of San Francisco, Cal., patented in 1875. A pump-cylinder is provided with a plunger, having a chamber in its lower end; a hole in the

FIG. 5.



Bruce's Type-casting Machine.

lower part of the cylinder allows the metal to flow in, and as the plunger closes this hole in descending, an opening in its upper part arrives opposite the discharge opening, and the liquid is forcibly ejected. A self-adjusting nozzle connects the pumps with the mould. Between the nozzle and the mould a carrier is interposed having several arms with holes. When the metal passes into the mould, it opens, and the carrier moves forward, holding the type by its stem, and places it on an inclined table. A clamp secures the type, and a sliding plate, breaking the type from its stem, forces it between rubbers, to smooth the rough edges, fitting the type for use. The stem left in the carrier is afterward forced out by a pin. A machine casts about 100 type a minute. By the hand-mould about 400 type were cast in an hour.

Wood Type.—The large letters used in handbills and posters are made of wood, usually maple or bay mahogany, which is prepared as for wood-engraving. The outline of the character is first carefully cut upon the face of the block, which is placed under a revolving drill, which cuts away the superfluous wood, when it is finished by an engraver. William Leavenworth of Allentown, N. J., in 1834 applied the pantograph to the cutting of wood type, in which a tracing-point at one end follows the outline of a large model letter, and is repeated at the other end by a revolving cutter, which cuts the letter from a block of wood, after which it is dressed with a graver. Wood type may be cut out by the SAND-BLAST (which see), by cementing the stencils on the ends of the blocks, and placing them together under a moving jet, after which they are ready for use and require no dressing.

Fonts.—A complete assortment of type of any one face or size is called a *font* or *fount,* which may be regulated to any extent. Type-founders have a scheme for the proportional quantity of every letter required for a font, and a peculiar scale is necessary for every language. English founders select a scale having 3000 of the small letter *m* for its basis. American founders adopt nearly the same scheme by weight, and proportion all fonts, large or small, accordingly, a font of 500 pounds containing 20 pounds 8 ounces of *a* and 28 pounds 4 ounces of *e*. The following table shows the relative proportion of every character required in a font of 800 pounds of pica for ordinary work in the English language:

A Font of Pica, weighing 800 pounds.

Small letters.		Points, etc.		Capitals.		Small capitals.	
a	8,500	,	4,500	A	600	A	300
b	1,600	;	800	B	400	B	200
c	3,000	:	600	C	500	C	250
d	4,400	.	2,000	D	500	D	250
e	12,000	-	1,000	E	600	E	300
f	2,500	?	200	F	400	F	200
g	1,700	!	150	G	400	G	200
h	6,400	'	700	H	400	H	200
i	8,000	(	300	I	800	I	400
j	400	[	150	J	300	J	150
k	800	*	100	K	300	K	150
l	4,000	†	100	L	500	L	250
m	3,000	‡	100	M	400	M	200
n	8,000	§	100	N	400	N	200
o	8,000	‖	100	O	400	O	200
p	1,700	¶	60	P	400	P	200
q	500			Q	180	Q	90
r	6,200	Figures.		R	400	R	200
s	8,000	1	1,300	S	500	S	250
t	9,000	2	1,200	T	650	T	325
u	3,400	3	1,100	U	300	U	150
v	1,200	4	1,000	V	300	V	150
w	2,000	5	1,000	W	400	W	200
x	400	6	1,000	X	180	X	90
y	2,000	7	1,000	Y	300	Y	150
z	200	8	1,000	Z	80	Z	40
&	200	9	1,000	Æ	40	Æ	20
ff	400	0	1,300	Œ	30	Œ	15
fi	500						
fl	200	Accents.		Spaces.			
ffi	150			3-em spaces	18,000		
ffl	100	ê	200	4- " "	12,000		
æ	100	à	200	5- " "	8,000		
œ	60	â	200	Hair "	3,000		
—	150	ô	200	Em quads	2,500		
——	90	All other ac-		En quads	5,000		
———	60	cents, 100 each.		Large quadrats, 80 lbs.			

This is the proportion for Roman letters, etc. An Italic font to accompany this would be in the proportion of one-tenth of the Roman, but generally not including spaces and small capitals. To give an idea of the number of pages this will set, suppose the page of type to be 8¾ inches long by 5¾ inches wide, or 53 lines long by 35 lines or (ems) wide, of pica. This will give 1855 ems in a page; there being 130 ems in a pound, this will make the page weigh nearly 14¼ pounds, which, divided into 800 pounds, gives about 56 pages. Allowing for capitals, etc., not used, the font given above will set from 45 to 50 pages of the size mentioned. Fonts of type now vary from 50 pounds to 20,000 pounds.

Case.—In the department of composition, or the art of composing or setting-up type, the type when received from the founder are arranged in a case containing boxes of various sizes for the different characters. The lower case has remained nearly the same as it was 200 years ago. It is a frame of wood, about 1¼ inches deep, 32½ inches long, and 16¾ inches wide. Cases go in pairs, the upper case (Fig. 6)

FIG. 6.—*American Upper Case.*

*	†	‡	§	‖	¶	☞	℔	℥	@	%	℅	'	°
¼	½	¾	⅛	⅜	⅝	⅞	$	£	2-em	3-em	—	⁀	⌐
⅓	⅔	&	Æ	Œ	æ	œ	–	—	2-em	3-em	&	Æ	Œ
A	B	C	D	E	F	G	A	B	C	D	E	F	G
H	I	K	L	M	N	O	H	I	K	L	M	N	O
P	Q	R	S	T	V	W	P	Q	R	S	T	V	W
X	Y	Z	J	U	]	)	X	Y	Z	J	U	hair sp.	ffl

containing 98 boxes for capitals, etc., and the lower case (Fig. 7) containing 54 boxes for small letters, figures, and

FIG. 7.—*American Lower Case.*

ffi	fl	5-m sp.	4-m sp.	,	k	e	1	2	3	4	5	6	7	8
j / ?	b	c		d			i		s	f	g		ff / fi	9 / 0
! / z	l	m		n		h	o	y	p	w	,		en qds.	em qds.
x / q	v	u		t		3-m spaces.	a		r		; / .	: / -	2- and 3-em quadrats.	

spaces. Fig. 6 shows the case adopted by American book-compositors, having the capitals on the left side and the small capitals on the right. Newspaper compositors prefer the capitals on the right side and the small capitals on the left. The lower case is so arranged that the letters most frequently used are placed in large boxes toward the middle and in front of the compositor. These cases are placed on a frame or stand about the height of the breast, and in a sloping position from the top to the bottom of the case, the capital case on the upper part of the frame, whence upper case, and the case containing the small letters on the lower part of the frame, hence called lower case. These cases contain only Roman letters. Italics and all other varieties are kept separately in similar cases. The spaces noticed in the cases are for equalizing the spacing. The *em* is a square space; *en,* two to an em; 3-em, 3 to an em; 4 to an em; 5 to an em; and hair-spaces, 6 to 13 to an em; 2- and 3-em quadrats are double or triple *ems.*

Composition.—The compositor in setting up type uses a small frame of steel, having three sides and a bottom, called the composing-stick. (Fig. 8.) It is usually from 6 to 12 inches long, 2 inches wide, and ⅝ inch deep, and will hold about 20 lines of minion, the type in which this CYCLOPÆDIA is set. Larger sizes are occasionally used for wide measures.

FIG. 8.

Composing-Stick.

Two sides are immovable, the third side being movable to be adjusted to the width of the page, and then clasped, as in the Grover patent (Fig. 8), or secured with a screw. A setting-rule, type high, and of the required measure, is also used with the stick; it is made of a strip of steel or brass, having a short pointed projection at the top of the right end or on both ends. It enables the type to be put quickly in its place, and is used to empty matter from the stick, to lift matter, and to support matter in the left hand while distributing with the right. Having received a "take" or small portion of the copy of a work, which is placed conveniently on the upper case, the compositor holds in his left hand the stick, made up to the required measure, like a small trough, the rule resting against the back, and stands in front of the frame or the left of the middle of the case. Observing and remembering a few words of the copy, he looks to the proper box for the first letter, picks it up with the right hand so that the nick (Fig. 1, *g*) shall be outward and from him, and lays it in the stick with the nick looking toward the opening, which

brings the letter right side up. While putting the first letter in the stick, his eye at the same time looks toward the next box, and, his hand following immediately, he again picks up a letter with the nick from him, and places it by the side of the other. He does not look at the face of the letter, but glances at the nick (Fig. 1, *g*), and takes it for granted that if it come from the right box it must be the right letter. He secures every letter successively with the thumb of the left hand as the type are placed side by side in line from left to right. As nearly as the letters will allow in print, the type are set in the stick thus: ꓕʎdoƃɹɐdɥʎ. The compositor always reads the type in this manner, and does so as quickly as the ordinary reader comprehends the printed page. When he comes to the end of his line, and finds that he has a syllable or word which will not fill out the measure, he has to perform an operation which requires care and taste. This is called *justification*. The first and the last letter must be at the extremities of the line; and there must not be wide spaces between some words and thin spaces between others, but the distances between them must be made as nearly as possible uniform by changing the spaces, already explained, and thus getting in or driving out part or the whole of a word. The first line being justified, the rule is lifted to the front, and the compositor proceeds with the next line, and so on till the stick is full. If the matter is open, thin strips of metal (called "leads") are placed between the lines. Placing the rule at the front, he clasps the stickful with the thumbs on each upper corner, the fore fingers on each lower corner, and the side of the first and second joints of each middle finger at the left and right sides of the type, presses the corners and the sides toward the centre, and thus readily lifts the mass of separate letters; but it requires some practice to do this neatly. The stickful is placed on a galley, or oblong tray of wood or brass, having a raised edge of half an inch on two, three, or the four sides, but generally on the left side and top. Having completed his portion, the matter, as it is now called, is ready to be made up.

Distribution.—When the compositor has set most of the type out of the case, he distributes *dead* matter. The matter is first wet with water to hold the type slightly together. Placing twenty lines or so on the rule, held in the left hand and resting against the inside of the thumb and on the side of the third finger, he takes a few words between the thumb and middle finger of the right hand, separates the letters by the pressure of the fore finger, and, when his hand is over the proper box, lets the letter fall. This he continues till the case is full.

Composing and Distributing Machines.—Labor and ingenuity have been expended in efforts to substitute machinery for hand-labor in composing type, and perhaps have not been wholly fruitless. Nearly 100 patents have been granted for such machines in Europe and America, yet at the most perhaps no five printing-offices in the world use the same machine, and the number using machines is certainly small. Referring the reader to Ringwalt's *Encyclopædia of Printing* (1871) for a list of the patents heretofore granted, a few of these machines may be described briefly. The first attempt at machine-composing appears to have been made by Dr. William Church of Connecticut about 1820, but patented in England in 1822. It cast and set the type directly from the molten metal, requiring no distribution, but did not come into practical use. Christian Sörensen of Copenhagen invented a practicable machine, which was operated for a long time on a daily journal in that place. It was exhibited in 1855 at the Paris Exposition, and composed and distributed at the same time. The matter was placed in a kind of basin, from which the letters were picked and deposited properly in the composing part. In the distribution part, the type, each having a different nick, passed by their own weight along a channel in which were openings with projections corresponding to the respective nicks in the type. This machine would do the work of three compositors. Of English machines, the Hattersley and the Mackie are the latest examples. Robert Hattersley of Manchester, England, about 1856 brought out his machine. It does not require special nicks in the type. It comprises classed cells of type on two tables. When a key is touched, a piston is pressed against the lowest type in a cell, and causes the type to pass down a short inclined plane. This plane is furnished with conduits, along one of which the type travels to the composing-stick. The table with the lower-case types is removable, so that a full case may be supplied for the empty one. From 4000 to 6000 types may be set in an hour, about three men's work. A distributing machine accompanies this. A. Mackie of Warrington in 1871 exhibited at the International Exhibition at London a machine possessing peculiar features. It uses a perforated ribbon. The perforator, distinct from the composer, consists of keys acting on a series of punches; the punches are brought into action according to the letters or syllables which the keys represent, and the ribbon is perforated by them as it travels through the machine. The composer is a circular framework, having around its periphery a series of pockets, each divided into eight sections. Concentric within, and a little below this ring of pockets, is a revolving wheel, the periphery of which has a ring of pickpockets, each with eight vertical pins. When during the revolution of the wheel one of these pins rises above the level of the others, it draws out a type from one section of the pocket near it, and drops it on a receiving table, which carries it round to the point of delivery. The determination of which pin or pins shall be raised depends on the perforated ribbon. The ribbon is unwound from a drum or reel, passes over a small wheel, and enters the machine among the pockets and pickpockets. The perforations facilitate the action of little triggers which raise the pins. Two or more types may be drawn, or a large number of words may be formed, at the same time. This machine may be worked by steam. The perforated ribbon may be multiplicated, and different sizes of type may be set from the same ribbon, or different editions of the same work in different countries. After twenty years' labor, M. Delcambre of France produced a machine in New York in 1875 which has the keys placed in three rows, each key connected by a vertical lever with a cell of type placed over it. The lever, when the key is pressed, strikes off the lowermost type in each pile, and sends it along an inclined plane to a justifying apparatus. A distributer, forming a separate machine, has a sliding groove in which the types are placed in a long line. A key is pressed as each letter comes under the eye, and at the same time a cell is opened into which the type falls. William H. Mitchel of New York in 1853 produced a machine in successful operation. The compositor has a keyboard, each key of which strikes out a type from a brass slide placed on an incline. The type travels along an endless band to a spot where it is turned on end and pushed forward by a notched wheel. The apparatus comprises numerous bands, the lengths and velocities of which so vary as to enable the types, at different distances from the wheel, to reach it in the order in which the keys are struck. The words are built up in rows 30 inches long, and justified by hand. The distributer has a long channel in which the lines of type are placed, and pressed forward to a vibrating metal finger; this finger pushes the type aside separately, and causes them to drop down on a grooved wheel revolving horizontally. By means of pins in these grooves and nicks on the type each type falls into its proper receptacle, over which it is brought by the revolution of the wheel. John E. Sweet, an American, at the Paris Exposition in 1867 exhibited the matrix compositor. It is designed to form the mould or matrix for stereotype-plates, dispensing with setting and distributing movable type. Keys give to thick, soft, and dry paper impressions of the required letters to form words, lines, and sentences for a column or page. (See the elaborate report of this machine, and a similar machine invented by Pierre Flamm of France, and of other printing machines and processes exhibited, by Pres. F. A. P. Barnard in the *Reports of the U. S. Commissioners to the Paris Universal Exposition of 1867*, vol. iii.) O. L. Brown of Boston finished in 1870 a machine to set and distribute. The case, with an index showing the letters at the bottom, consists of channels to hold the type, standing on their feet, and the case is set at such an angle that they slide by their own gravity. A stick, consisting of a semicircular groove for receiving the type, and a lever for operating it, slides in front of the case. As the handle of the key is depressed, a type is thrust into the stick, and when full the type is placed on a justifier. The distributer is a rotating ring about ten inches in diameter. The channels radiate from the ring. The type, fed into the ring, is caught by certain levers according to the nick, and placed in its proper place. The operation is on the same principle as the common lever-lock: the levers with the type form a certain combination, which will move around until it arrives opposite its own key. The lock will then be unlocked and the letter forced out. The Alden machine, to set and distribute simultaneously, was first begun by Timothy Alden of Massachusetts in 1846, which after his death was further improved by his brother, Henry W. Alden. It had the type arranged in cells around the circumference of a horizontal wheel; as the wheel rotates, several receivers rotate with it, and these pick up the proper types from the respective cells. Several improvements have been made by different persons. A. C. Richards obtained patents for two machines in the latter part of 1875—one a compositor, and the other a distributer. The compositor consists of upright channels holding the type, and an endless band with belts at the two sides, which together conduct the type to the mouth of the re-

ceiving channel, where they are placed upright in a continuous line. The distributer is automatic, and with an excavated rim, by conveyers in a revolving cylinder, guides each type to its place. Following the idea of Dr. Church's machine, Charles S. Westcott of New Jersey made further improvements in his machine, patented in 1875. It casts directly from the molten metal, and sets the type in line for justification. The type-metal is contained in a tank, and heat applied below. The metal is forced into the matrix, and the conduit is then closed by a valve-rod, which, projecting slightly, forms a small cavity in the foot of the type, instead of the usual jet. The metal-pot has one nipple suitably arranged to meet the matrix. A matrix is provided for every character, and all the matrices rest on a stock away from the metal-pot. When a key is struck, the corresponding matrix is brought forward to a straight race, where a carrier lifts it from the stock and takes it to the nipple, where it receives a portion of metal. The matrix is carried to its stock, the mould opens, the type is seized by a hook and carried to cutters and rubbers, where it is dressed, and taken to a receiving-stick, whence it is justified. This dispenses with distributing, as the dead matter is melted when wanted.

Unit of Measurement.—The compositor is paid according to the number of *ems* he sets—a method found most just, owing to the great difference between the amount of type put together by a quick and clean compositor and that by a slow one or one who makes many errors. Difficult manuscript or intricate composition, however, is generally done at a certain price per week. The letter *m* was at one time perfectly square, and the square space—a space having the width (Fig. 1, *a* to *b*) equal to the depth (Fig. 1, *b* to *d*)—has since taken the name *em;* and half this space, an *n*, being equal to half of *m*, took the name of *en*. The reader may always know the *em* of the type in which a book is printed by observing the space left between a period and a capital letter—that is, the end and the beginning of sentences—or the space before the beginning of a paragraph. The *en* is used to measure the matter in England, and the *em* in America. In measuring the width of columns or pages, the letter *m* is placed sidewise in the stick, thus,

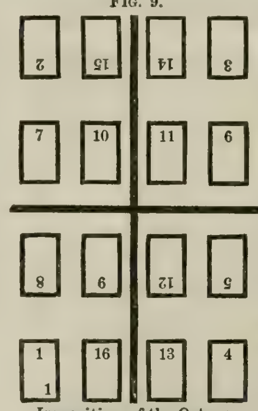
ΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞΞ;

and the number of these, multiplied by the number of lines in length, will give the number of ems; for instance, this CYCLOPÆDIA is set in minion type, 26 ems wide in a column, 91 lines long (not counting head- and foot-lines), and two columns in a page—$26 \times 91 \times 2$, making 4732 ems in a page. The average number of pieces of metal, spaces and letters, is 2.25 to an em, so that 1000 ems contain about 2250 pieces. In an average page of this CYCLOPÆDIA there are 1730 words, 9.5 words to a line, 5 letters to a word; in addition, the spaces average 2.25 ems in a line, and 409 ems in a page. Words, therefore, in the English language average 5 letters, and in type 2.5 ems each. The average number of ems a compositor will set in an hour is 1000, for which he is paid about 50 cents. He is not paid for distributing to fill his case, or for correcting the errors he makes in composition. Many compositors are reported to have set from 1500 to 2000 ems per hour, and a large number average over 1300 ems. The best authenticated case is that of George Arensberg, the "velocipede" in New York City, who in a match in Feb., 1871, set 2064 ems solid minion in one hour. An important element in judging of fast composition which has never been recorded is that of the measurement of the alphabet; for a compositor will certainly set more with an alphabet measuring 14 or more ems than he can with book-type measuring 12 ems or less. To ascertain what a manuscript work will make in print, count the number of words in a fair page of the manuscript, and multiply it by the number of pages. Take a printed page of the desired size and style of type, count the words, and divide the number of words in the manuscript work by the number of words in the printed page, and it will give the number of printed pages, nearly.

Make-up.—In newspaper-work or work requiring many corrections, or for other reasons, a proof is taken of the matter secured in a galley in long pieces, read, and corrected, sent to the author, and then made up, read, corrected, and sent to press or stereotyped. Usually, it is placed in the hands of the "maker-up," who, having set the appropriate headings, places a head-line at the top of the matter, containing the running-title of the book or the appropriate subdivisions of the work, divides the matter into pages with a gauge, affixes the foot-line—a blank line put at the bottom of a page—containing sometimes the signature or folio, and binds the page with cord. A proof, termed the "first proof," is taken, given to the proof-reader, who carefully compares it with the author's copy by the aid of a copy-holder, who reads aloud, and the errors noted are corrected by the compositor. It is not necessary to explain the symbols used by the proof-reader in noting the corrections for the compositor, nor expatiate on his requirements and education. The symbols, however, may be seen in Webster's *Dictionary* on page 1696, but as they are apt to be used wrongly, it is best for the author to mark out any wrong word or words entirely, and write plainly in the margin what he desires. If he wishes anything taken out, he should write in the margin *dele*, meaning "take out." A second proof, or "revise," is compared with the first, and sent to the author for his revision. His corrections are made, and the third or "press proof" is carefully read, generally by a more skilful proof-reader than the first, when the corrections are made, and the matter is ready for the press or for stereotyping or electrotyping.

Imposition.—This is the method of so arranging the pages that they will be in consecutive order when the sheet or section of a book is folded. When the pages are to be stereotyped or electrotyped, only a few pages in their regular order are secured together and cast; yet these cast pages are afterward imposed on the press in the same manner as described below. For over 400 years imposition remained merely a trial process, the few early modes having been handed down to the present time without any attempt at systematic explanation. George H. Bidwell of New York, in his *Treatise on the Imposition of Forms* (1864), was the first one to show the principles which govern imposition, giving the reasons, and the results to which they lead. The pages are laid upon a marble or iron table, called the *stone*. Any number of pages may be imposed in one form, from 2 to 128, according to the size. The first page in simple forms is placed in the left-hand corner, with the foot of the page toward the imposer, and when completed the last page is found at its side. The second page and the next to the last are together; the third and the third from the last, and so on, advancing one from the first folio and receding one from the last, until the two middle pages are reached, which are in the 4to the 2d and 3d; in the 8vo, the 4th and 5th; in the 12mo, the 6th and 7th; in the 16mo, the 8th and 9th; in the 24mo, the 12th and 13th, and so on. (The terms 4to, 8vo, etc. here refer to the number of pages in a form, the usual designation of printers.) The imposition of the octavo, Fig. 9, and of the duodecimo, Fig. 10, will illustrate the principle, the folio at one end of the page representing the head.

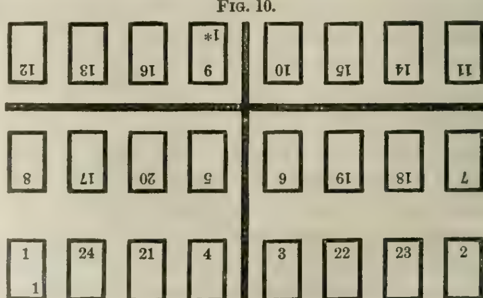
FIG. 9.



Imposition of the Octavo.

The pages are adjusted to the required distance apart according to the size of the paper, an iron "chase" or frame is placed around them, and wood or metal furniture, half an inch high, of various thicknesses, is placed, some at the head of the pages, called "head-sticks," some between the pages, called "gutters," and others at the sides and feet, called "side-" and "foot-sticks." The latter are larger at one end than the other, so that small wedges of wood, or "quoins," may be driven tightly between them and the sides of the chase, locking the type firmly, making it like a solid piece, which may be lifted and placed on the press. The general practice up to recent date was to place the pages which would appear on the outside of a sheet in a single chase, and the inside pages in another chase, requiring every sheet to be printed from two forms for one copy. All the pages of a single sheet are now usually

FIG. 10.



Imposition of the Duodecimo.

placed in one chase, and the paper turned over on the press, making two copies at two impressions. The chase is crossed by two iron bars, represented by the long lines across Figs. 9 and 10, which support and keep the chase from springing.

Signatures.—The signature is a figure or a letter of the alphabet placed at the foot of the first page of every form, or a section or sub-section of a form, to denote the order of the sheets, and serves as a guide to the binder. In an edition of *Terence*, printed by Antonio Zorat at Milan in 1470, signatures were used, and it is the first book known to have them. Catch-words were once extensively used, placed at the foot of the page, to show the connecting word on the next page, and are said to have been first used by Vindeline di Spori in Venice. At the beginning of this article it is shown that the Assyrians used catch-words. The English generally use the letters of the alphabet, omitting J, V, W, which were not used in the Gothic letters of the early printers; and if the sheets extend beyond Z, the letters are doubled or preceded by a figure. The American practice, and that of most European nations, is to use figures, a section to be inset being distinguished by a star after the signature figure, and is the simplest and readiest for the binder. When it is desired to print the same book both as an octavo and as a duodecimo, or otherwise, figures are used to indicate the signatures of the one, and letters the signatures of the other. The position of the signature (1) and star signature (1*) is noted in Figs. 9 and 10. A star signature shows that that part of the sheet is cut off and placed inside the first part when folded. The following table shows on what page the signature is put in the octavo, duodecimo, and eighteenmo, and also the amount of paper required to print 1000 copies of every sheet, a ream counting 20 quires of 24 sheets, or 480 sheets:

Table of Signatures.

Octavo.			Duodecimo.			Eighteenmo.			Paper required for 1000 copies of a sheet.	
Signatures.	Signature pages.	Pages in sheet.	Signatures.	Signature pages.	Pages in sheet.	Signatures.	Signature pages.	Pages in sheet.	Rms.	Qrs.
1	1	16	1	1	24	1	1	36	1	2
2	17	32	1*	9		1*	5		2	4
3	33	48	2	25	48	2	13		3	6
4	49	64	2*	33		2*	17		4	8
5	65	80	3	49	72	3	25		5	10
6	81	96	3*	57		3*	29		6	12
7	97	112	4	73	96	4	37	72	7	14
8	113	128	4*	81		4*	41		8	16
9	129	144	5	97	120	5	49		9	18
10	145	160	5*	105		5*	53		11	
11	161	176	6	121	144	6	61		12	2
12	177	192	6*	129		6*	65		13	4
13	193	208	7	145	168	7	73	108	14	6
14	209	224	7*	153		7*	77		15	8
15	225	240	8	169	192	8	85		16	10
16	241	256	8*	177		8*	89		17	12
17	257	272	9	193	216	9	97		18	14
18	273	288	9*	201		9*	101		19	16

In the duodecimo, the inside eight pages, marked star, are cut off and placed in the middle of the sheet. In the eighteenmo, the sheet is cut into three sections of twelve pages; the inside four pages, marked star, of the different sections are cut off and placed in the middle of the section, and the three sections are placed side by side. Forms composed of several sections of eight, twelve, or sixteen pages are treated in a similar manner.

Sizes of Books.—The descriptive names of the sizes of books refer to the size of the leaves, and originated from the number of leaves into which a sheet of paper was folded after printing. The facility of paper manufacture has placed within the reach of printers any size of sheet, so that the size of the page of a book now depends only on the wish of the publisher. The book when bound is termed according to the nearest size of the regular sheets.

Size of book.	Pages in a sheet.	Size of leaf in inches.
Royal 4to	8	11×14
Medium 4to	8	9×12
Imperial 8vo	16	8×12
Superroyal 8vo	16	$7 \times 10\frac{1}{2}$
Medium 8vo	16	$6 \times 9\frac{1}{2}$
Crown 8vo	16	$5\frac{1}{2} \times 8\frac{1}{4}$
Medium 12mo	24	$5\frac{1}{8} \times 7\frac{2}{3}$
" 16mo	32	$4\frac{1}{2} \times 6\frac{3}{4}$
" 18mo	36	$4 \times 6\frac{1}{3}$
" 24mo	48	$3\frac{5}{8} \times 5\frac{1}{2}$
" 32mo	64	$3 \times 4\frac{3}{4}$

The size of paper called medium, 19 by 24 inches, is the standard by which all sizes of books, not otherwise specifically described, are classified; and quarto, octavo, duodecimo, etc., mean that the leaves of books of these sizes are nearly the fourth, eighth, twelfth, etc., of the medium sheet. The length of the American page is usually about one-half more than its width. The English is two or three lines of letter-press shorter. The preceding table shows the usual sizes.

Stereotyping.—This is the art of making plates cast in one piece of type-metal from the surface of one or more pages of type. To Firmin Didot of Paris is due the word *stereotype* (Gr. στερεός, "fixed," and τύπος, "impression") under which the editions printed by his process were known, and which is now a word used in literary as well as technical language. The necessity early arose for some means to preserve large works in type to be printed as occasion demanded, without requiring the expensive and inconvenient mode of using and resetting the ordinary type. Indeed, the first known instance was the Bible, which Van der Mey of Antwerp in 1698 printed from type which had been soldered at the bottom. Stereotyping proper was invented by William Ged, a goldsmith of Edinburgh, Scotland, about 1725, who used the plaster-of-Paris process, which is still the most efficient method. Certain Bibles and prayer-books were stereotyped by him for Cambridge University about 1731, but the jealousy of the printers prevented their use, and the process was abandoned for many years. Two plates escaped destruction, and are printed in Hansard's *Typographia* (1825). Ged, however, afterward successfully executed several editions of Sallust in Edinburgh by his process, the edition of 1739 being the first book correctly printed from stereotype plates. Firmin Didot, as already noticed, about the same time had hard type made, pages of which he impressed upon soft lead, which he laid upon molten lead just about to solidify, and obtained a cast. He believed this process more successful in obtaining a sharp cast of the type than by the plaster process; but it was not used to any extent. Other processes were tried, but were little used. In 1743, Dr. Cadwalader Colden explained a process of stereotyping to Franklin, and his nephew, Benjamin Mecom, cast plates for some pages of the New Testament. Dr. Alexander Tilloch of Glasgow rediscovered the art in 1781, and about 1810, Earl Stanhope introduced Ged's process with improvements, since which time it has extended widely and successfully. Through David Bruce stereotyping was introduced into the U. S. in 1813, as noticed previously. The *Larger Catechism of the Westminster Assembly* claims on its title-page to have been the first work stereotyped in America, dated June, 1813. Three processes are now in general use—the *plaster*, the *clay*, and the *papier-mâché* process.

Plaster Process.—For stereotyping the type is set with high spaces, etc., whereas for the press they are generally about one-third shorter. The type used to have the shoulders bevelled, until David Bruce, for greater facility, and to make the plates thinner, introduced type having the shoulders high and square, as in Fig. 1. Only a few pages are imposed at a time, in a chase thinner than that used for printing, the pages having guard-lines at the top, and bearers scattered through the larger blanks in the pages. The surface is cleaned, oiled with sweet oil, and a frame, called a "flask," put around the form to hold the fluid plaster. Through the corners of the flask are thumb-screws, to level the frame and gradually lift it from the type when the plaster is set. Fine plaster of Paris is used, mixed with water to a half-fluid state, and a little salt to aid the setting. Some of the plaster is poured over the face of the type, and with a buckskin roller slowly worked into the hollows to expel the air and fill the surface, when the rest of the plaster is poured on, levelled, and allowed to set. The screws are gently turned to raise the mould from the type, and the mould trimmed. The mould used to be baked to expel the moisture, but it is usual now to put it into the casting-pan, and by a crane allowed to float on the molten metal for about five minutes, which dries the mould and heats the pan. The metal is softer than type-metal, consisting of 91 parts of lead, 5 of antimony, and 4 of tin. The casting-pan is of iron, with sloping sides, about 20 by 15 inches, and $1\frac{3}{4}$ inches in depth, having a cover with the corners cut off and holes in the centre. In the bottom is a floater or iron plate, on which several moulds are placed face downward, leaving about an eighth of an inch between the cover and the moulds. The pan is attached to a crane by a movable handle. When the pan is heated, it is pressed into the molten metal, which enters through the corners, covers the floater, and finds its way between it and the moulds, filling up the interval and pressing upward against the face of the moulds, when the pan is removed, cooled with water, and, as the metal shrinks on cooling, more metal is poured in through the corners. The cast is removed from the pan, the plates freed from the plaster, and the backs shaved in a planing-machine to the thickness of about three-sixteenths of an

inch. The face is examined, any pieces of plaster or metal in the letters picked out, defective letters made perfect or cut out with a chisel and replaced with ordinary type soldered at the back, and the plate finished. Stereotype plates are used on the press with blocks of wood or metal to make them type-high, and having clamps to hold the plates. This process is used for book-work. A cheaper process is used for temporary work, as circulars, pamphlets, etc., by the clay process.

Clay Process.—For this process a composition of 2 parts of dry china clay and 1 part of powdered soapstone is sifted through fine bolting-cloth, mixed with water to the consistency of tough dough, and laid away for about a month before using. A small press is used like the copying-press, on the bed of which the form is placed, and the type brushed with benzene or kerosene oil. Some of the dried composition is mixed with a little gum-arabic water and with plaster of Paris, placed on an iron plate, and set in a frame attached to the bed of the press. This frame is turned down on the form, covered with muslin and paper, the bed run under the platen, and an impression taken to cause the clay to flow into the blank spaces and give the general outlines of the type. The frame is raised, the cloth and paper removed, and also any superfluous material thrown up by the pressure; the press is closed, and a complete impression taken, imbedding the type in the clay to the desired extent. This process is repeated one or more times to give depth to the cups of the letters. The plate carrying the mould is removed, dried, and heated on the metal. The mould is surrounded on three sides by an iron wire, another plate clamped over it, and the whole put into the trough of molten metal, the open edge of the mould upward, into which the metal is poured. When cooled, the plate is finished as before.

Papier-Mâché Process.—In 1848 the French introduced the papier-mâché process for books. It was afterward introduced into New York, and soon extensively used for newspapers on account of its great advantages both in saving type and time. For this process the spaces need not be high. With the matrix is used a paste formed of 5 ounces of flour, 7 ounces of white starch, a tablespoonful of powdered alum, and 4 quarts of water. The first three are mixed with a little of the water, cold, to the consistency of thick cream, and the remainder of the water, boiling, gradually added. It is put over a fire and stirred till it boils, then cooled. When about to be used, Spanish whiting is added till not too stiff, and passed through a fine wire sieve with a stiff brush. The paper matrix is formed by spreading the paste over a sheet of thick, unsized, and soft paper, and covering it successively with three sheets of tissue-paper, smoothly placed one over the other. It is saturated with water and laid away for use the next day. The face of the type is brushed with olive oil; the tissue side of the matrix is prepared with powdered French chalk, smoothed over with a preparing brush, and laid upon the type. A piece of damp linen is placed over the back, and the whole gently beaten on to the type with a large brush. The cloth is removed, and another sheet of matrix-paper placed on the back of the matrix, and both then beaten to perfect the impression and unite the two sheets. A blanket is put over the matrix and form, and placed under the drying-press, which is screwed down, and heated by steam till the matrix dries. The matrix is removed, warmed on the moulding-press, placed in a heated casting-mould, and a gauge, to determine the thickness of the stereotype plate, placed on it which extends around three sides of the matrix, the open fourth side serving to pour in the molten metal. A cover is screwed tight over the whole, the mould tipped to bring the mouth up, and the metal poured in. The plate is removed and finished. As may be observed, the paper matrix may be rounded to any curve by placing it in a mould having the required curvature. The cast does not destroy the paper matrix, and it may be used to furnish twenty or more duplicate plates. By this process plates may be made ready in twenty-five minutes, or may be finished in fifteen minutes if necessary. It is this process that enables the newspapers to print large editions by furnishing duplicates and printing on several presses, as well as saving the wear of the type, or setting the type in duplicate, as was necessary for some time on the London *Times*. Stereotype plates will print about 100,000 impressions, and up to 200,000 or more.

Electrotyping.—For large numbers of copies electrotyping is more durable than stereotyping. It is an outgrowth of electro-plating, which is explained in the article ELECTROTYPE. It originated with Joseph A. Adams, a wood-engraver of New York, in 1839–41, who reproduced an engraving, and afterward, in 1843, the various borders around the large engravings in *Harper's Illustrated Bible.* The process rapidly extended, and improvements were made by Wilcox, Filmer, Gay, Lovejoy, Knight, and others. This process requires high spaces. The form is coated with graphite with a soft hatter's brush. The mould is formed of the best pure yellow beeswax, which is melted and run into a shallow moulding-pan. This is secured to the head of a press, and the form placed on the bed, which is raised by toggle-joint or hydraulic pressure to deliver the impression of the type upon the wax. The pan is removed, and where there are large blanks some wax is run or "built" on them to make them deeper in the plate. That the electric current may deposit the copper on the mould, it is necessary that the surface should be made a conductor, which is obtained by working finely-pulverized graphite into the letters and lines. This has been done with the dry graphite. Silas P. Knight's wet process is expeditious, and prevents the dust flying around. The wax mould is laid face upward on the floor of an enclosed box, and a torrent of finely-pulverized graphite suspended in water is poured upon it by means of a rotary pump, a hose, and a distributing nozzle, which dashes the liquid equally over the whole surface. Washing removes the superfluous graphite. This process also coats the mould with graphite, wets it ready for the bath, and expels air-bubbles from the letters. After the dry process, the face of the matrix is wetted to drive away films or bubbles of air. The mould thus prepared is placed in a bath containing a solution of sulphate of copper, and is made part of the electric circuit, in which is also included the zinc element in the sulphuric acid solution in the other bath. The current deposits a film of copper on the graphitic surface of the mould, and when it is sufficiently thick it is taken from the bath, the wax removed, the shell trimmed, the back tinned, straightened, and filled in with an alloy of type-metal, and shaved to the proper thickness. A quicker process is that of Knight, which consists in dusting fine iron filings on the wet graphite surface, and pouring on it a solution of sulphate of copper, when the acid leaves the copper, forms a sulphate with the iron, and frees the copper, which is immediately deposited in a metallic form on the graphite. The film is afterward increased in the electric bath. Electrotype plates will print over 300,000 impressions with little wear.

In all the processes for stereotyping and electrotyping, machinery has been introduced to expedite the moulding and finishing, and may be run by steam and employ steam for the drying. These machines are furnished by R. Hoe & Co. of New York, descriptions of which may be obtained in their catalogues, and their machinery is now in use in every quarter of the globe.

Copper-faced Type.—In 1850, Dr. L. V. Newton of New York invented his process for copper-facing type, which permits the use of type for a longer time than can be obtained by any other methods, no practicable substitute for the ordinary type-metal having yet been found. Stereotype plates may also be copper-faced.

Printing Ink.—The requirements of printing ink are—intenseness of color, impalpability, covering the surface of the type perfectly, quitting the surface when the paper is pressed upon it and adhering to the paper, not smearing after printing, and retaining its appearance without change. (For its composition see INK.)

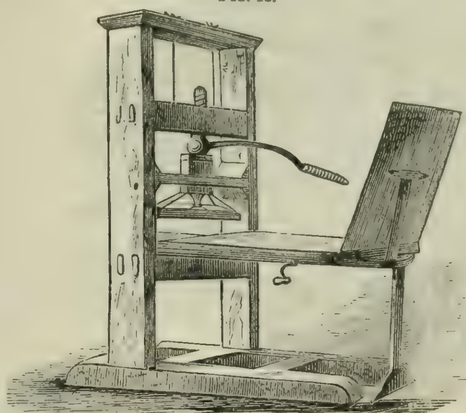
Printing Rollers.—In the early days of printing the ink was applied to the type by balls, made of a sort of wooden funnel with handles, the cavities of which were filled with wool or hair, and a piece of felt or leather nailed over the cavity, and made soft by soaking in urine and being well rubbed. One of these the pressman took in each hand, and, applying them to the ink-table, daubed and knocked them together to distribute the ink equally, and then blacked the form by beating the balls upon the face of the type. Rollers wound with cloth and covered with soft leather were next introduced; but to B. Foster of England is due the invention of the present roller. These rollers consist of a composition of glue and molasses, boiled together, and run on a cylinder of wood covering an iron rod, which works in a handle or in a proper frame for large presses. The cylinder is rolled over the type, and thus applied in a quick and even manner. Other compositions have been tried for rollers, but this is found the only practicable one on account of its peculiar softness, even retention of the ink, and cheapness. The balls, however, are the best means for inking fine wood-engravings and producing brilliant impressions.

Paper.—The paper used in printing is always dampened before use, as wet paper takes the ink better than dry, and is now generally wet by a wetting-press. Paper is usually supplied by the ream of 20 quires of 24 sheets, or 480 sheets per ream. For the perfecting-press paper is supplied from 3 to 5 miles long, a single web containing from 5000 to 10,000 sheets. (See PAPER.) After printing, for book-work the sheets are hung up to dry, placed between sheets of thin smooth mill-board, placed in an hydraulic

press, and subjected to great pressure, which smooths and restores the brilliant appearance of the paper. The sheets are afterward forwarded by the binder. (See BOOKBINDING.)

The Printing-Press.—The earliest form of the printing-press was an adaptation of the wooden screw-press. Copies of the earlier block-books seem to have been taken by a rubbing process, and perhaps afterward by beating a block of wood with a mallet on the paper, as proofs are yet taken of large forms before putting on the press. About 1620, Blaew of Amsterdam made some improvements. His press had a travelling bed, a platen depressed by a screw moved by a lever, and a spring to raise the screw and platen after the delivery of the impression. This press, with little alteration, was used for nearly a century and a half. In 1725 the press upon which Franklin worked in London was a Blaew press, with minor details, known as the Ramage press, and it is now preserved in the patent office at Washington. It was exhibited in the Centennial

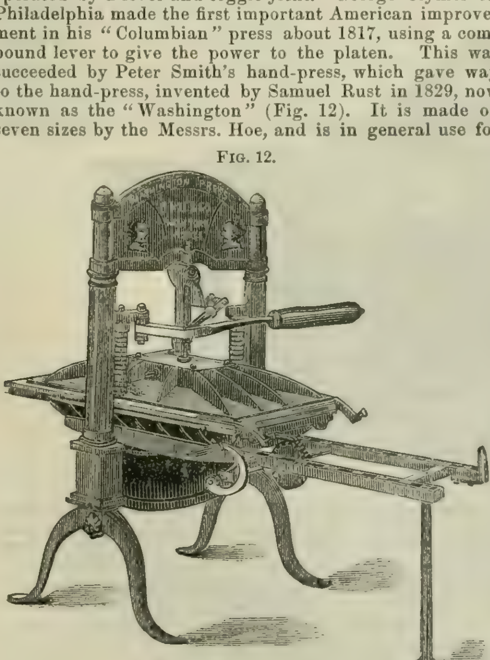
FIG. 11.



Franklin's Press.

Exhibition at Philadelphia in 1876, and is represented in Fig. 11. About the beginning of this century Earl Stanhope introduced a press, the frame of one piece of iron, operated by a lever and toggle-joint. George Clymer of Philadelphia made the first important American improvement in his "Columbian" press about 1817, using a compound lever to give the power to the platen. This was succeeded by Peter Smith's hand-press, which gave way to the hand-press, invented by Samuel Rust in 1829, now known as the "Washington" (Fig. 12). It is made of seven sizes by the Messrs. Hoe, and is in general use for

FIG. 12.

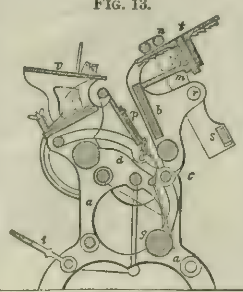


"Washington" Press.

fine hand press-work. A bed slides on a track, and is run in and out from under the platen by a turning crank, which has a belt attached to its pulley. The platen is depressed by a compound lever acting on a toggle-joint, and the platen is lifted by springs on each side. A frame, called the tympan, covered with cloth, is attached to the bed, which is interposed between the type and the platen when pressure is made on the type. Another frame, called the frisket, is attached to the tympan, which is covered with a sheet of paper, having only the part printed upon cut away, which prevents the blanks, etc., from printing on the sheet of paper. An automatic ink-roller is also attached to this press, which is operated by a weight raised by the pull of the pressman. The descent of the weight draws the roller over the type, and returns it to the inking-table while the pressman is placing another sheet upon the tympan and folding upon it the frisket. In hand-printing the form of type is placed on the bed, inked with a roller, damp paper placed on the tympan, the frisket folded over the paper, and the tympan turned down on the type. The bed is rolled under the platen, the lever-handle is turned, the bed rolled out, the tympan raised, and the sheet removed. A good pressman can print about 2000 impressions a day.

Job-Presses.—A great variety of handy job-presses are made in America, generally known from their makers or by some trade-mark, as the Hoe, Adams, Ruggles, Wells, Degener, Globe, Cincinnati, Universal, Gordon, and others, which print cards or sheets up to half medium. A large number of small presses are also in use specially to print cards, and also adapted to print cards in colors, number them consecutively, and print coupons with the tickets, the most celebrated of which are made by the Messrs. Hoe. The principle of the ordinary job-presses is shown in Fig. 13, a vertical section of the Gordon press. The form of type, secured in a chase, is clamped to the bed b, which rocks on the pivot c, and comes into parallelism with the platen p when the impression is about to be given. The platen rocks on the shaft d, propelled by pitman and gearing from the treadle i. The arm $m\ s$ is the roller-carrier, which swings on a pivot r, and carries the rollers $n\ n$ alternately over the form and over the revolving disk t, which distributes the ink; g is a counterweight to balance the swinging bed and attachments, and operates the movable fingers by a spring-bar a. A feed-board v rests on top of the frame of the press. It will print about 1000 copies an hour.

FIG. 13.



Gordon Press.

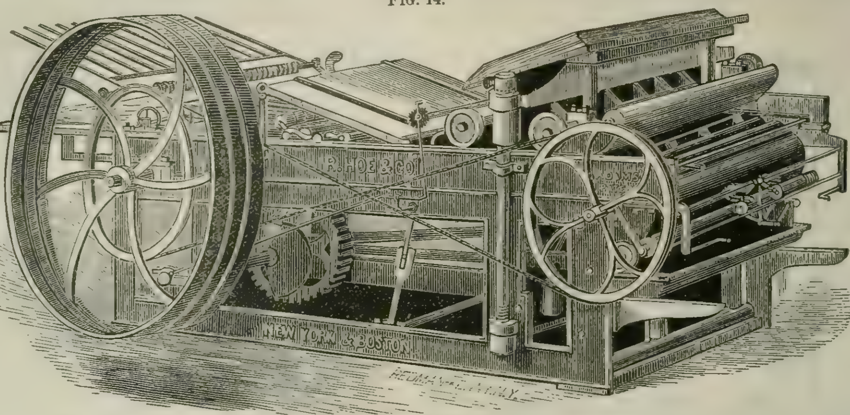
Power-Press.—The hand-press was deficient in speed, and attempts were made to print more rapidly. In 1790, W. Nicholson patented a cylinder press, which, though unsuccessful, contained the principles of all the modern presses. The first working press was invented by T. König, a native of Saxony, in 1814, for the London *Times*, the issue of Nov. 28 being the first newspaper printed by machinery. In this press the type on a flat bed passed alternately beneath the ink-rollers and the cylinder carrying the sheet of paper. Another cylinder, carrying the sheet, was afterward added, the type passing beneath both, between which were placed the ink-rollers. This printed 1100 impressions an hour. König in 1815 formed a press for printing both sides of the sheet; it resembled two single presses placed with their cylinders toward each other, the sheet being conveyed by tapes from the first to the second cylinder. It printed 750 sheets, both sides, an hour. In 1813, Donkin & Bacon furnished Cambridge University with a press in which the type were placed on the four sides of a prism, the paper being applied by another prism. It was unsuccessful, but in this press were first introduced inking-rollers of glue and molasses. Cowper of England in 1815 curved stereotype plates and fixed them to a cylinder, the remainder of which formed a distributing surface for the ink. Two plate-cylinders and two impression-cylinders were afterward worked together in one press by Cowper, printing both sides of the sheet at the rate of 1000 per hour. Applegath and Cowper's single cylinder retained the reciprocating bed, but was the first to have diagonal distributing-rollers to spread the ink by sliding on the reciprocating ink-table. They then constructed a press to print both sides of the sheet from type, conveying the sheet from one cylinder to the other by drums and tapes. In 1827 they applied four impression-cylinders to the reciprocating bed to carry the type for one side of the sheet, the sheets being fed from four feed-boards, and the impression-cylinders alternately rising and falling, so that two sheets were printed during the passage one way, and the other two on the return passage. A pair of inking-rollers between the impression cylinders obtained ink from the reciprocating table. This printed 5000 an hour on one side.

Bed and Platen Presses.—The first power-press used in America was a flat-surface press, made by Daniel Tread-

well of Boston in 1822; in which the platen came down on the type, two of which were used by the Bible and Tract societies, and one at Washington. The best press of this class is that of Samuel Adams of Boston, invented in 1830, improved by Isaac Adams, and now manufactured by Messrs. Hoe in fifty-four sizes. It is represented in Fig. 14, is widely used for book-work throughout the world, and is that upon which this CYCLOPÆDIA is printed. In this press a feed-board holds the paper, which is fed by hand to a second board, or tympan, having points to make holes in the sheet to register the second side. The type rests on a bed which is raised by straightening a toggle-joint against the upper platen. The ink-fountain is at one end of the press. The inking-rollers pass twice over the form. The paper is caught by grippers, carried on a frisket over the form, receives the impression, and is carried forward by tapes to a fly, which delivers it to the sheet-board. One thousand sheets an hour is a full speed for a large Adams press.

Cylinder Presses.—These have a reciprocating bed, and a cylinder to carry the paper and receive the impression. There are a great many kinds of cylinder presses, adapted to all work, from common posters to the finest cut- and book-work, known as Hoe's, Taylor's, Potter's, Campbell's, Cottrell & Babcock's, according to the makers. As a specimen of the refinements to which these presses have attained, an illustration of Campbell's cylinder is given in Fig. 15. It is controlled in its operation entirely by the sheet, so that it is impossible to print the sheet out of register. When the sheet is fed badly, it is thrown out unsoiled. The pointing of the sheet is operated by electricity, ensuring perfect register. Color is taken for every

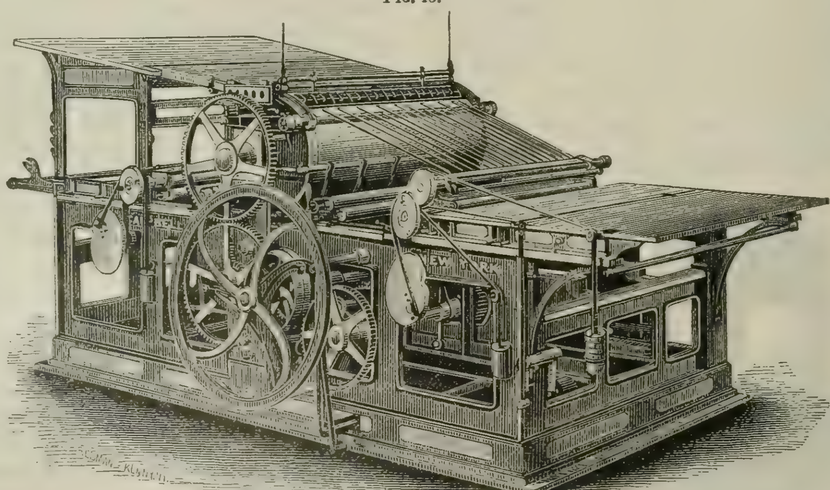
FIG. 14.



Adams Press.

successive sheet only. It has also a double fountain, having two sets of inking apparatus which distribute the ink on the form in two strata; these like two wedges overlap to form a single stratum of uniform thickness. There is one inking apparatus on each side of the cylinder, and as many as fourteen distributing and inking rollers may be

FIG. 15.



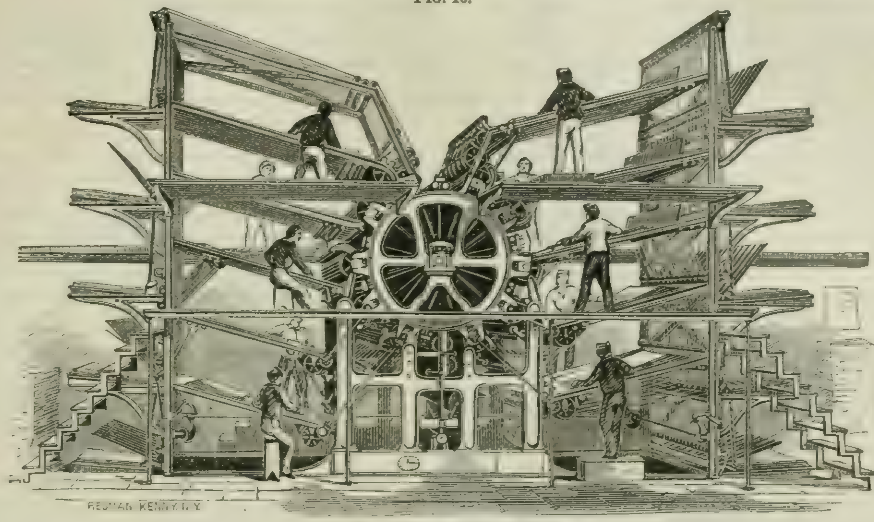
Campbell Cylinder Press.

used. The fly operates only when the sheet is fed. This press also has no springs or tapes, yet is simple in construction. A variety of cylinder press is known as the "stop cylinder," in which, after a sheet is printed, the cylinder remains stationary while the bed is running back, during which a fresh sheet is placed in position.

Rotary Presses.—Presses in which the cylinder carries the type or plates, from which another cylinder receives the impression on the paper, are termed rotary or type-revolving presses. Many attempts have been made to supply newspapers with a fast press, but the most practicable is found to be the cylinder carrying the type. The idea of the rotary press was suggested by Nicholson in 1790, but it was not put into successful operation, on account of the attempt to use bevelled type and for lack of the refinements of the more modern press. The first successful rotary press was invented by Col. Richard M. Hoe, put into operation in 1846, and had at first four impression-cylinders, and afterward six, eight, and ten. This press is represented in Fig. 16. The form of type is placed on the surface of a horizontal revolving cylinder of about four and a half feet in diameter. The form occupies a segment of only about one-fourth of the surface of the cylinder, and the remainder is used as an ink-distributing surface. Around this main cylinder, and parallel with it, are placed smaller impression-cylinders, varying in number from four to ten, according to the size of the machine. The large cylinder being put in motion, the form of types is carried successively to all the impression-cylinders, at each of which a sheet is introduced and receives the impression of the types as the form passes. Thus, as many sheets are printed at each revolution of the main cylinder as there are impression-cylinders around it. One person is required at each impression-cylinder to supply the sheets of paper, which are taken at the proper moment by fingers or grippers, and after being printed are carried out by tapes and laid in heaps by means of self-acting flyers, thereby dispensing with the hands required in ordinary machines to receive

and pile the sheets. The grippers hold the sheet securely, so that the thinnest newspaper may be printed without waste. The ink is contained in a fountain placed beneath the main cylinder, and is conveyed by means of distributing rollers to the distributing surface on the main cylinder. This surface being lower, or less in diameter, than the form

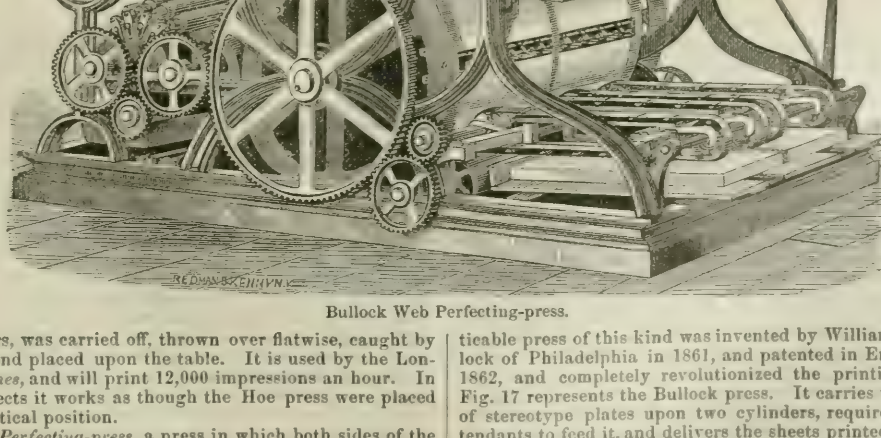
FIG. 16.



Hoe Ten-cylinder Rotary Press.

of types, passes by the impression-cylinder without touching. For each impression there are two inking-rollers, which receive their supply of ink from the distributing surface of the main cylinder: they rise and ink the form as it passes under them, after which they again fall to the distributing surface. Each page of the paper is locked up on a detached segment of the large cylinder, which constitutes its bed and chase, termed the "turtle." The column-rules run parallel with the shaft of the cylinder, and are consequently straight; while the head, advertising, and dash rules are in the form of segments of a circle. The column-rules are in the form of a wedge, with the thin part directed toward the axis of the cylinder, so as to bind the types securely. These wedge-shaped column-rules are held down to the bed by tongues projecting at intervals along their length, which slide in rebated grooves cut crosswise in the face of the bed. The spaces in the grooves between the rules are accurately fitted with sliding blocks of metal even with the surface of the bed, the ends of which blocks are cut away underneath to receive a projection on the sides of the tongues of the column-rules. The form of type is locked up in the bed by means of screws at the foot and sides, by which the type is held as securely as in the ordinary manner upon a flat bed—if not even more so. The speed of these machines is limited only by the ability of the feeders to supply the sheet. The ten-cylinder was first used by the *Public Ledger* of Philadelphia, and employed by the leading newspapers in America and Europe for many years. It will print about 20,000 impressions an hour. A. Applegath of London invented a rotary press, which he introduced in 1848, but in this case placed the type in separate vertical columns around a large vertical drum, forming, in fact, the sides of a polygon. On the vertical type-cylinder the type were arranged in upright columns, forming flat polygonal sides to the drum. Arranged around it were eight sets of inking apparatus alternating with eight impression-cylinders, and the paper, fed from eight *banks*, was delivered upon as many tables. The paper fed from each feed board was carried by tapes and rollers, and passed on edge to the type- and impression-

FIG. 17.



Bullock Web Perfecting-press.

cylinders, was carried off, thrown over flatwise, caught by a boy, and placed upon the table. It is used by the London *Times*, and will print 12,000 impressions an hour. In all respects it works as though the Hoe press were placed in a vertical position.

Web Perfecting-press, a press in which both sides of the sheet are placed on cylinders, usually by plates, and the paper fed automatically from a single web. The first practicable press of this kind was invented by William A. Bullock of Philadelphia in 1861, and patented in England in 1862, and completely revolutionized the printing-press. Fig. 17 represents the Bullock press. It carries the forms of stereotype plates upon two cylinders, requires no attendants to feed it, and delivers the sheets printed on both sides. The paper, in the form of an endless roll, is moistened by passing through a shower of spray. A single roll

will contain enough for several thousand sheets, and the printing operation, including the cutting of the paper into proper lengths, proceeds uninterruptedly until the roll is exhausted. The roll of paper having been mounted in its place, the machinery is started, and the paper unwinds. The paper is cut into sheets by a knife on a roller acting against a cylinder. The sheets are seized by grippers, carried between the impression-cylinder and the form, receiving the first impression. The printed sheet then follows the large cylinder to the second form, receiving its second impression from this form acting against the large drum. From the large cylinder the sheets are automatically delivered to the receiving-board at the rate of over 11,000 an hour. To the press is attached a counting device or arithmometer. The inking-rollers are shown above the inking-cylinders, beneath which are the ink-troughs. The starting-lever is shown on the right. This press was first used on the Cincinnati *Times* in 1861. A press has been ordered for the *Sun* of New York which will print 60,000 copies an hour. The *Sun* employs seven Bullock presses, and there are over fifty in use in the U. S.

In 1869, Mr. Walter of London, after some years' experimenting, brought out the Walter press, now used by the London *Times* and the New York *Times*. It is the same principle as the Bullock, with some minor details. A roll of paper three miles long reels off over a pulley which serves to keep it taut. It then passes by the wetting-rollers, and over a cylinder to the first plate-cylinder, between which and the blanket-cylinder it receives its first impression. Following the direction of the plate-cylinder, it passes between two blotting-cylinders, and is delivered to the second plate-cylinder, receiving the impression on the opposite side. It is carried forward to a pair of cylinders to cut the sheet, which is carried rapidly up an inclined plane and delivered downward to a vibrating frame, which piles the sheets alternately on two tables beneath. It will print about 11,000 copies an hour.

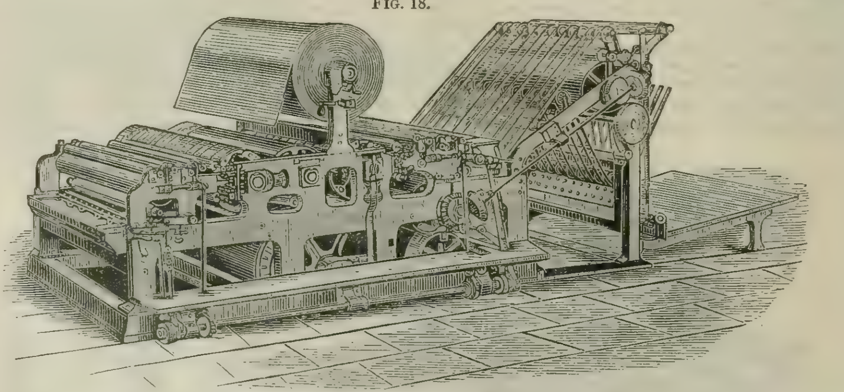
The *Maschinenfabrik* of Augsburg introduced about 1872 a press similar in construction to the Walter press. The principal difference is, that the paper is taken from the under side of the web-roll instead of the top, and is carried to the lower cylinders first, instead of passing to the upper portion of the machine and thence down; which allows the press to be lower. The paper passes through damping-rollers, then through rollers to regulate the tension to the first type-cylinder. The two type-cylinders and the two impression-cylinders lie in the same vertical plane, the middle ones being the impression-cylinders. Printed on one side on the lower cylinder, the paper is carried upward over the two impression-cylinders, receives the second side from the top cylinder, and is carried forward to the cutting-cylinders, when the sheet is led a little upward by tapes to give sufficient height for the delivery apparatus. The sheets are then led downward on an oscillating frame, and placed alternately to the right and the left on two tables. It will print 12,000 an hour.

About 1870, Messrs. Duncan & Wilson of Liverpool, England, invented the Victory press. The paper is led over two wetting-boxes, and then over two hot copper cylinders, and entered between the first type- and impression-cylinders. Here one side is printed, and it thence goes to the second type- and impression-cylinder, where it is backed. It then travels on tapes to the cutting- and folding-cylinders. Here it receives a transverse fold, and the doubled paper is passed to a serrated knife, which cuts the first printed sheet from the web. A second blunt knife again folds the double sheet, which is carried by grippers to a vibratory frame, entering each alternate sheet to the respective pairs of cross-folding rollers, which deliver the sheets to tapes, which carry them to a swinging delivery-frame, by which they are deposited in a pile on the table. This machine will damp, print, cut, fold, paste, and deliver 6000 to 8000 per hour of an eight or twenty-four page newspaper.

The Marinoni press was used in Paris and in London. It had two plate-cylinders, which printed and perfected paper supplied by six feeders, at the rate of 10,000 copies an hour. In 1873, at the Vienna Exhibition, it was improved and made a web perfecting-press. There are two rolls of 5000 yards each, one at each end of the press, the second to be set to work when the first is exhausted. The paper, uncoiling, passes over a wetting-cylinder on to the drum, carried by tapes between two cylinders, where knife-edges cut it into sheets; the sheets are conducted by other rollers and tapes to the two plate-cylinders, and when printed on both sides are deposited by flyers on four receiving-tables.

In the web perfecting-presses the Messrs. Hoe have made some improvements, and an engraving of their press is given in Fig. 18. The paper is printed from a roll containing a length of over four miles and a half, equal to

Fig. 18.



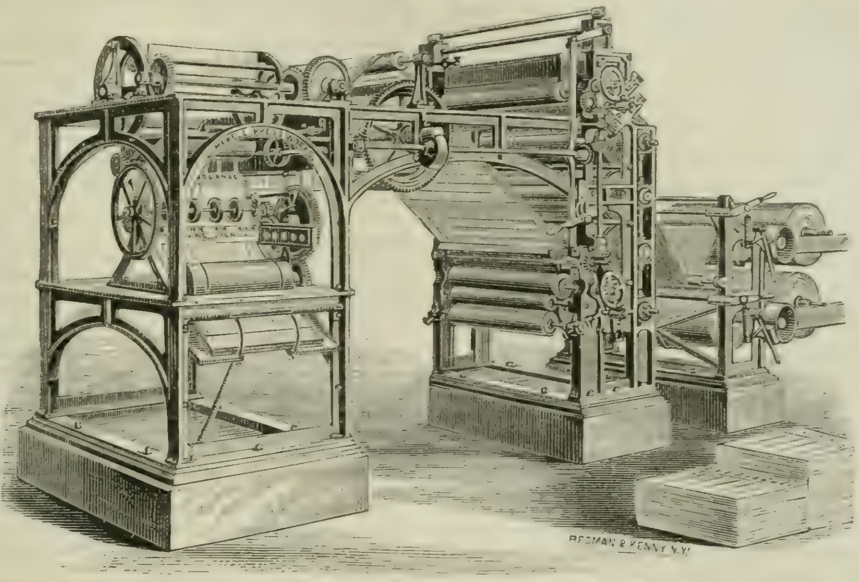
Hoe Web Perfecting-press.

10,000 papers. The machine has three pairs of cylinders geared together. A roll, having been previously damped, is lifted into place by a small crane, and the paper from it passes between the first pair of cylinders, the circumferences of each of which are just equal to the required length of the sheet. One of these cylinders has its periphery covered with stereotype plates of the matter to be printed, and is supplied in the usual manner with an ink-fountain and distributing-rollers, which, as the cylinder revolves, apply the ink to the stereotype forms. The other cylinder is covered with a blanket, and as they revolve together, with the paper between them, they print its first side. The paper then passes on between the second pair of cylinders, and presents its blank side to the stereotype plates of the second type-cylinder. It next passes to the cutting-cylinders, the periphery of one of which has a vibrating and projecting knife that at each revolution enters a groove in the opposite cylinder and severs a sheet from the roll. The sheets are successively conveyed by two series of endless tapes to a revolving cylinder, which retains them until six (or any desired number) are collected upon it, when they are delivered in a body to the sheet-flyer. A circular cutter cuts the double sheets into single copies. A counter is attached which shows the number of sheets printed. The press is 20 feet long, 6 feet wide, and 7 feet high, and delivers 12,000 to 15,000 perfected sheets an hour. A number of these presses are in use in Europe and America. To these web perfecting-presses folding-machines have recently been attached.

The latest web perfecting-press was introduced about 1875 by A. Campbell, the inventor, and is represented in Fig. 19. It will print, inset, paste, and fold any number of pages up to twenty-four. To prepare and dampen the paper for the press, a machine for rewinding the roll is used to cause the paper to be wound on the press-roll under great tension with the edges even. Between the two rolls is placed an upright frame, which carries a water-trough and two upright shafts geared to run at a high speed. On each of these shafts is a metal disk or saucer supplied with water by means of two tubes connected with the water-trough above. While the paper is wound and unwound, the water is thrown out of these disks by the centrifugal force obtained by their high speed in the form of an invisible, impalpable spray upon the paper as it passes to the press-roll, thus thoroughly and evenly dampening it. As the press-roll increases in di-

ameter, a corresponding supply of water is admitted to the disks. The press resembles two upright stands connected overhead by a frame, one end carrying the cylinders, the other the cutting and folding machinery. The ink escapes from the ink-trough in rather a thick stream upon the first roller, and is afterward taken up by two or three successive rollers, the last of which, revolving very rapidly, throws it in the form of spray upon the roller which inks the cylinder, there being a set for each cylinder. Nearly all its movements are positive. Only one cam-motion revolves once to 144 revolutions of the cylinders. With this exception all its motions are rotary. One or two springs only are in some of the subsidiary parts. It is entirely free from tapes and similar annoying contrivances. The press has been driven up to a printing speed of 10,000 per hour, but with the paper thrown off it has been driven

Fig. 19.



Campbell Web Perfecting-press.

up successfully to 15,000, 20,000, 25,000, 30,000, and 35,000 revolutions per hour without the slightest injury to any of its parts. The cylinders are so arranged as to admit of each having one type-column, in addition to the stereotype plate, so that the "latest news" may be set in at any time. To record the number of revolutions, there is a glass tube, with graduated plate like a thermometer inserted in a metal disk or cup, in the sides of which are inserted three small upright iron tubes with enlarged caps on their upper ends. The disk and the tubes are geared up to the driving-shaft, and as it revolves the mercury by centrifugal force is drawn out from the disk and glass tubes into the caps on the upper ends of the iron tubes, causing a corresponding depression in the glass tubes, and indicating on the graduated plate the number of revolutions. This is the recent invention of Edward Brown of Philadelphia. This press is now used on the *Evening Journal* of Jersey City, and by Frank Leslie of New York and J. C. Ayer & Co. of Lowell, Mass.

Printing in Colors.—This is accomplished properly by having the page or pages separated into as many forms as there are colors. Presses are adapted to color-printing, but are modifications of the cylinder and Adams.

Polychrome Printing accomplishes the printing of one or more colors at the same time. Several attempts had been made to do this, but Congreve in 1820 was the first to carry it out successfully with metal plates. His plan was to outline the picture on a metal plate. If intended for two colors, the details of the chief color are completed on the plate, and all the parts for the other color are cut out. Into these parts other plates are fitted, like the portions of a child's puzzle-map, and on these the engravings for the parts of the second color are completed. When these are done, a thickness of type-metal is attached to the back of these interior pieces, so that they can be held separately, and pushed forward or drawn backward at pleasure. Then they are so adjusted to the machinery of the press that they are withdrawn when the first color-roller passes over the surface of the main plate, and are pushed forward beyond the face of the main plate so as to receive the color of the second roller, which then passes over them without touching the first or main plate. Having received their colored ink, the secondary plates are again moved back to a level with the other, so as to form an entire plate, carrying two colors, which are thus, in the ordinary way, imprinted on the paper. Many improvements of this have been made, but the principle remains the same, and it has now a wide application.

Laws relating to Printing.—Europe has many restrictive laws relating to the printing and publication of books and newspapers (for which see Press, Freedom of the). In the U. S. the Constitution by the first amendment prohibits the passage of any laws abridging the freedom of the press, which is sustained by the constitutions of the respective States. The law of Libel (which see) defines the limit of privileged communications and reports, and printers are protected in the necessary publication of charges, etc., demanded by Congress. Some States prohibit the publication of lottery advertisements and similar schemes and objectionable drugs or nostrums. Obscene illustrations and books are generally prohibited. It is the policy of the government to free the press from high postal rates for the public benefit, and for a long period newspapers were free through the post-office in the counties where printed. Newspaper exchanges are circulated free of postage to editors. Indeed, the U. S. enjoys the most unlimited freedom for its press and in the interest of the people. There is a government printer controlled by Congress, the laws relating to which may be found in Brightly's *Digest of the U. S. Laws*. The history of the patent laws will show that in early times grants were made to persons to print works exclusively. (See Patent Laws, History of.) For the laws relating to copyright and literary property generally, see Literary Property.

Bibliography.—The bibliography of printing is voluminous, and but a few of the volumes containing lists of works on printing and the more prominent treatises can be given. The first extensive bibliographic publication on printing is the *Monumenta Typographica* of J. C. Wolfius (Hamburg, 2 vols., 1740), which contains forty-seven treatises and dissertations on the origin, history, and art of printing, nearly all the writings published anterior to that date; Bernard, *De l'Origine et des Débuts de l'Imprimerie en Europe* (Paris, 1853); Breitkopf, *Ueber die Geschichte der Erfindung der Buchdruckerkunst* (Leipsic, 1779); Dibdin, *Bibliotheca Spenceriana* (London, 1814–15); Didot (Ambroise), *Essai sur la Typographie* (in *Encyclopédie moderne*, Paris, 1851); Falkenstein, *Geschichte der Buchdruckerkunst* (Leipsic, 1840); Fournier, *De l'Origine et des Productions de l'Imprimerie* (Paris, 1759); Meerman, *Origines Typographicæ* (Hague, 1765); Maittaire (P.), *Annales Typographici* (Hague, 1819); Ottley, *Origin and History of Engraving* (London, 1816); Schaab, *Die Geschichte der Erfindung der Buchdruckerkunst, durch Gutenberg* (Mayence, 1830); Sotheby, *Typography of the Fifteenth Century* (London, 1845); Schoelhorn, *De Antiquiss. Latin. Bibliorum Editione, ceu primo Artis Typog. Fœtu* (Ulm, 1760); Wimpfeling, *Catalogus Episcop. Argentin.* (Strasbourg, 1660); Thomas, *History of Printing in*

America (Albany, 1874); J. F. Marthens, *Typographical Bibliography* (Pittsburg, 1875), which contains a list of all the works on printing in the English language; T. L. De Vinne, *Invention of Printing* (New York, 1876). (For materials and information the undersigned is indebted to Messrs. R. Hoe & Co., Mr. A. Campbell, Mr. W. H. Williams of the Bullock Printing Press Co., and Mr. Jonathan S. Green.) William S. Paterson.

Printing, Laws Relating to. See Printing.

Pri′or [Lat. *prior*, the "first" of two], in the Augustinian and Benedictine orders of monks, a prelate of the second rank, one who is either the second officer of an abbey under the abbot, or the first officer of a priory, which is a monastery of the second class. The corresponding officer among nuns is the prioress.

Prior (Matthew), b. at Wimborne-Minster, Dorsetshire, England, July 21, 1664, the son of a joiner; was sent by an uncle to Westminster School, and gained the favor of the earl of Dorset, by whom he was enabled to complete his education at St. John's College, Cambridge, where he obtained a fellowship and formed an intimacy with Charles Montagu, afterward earl of Halifax, and with him wrote a poem, *The City Mouse and Country Mouse* (1687), intended as a travesty upon Dryden's *Hind and Panther*. Introduced at court by his patron, Prior was appointed in 1690 secretary to the embassy at the Hague; became a favorite with William III., by whom he was made gentleman of the bedchamber; was secretary of the commissioners who concluded the Treaty of Ryswick 1697; secretary of embassy at Paris 1698; under-secretary of state 1699; commissioner of trade 1700, in which year he published his *Carmen Seculare*, in praise of King William; entered Parliament 1701; became soon afterward a vehement Tory; was sent to Paris with Bolingbroke 1711 to make private proposals for peace; was charged with treason for his conduct in this negotiation on the accession of the Whigs to power in 1714; was imprisoned two years in his own house, during which time he wrote *Alma, or the Progress of the Mind;* gained 4000 guineas by the publication of his poems by subscription, and was presented by Lord Harley with a life-interest in the estate of Down Hall, Essex. D. at Wimpole, Cambridgeshire, a seat of the earl of Oxford, Sept. 18, 1721, and was buried in Westminster Abbey. The best edition of his poems, now little read, is that of Mitford (2 vols., 1835), preceded by a memoir.

Pripet, a river of European Russia, rises in the government of Volhynia, flows first N. E., then E., forms the boundary between the governments of Grodno and Minsk, traverses the immense swamps of Pinsk, enters the government of Kiev, becomes navigable at the city of Kiev, and joins the Dnieper after receiving the waters of the Vijovka, Styr, Pina, Morotch, Plitch, etc.

Pris′cian, surnamed Cæsariensis, probably because he was born at Cæsarea, flourished about 500 A. D., and lived as a teacher of Latin at Constantinople, where he received a salary from the court. Of his works are still extant *Commentariorum Grammaticorum Libri XVIII.*, of which the first sixteen books treat upon the eight parts of speech recognized by the ancient grammarians, and the last two on syntax, edited by Krehl (Leipsic, 1819) and Hertz (Leipsic, 1855), and some minor essays and poems, among which are a grammatical catechism on parts of the *Æneid*, a treatise on the symbols used to denote numbers and weights, an essay on accents, another on the metres of Terence, etc., edited by Lindemann (Leyden, 1818) and by Keil (Leipsic, 1856–60).

Priscianus (Theodorus), a celebrated physician, a pupil of Vindicianus, lived at the court of Constantinople in the fourth century A. D., and is the author of a Latin work, *Rerum Medicarum Libri Quatuor*, first printed in 1532 at Strasburg, in which he tries to combine the ideas of the methodical and dogmatical schools with those of the empirical.

Priscil′lian, belonging to a noble family of Cordova, Spain, founded a sect whose doctrines were a blending of Manichæism and gnosticism. In 379 the existence of the sect became known, and in 380 the Council of Saragossa condemned its doctrines and banished its founder. The influence of Priscillian was too powerful, however, and his most zealous adversary, Bishop Ithacius of Assonuba, was compelled to fly. He sought refuge with the usurper Maximus, who had Priscillian brought to trial before the Council of Treves, condemned, and put to death in 385. It was the first instance of a Christian being put to death for heresy, and it aroused the indignation of St. Martin of Tours, St. Ambrose, and others. The sect spread subsequently from Northern Spain to Languedoc, and even into Northern Italy, but disappeared entirely in the sixth century, after the synod of Braga in 563. (See Lübkert, *De Hæresi Priscilliani* (Hafnia, 1840), and Mandernach, *Geschichte des Priscillianism* (Treves, 1851).)

Prism [Gr. πρίσμα], a polyhedron two of whose faces are equal polygons, having their sides parallel and all the remaining faces parallelograms. The first-named faces are called bases, and the remaining ones make up what is called the lateral surface of the prism. The distance between the bases is the altitude of the prism.

Pris′moid [Gr. πρίσμα and εἶδος], a polyhedron resembling a prism. It is a frustum of a wedge. The volume of a prismoid is equal to the sum of its parallel bases plus four times the section midway between the bases multiplied by one-sixth of the altitude.

Pris′on [Fr.], primarily, a place of detention for debtors or persons charged with political or other crimes until they were tried or adjudged guilty or innocent of the offences for which they were committed; later, and for the most part within 150 years, the prison has come to be, to some extent, the place and instrument of punishment. The idea of punishment by imprisonment itself does not seem to have entered into the minds of the rulers of ancient times, though the prison was often, from its crowded and filthy condition, its want of ventilation, the foul fevers and plagues engendered there, and the starvation inflicted on its hapless inmates, a place of cruel torture and often of speedy death; but the ancient idea of punishment was embodied in the stocks, scourging, beating with rods, the bastinado, the knout, the wheel, the rack, the thumb-screw, the iron boot, mutilation of the eye, the ear, the nose, the hand, the foot, etc.; the crown of thorns, walking over hot irons or coals, branding, whipping at the whipping-post or the tail of a cart, the pillory, the ball and chain, the treadmill, or the galleys; or, where the punishment was intended to be death, the stake, the terrible death by crucifixion, beheading, stoning, the administration of poison, or, in more modern times, hanging, the guillotine, or the garrote.

Detention of debtors and of political and other offenders was very early an admitted necessity. The earliest instances of its use are found among the Egyptians, whose superior civilization led them to devise measures of police of which other nations, less advanced, had not yet felt the want. Thus, we find in Gen. xxxix. 20 that "Joseph's master took him and put him into the prison, a place where the king's prisoners were bound; and he was there in the prison." This was primarily a place of confinement for political prisoners, and to it were committed such offenders as the chief butler and baker of Pharaoh, important officers of the royal household; and it was only because of the high position of Potiphar, Joseph's master, and perhaps also from some doubts of his guilt, that Potiphar committed him to this prison instead of putting him instantly to death on the grave charge preferred by his wife. There are numerous references to prisons in the Old Testament, as well as among profane writers contemporary with its later books, but always as a place of detention simply, though in the case of Jeremiah the dungeon connected with the prison (Jer. xxxviii. 6), from the depth of its miry bottom and its filthiness, seems to have been intended for the destruction of the prisoners who were cast into it. All the Oriental monarchies had their prisons; but though these were, as they are to this day, wretched, ill-ventilated, and filthy dens, in which it would seem to be impossible to support life, and where the poor culprit who had no money or friends was welcome to die of starvation and foul air as soon as he liked, still, the only theory of the prison was that it was simply a place of detention, and no length of endurance of its horrors was allowed to mitigate in any way the severity of the physical tortures or punishments inflicted on him if he was adjudged guilty of the offence with which he was charged. A recent description of several Chinese prisons demonstrates that they have changed very little in the last 3000 years. Debtors and criminals sentenced to death are their principal inmates, the latter usually wearing a *cangue* or broad heavy yoke around their necks, the head and neck being drawn forward in these by the executioner as he is about to behead them. The squalor of these prisons is said to be beyond all description.

Among the Greeks and Romans the prison, though more cleanly, was generally only a place of detention, though the "inner prison," low, close, and hardly ventilated at all, and containing often the stocks or other instruments of torture, was occasionally made a place of temporary torture. By the laws of Rome, a Roman citizen could not be cast into prison except by the direct command of the emperor and for some very grave offence; and the violation of this law was severely punished. The usual method of detention for Roman citizens was to chain their right arm to the left arm of a soldier, who was made responsible for their safe-keeping; sometimes each arm was chained to a soldier; this guard was changed every twelve hours. In the first century after Christ there was at Rome one prison,

and possibly more, intended for the confinement of prisoners condemned to death or awaiting a final hearing before the emperor. This was the Mamertine prison, or rather the Mamertine vaults—for there were two, and possibly three, distinct vaults, one below the other—to which Juvenal is supposed to refer in his third *Satire* as, in the good old time, having been sufficient to contain all the criminals in Rome. The two principal dungeons are constructed of huge blocks of tufa, and the lower is supposed to be of Pelasgic architecture and the oldest building in Rome. The upper is 16 feet in height, 30 in length, and 22 in breadth; the lower is smaller and lower, and the only access to it is by a hole in the middle of the ceiling, through which the prisoners were let down. This was originally the case also with the upper vault, called the dungeon of Ancus Martius. Many noted persons were imprisoned here, and some, as the Catiline conspirators, Jugurtha, Vercingetorix, Sejanus, and Simon Bar Gioras, were put to death. Tradition says that Sts. Paul and Peter were confined in this lower dungeon till their execution, but this is uncertain. There were houses of detention in Rome which were used for the safe-keeping of slaves. But even at a later period, the Code Justinian has very little to say of prisons; its penalties were scourgings, tortures, mutilations, and death. The punishments of the Roman empire for crimes were not wanting in severity, even to those who enjoyed the great privilege of citizenship; but they were either physical, like those just enumerated, or moral and political, such as the loss of family authority and position, the loss of citizenship and of liberty—*i. e.* compulsory enslavement—and did not ordinarily include, except for a brief period, incarceration. With the downfall of the Roman empire, and the assumption of power over small districts of territory by the feudal barons, there came a change. Constantly in conflict with each other, and holding their castles only by superior bravery or the right of the strongest, these doughty barons could not let their unsuccessful rivals or their captive foes escape from their hands. The great tower of every castle, the *donjon*, had its *keep* or strong-room, often underground, to which foe or rival was forthwith consigned, if he fell into the hands of his enemy. Our word "dungeon" is said to come from these donjon-keeps; and well it may, for more horrible places than some of them it would be hard to find. Damp, filthy, with no means of lighting, warming, or ventilating, and usually without egress or ingress except by being let down from or drawn up to an opening at the top, they were utterly unfit for the confinement of human beings, and the names *oubliettes* ("little places of the forgotten") or *vade-in-pace* ("go in peace") by which they were designated in grim jest by their builders or owners indicated but too truly their murderous purpose. Of a somewhat better character, though still cheerless and almost hopeless prisons, were those isolated fortresses where chiefs, nobles, and kings in the Middle Ages were so often incarcerated. Richard of the Lion Heart, as well as several other European monarchs, and nobles without number, languished in these prisons; and the Tower of London, which belonged to the same class, had its long succession of noble prisoners, many of whom went thence to the stake or the headsman's block. The prisons of the Inquisition in Italy, Spain, Portugal, France, Belgium, and Austria, though not in the main intended so much for punishment as for detention—the punishment (often within the prison-walls) consisting mainly in the racks, wheels, boots, thumbscrews, and other instruments of torture which a fiendish ingenuity exhausted itself in contriving, and in the *autos-da-fe* and other modes of inflicting the death-penalty—were yet, in some cases, places of protracted and cruel punishment, in which every idea of horror and apprehension which could torture the mind of the victim was suggested, to aggravate the distress of confinement. Even during the present century, the victims of this cruel imprisonment have died by slow torture. On the Continent, however, and even in Great Britain, the idea that imprisonment, except in the case of political offenders, constituted any part of the punishment of crime does not seem to have dawned upon the minds of statesmen, political economists, or penologists—if the latter class could be said to have existed—till within the last 150 years. There were jails, houses of detention, prisons—if they might be called such—both in Great Britain and on the Continent, but they were filled with debtors, persons arrested for crime and awaiting trial, and those who had been sentenced to banishment or transportation, to slavery, to the galleys, or to execution. The jails and prisons were so filthy and ill-ventilated that deadly fevers, the plague, and the black death would occur in them, and frequently spread over the adjacent country. At what was known as the "Black Assize" in England, in the seventeenth century, over 300 persons, including judges, jury, lawyers, and spectators, fell victims to a malignant jail-fever which was communicated by the prisoners brought out of the jail for trial. The moral pollution of these jails was as great as the physical: the grossest intemperance and licentiousness prevailed in all of them, and the fee for the prostitution of the female prisoners was a recognized perquisite of the keepers. No confinement in these pest-houses, however protracted, was accepted as in any degree diminishing the severity of the sentence to the galleys, the mines, to the treadmill, or the whipping, pillory, branding, ear or nose slitting, cropping, or transportation to distant colonies. Attempts were made to reform and improve the jails in England, as well as on the Continent, by John Howard in the latter part of the eighteenth century; they were attended with some success, though not so great as his philanthropic efforts and his final sacrifice of his life to the cause warranted. The reformation of great and old abuses is difficult, and makes slow progress at first; still, something was accomplished, and Beccaria in Italy, and Sir William Blackstone, Jeremy Bentham, and Mr. Eden took up the work and went forward with it. At this time, however, Great Britain was largely engaged in schemes of transportation, which her statesmen believed would rid them of their vicious population, and they were not inclined to give much heed to measures of prison reform. They had sent convicts to Virginia from 1619 to 1770, until they would no longer be received, and, after the beginning of settlements in Australia and the adjacent islands, had forwarded thousands to Botany Bay, Sydney, Tasmania, North and West Australia, and to British Guiana, till about 1850; but, contrary to their expectations, the number of criminals at home did not decrease. Most of the continental states had tried the same experiment of transportation, and with about the same success. France, while sending off large numbers of criminals, consigned very many to the galleys, where they learned only evil, and at their discharge became leaders in crime. Russia sent the greater part of her criminals, as well as her political offenders, to the mines in Siberia, and most of the other powers rid themselves of their criminals by transportation wherever they could find the opportunity, sometimes sending them to our frontier territories, to Mexico, and to South America. These efforts did not lessen the number of actual criminals. As yet the possibility of the reformation of criminals was not conceded. All efforts to keep down the number by transportation having failed, and the benevolent labors of John Howard, of Mrs. Elizabeth Fry, and of the aldermanic committee of London having proved ineffectual to remedy the evil, Sir T. Fowell Buxton, a member of Parliament, published in 1818 an *Inquiry whether Crime and Misery are produced or prevented by the Present System of Discipline*. In this work he laid down certain principles concerning the relative rights of prisoners and of society, and boldly took the ground that a majority of prisoners might be reformed and restored to society by a proper method of discipline. After a conflict of nearly thirty years the prisons and prison-systems of Great Britain and Ireland have been very thoroughly reformed; transportation has ceased, and the convict prisons, though more expensive than they should be, are on the whole well managed, and many of their prisoners are reformed. Many of the convicts are employed in the great naval shipyards at Dartmouth and Portsmouth. The jails are cleanly, well-ventilated, and for the most part have some employment for the prisoners, which keeps them from mischief and contributes a small sum toward the expense of their support. The reformatories for young offenders, which are generally well conducted, have, by reforming the young criminals, prevented the increase of the criminal class, and greatly diminished the number and magnitude of crimes in the country. In Scotland and Ireland, by a different application of the same principles, a still greater measure of success has been attained. What is known as the Crofton or Irish system of prison discipline has proved very successful in Ireland (more so, perhaps, than it would in some other countries), and the diminution in the number of great crimes has been highly gratifying.

In the U. S. transportation has never been attempted as a means of ridding the community of the dangerous classes. Before the Revolution the criminal code was very severe; death was the penalty of a great number of crimes; in one of the States 115 crimes punishable by death were enumerated; in other States the number was from 80 to 100. Burglary, horse-stealing, highway robbery, and even grand larceny, as well as forgery, counterfeiting, and many other crimes now punishable by a moderate term of imprisonment, subjected the criminal to the death-penalty. At the same time the prisons were in a wretched condition, hardly better than those of Great Britain. In 1786, Pennsylvania made the first effort at improvement of her prisons by the

erection of the Walnut street prison and the adoption of the *solitary* plan of discipline. The cell was larger than usual, but the prisoner was compelled to remain in it without work or books, and during his whole period of confinement was allowed to see no human face, to hear no human voice. The result was terrible. The prisoner, deprived of all opportunity of occupying either mind or body, and shut up to his own thoughts, soon became insane or fatuous, and the really humane men who had devised this system found that they had made a frightful blunder. The system was modified about forty years later by the adoption of what has since been known as the "separate plan." In this the prisoner, while still isolated from the sight or hearing of his fellow-prisoners, has a large cell and a small yard for exercise opening out of it; he has work, books, and moral and religious instruction from an instructor whom he can hear, but not see. He is allowed to converse in regard to his work with the instructor in that work. The two penitentiaries of the State are conducted on this plan, and we believe one or two local prisons have also adopted it. It is very expensive; the work is unprofitable, the proceeds of it not defraying more than one-sixth of the expenses of the prison; and, though there is not so much insanity or fatuity as under the solitary system, the prisoners fail in self-reliance, and are very seldom of any service to the community after their discharge. All the zeal of its advocates has failed to induce any other State to attempt it. The "solitary system" was tried in several States, but with uniformly disastrous results. In 1821–23 the "congregated or silent system" was adopted at Auburn, N. Y. (it had been previously tried in Holland), and soon attained such a reputation that it was adopted by other States, and with various modifications is now the prevalent system in the U. S. Since the first experiment of Capt. Elam Lynde at Auburn, the system has been so much modified that, as practised in some of the States, it is hardly recognizable. The original plan required congregated labor, but in perfect silence; no word must be uttered by the convict, nor must his eye ever be lifted to a human face. At night he was locked into his cell, the corridors watched, and no communication permitted with any one. No lights were allowed after going to his cell. These severities are now greatly mitigated; the cells are lighted at night, books allowed to the prisoner and instruction by the chaplain; he may converse with his keepers, his instructor, and the chaplain; as a matter of fact, he does converse with his fellow-prisoners; in many of the prisons an allowance is made of from one to five days on each month of good behavior, and thus the term of the sentence may be materially shortened; the avails of overwork are in some prisons allowed to the prisoner at his discharge, or are sent to his family at his request. In many of the congregate prisons the labor of the prisoners is let to contractors at a given sum per day; in several of the States the whole expenses of the prison are thus defrayed, and in some a surplus is paid into the State treasury. In some cases the State employs the convicts and disposes of the products of their labor, but these generally fail to defray the entire expenses. The number of prisoners who, on their discharge, prove to be really reformed varies greatly in different States. Where zealous effort is made by such agencies as the prison associations, to aid discharged prisoners in leading honest and upright lives, the number reformed is much greater than elsewhere. What is needed in the management of convict prisons in the U. S. is not so much the adoption of any new system as the entire divorce of the prisons from partisan politics; the appointment of honest, upright, and competent men, after a severe competitive examination, as wardens, keepers, inspectors, and other officers, and their retention in their places during good behavior; the inculcation of moral and religious, but not sectarian, principles to the prisoners in such a way as to reach their hearts; and the presentation of such motives to good conduct as shall make them more desirous of being good than of merely seeming to be so. If to these modifications in the present management of prisons there is added an efficient agency for aiding and directing them to employment on their discharge, there is no good reason why at least 70 per cent. of the convicts should not be reformed. Many objections have been made to the contracting of the labor of prisoners. If properly and honestly managed, it is hardly more objectionable than the employment of the prisoners by the State. Labor is a necessity both for the health and the reformation of prisoners, and the chief problem to be solved is so to regulate it that it shall do no injustice either to the prisoners or to the community.

The jails throughout the country need a radical reform. Very few of them are well or honestly managed, and they exert a deadly influence on young offenders, brought by their means into contact with older and depraved criminals. They, also, should be entirely divorced from partisan politics, and classification, labor, and moral instruction should be required to the utmost possible extent. But, after all, the great source of the increase of crime is in the demoralization of the young. The juvenile delinquents and vagrants make up in their turn the great mass of older criminals, and the increase and improvement of our reformatories, and if necessary—as it will probably be found to be—the gathering up, by some forcible legal process, of these viciously-inclined children, and placing them in institutions under circumstances favorable to their reformation and improvement, will prove the key to our greatest success in diminishing crime. L. P. Brockett.

Pris'on Dis'cipline, as a science, is, so to speak, but of yesterday. For ages public punishment appears to have had but one object—to terrify and deter through torture. The cruelties and horrors of the prison-house were almost past belief. It would seem as if the terrific personification of punishment in the Hindoo code had become there a living reality: "Punishment is the inspirer of terror; with a black aspect and a red eye, it terrifies the guilty." But Christianity has at length wrought a change which, sooner or later, was inevitable under its benign and refining influence; and the merciless scourgings, ponderous irons, torturing thumbscrews, underground dungeons, and chainings to dead bodies once inflicted on prisoners have given place, if not wholly, at least in great part, to looks and tones and acts of sympathy and kindness. Two eminent men, friends and colleagues in one of the most noted literary enterprises of modern times, in writings separated from each other by only a quarter of a century, have aptly given us the salient characteristics of the two systems. In an article printed in the *Edinburgh Review* in 1821, Sydney Smith maintained that for the looms then just introduced into Preston jail should be substituted the crank, the treadmill, or some other species of toil whose product the prisoner could not see; that this toil should be made as monotonous, irksome, and distasteful as possible; that irons and a particolored dress should be employed as instruments of disgrace and humiliation; that terror, pain, suffering—wanton, wasted, useless suffering—should be the foundation of every penal system; that reformation was not to be thought of; and that a prisoner committed for not more than three months should pass a part of that period in complete darkness, and the whole of it in complete solitude and idleness, because, forsooth! solitary idleness tends to repentance. In a paper communicated in 1856 to a meeting of prison reformers in Bristol, Henry Brougham, *per contra*, used this language: "The result, then, of our inquiry has led to this proposition, which I venture to lay down as resting on arguments wholly irrefragable—viz. that all punishment should be conducted mainly with a view to reforming the offender. I regard the culprit as our patient; I consider the judge who consigns him to punishment as the parent, or guardian, or master, who sends his child, or ward, or workman to a hospital; I look upon the state as the superintendent of that infirmary, and the governor with his assistants as the physician with his helpers occupied in bringing about a cure. The malady is rather chronic than acute, and it is always infectious; but the treatment is to be regulated by principles, guided by knowledge, tempered with kindness and tenderness, yet administered with a firm and unflinching hand. There is occasionally a fatal result, sometimes a long-protracted cure; but in the vast majority of cases the skill and the care of the physician prevail, and the result is happy for both the patient who recovers his health and the community which avoids the contagion."

Prison discipline, the science of public punishment, the philosophy which investigates the proper treatment of criminals, must have a profound interest for all lovers of the human race. It goes down to the foundations of public order. It touches the stability and security of the public peace. It affects the sacredness of human life. It is concerned with the protection of property and the safety of our homes and persons. It has a vital relation to the material well-being of communities, and a yet more vital relation to the purity of public morals and the redemption of multitudes of human beings, our brothers and sisters, from sin and suffering. In all the wide range of social science, in all the varied fields of inquiry which command the study of the friends of human happiness and progress, there is scarcely one more comprehensive, more complex, more important, or more abundant in the fruits which a wise culture will be likely to yield than this. We have neither time nor space to traverse the history of the past, but at the present moment three general systems of prison discipline divide the study and the suffrages of the civilized world—viz. the Auburn, or congregate silent system; the Philadelphia, or separate cellular system; and the system of progressive classification—sometimes called the

Irish system, because first applied in Ireland—sometimes the Crofton system, from the name of the gentleman who devised and applied it in the form it has there, though it might, perhaps, be more properly named the Maconochie system, from Capt. Alexander Maconochie of the British navy, the real author of the system and the most original, profound, and philosophical of all prison reformers. The essential principle of the Auburn system is that of absolute separation of the prisoners by night and associated silent labor by day. Outside of Philadelphia this system is found everywhere in the U. S., and has also a foothold, more or less extensive, in various European countries, where, too, the old system of common dormitories has far too wide a prevalence, though it has no defenders, and is destined, certainly, to give way, sooner or later, before the progress of sounder thought and wiser methods. One limitation, however, needs to be made here. We have characterized the Auburn system in the U. S., looking to one of the leading elements in the theory of the system, as that of "associated *silent* labor." The last of these epithets has become, in a degree, inapplicable. Some of our convict prisons do not even claim to conduct their discipline upon the strictly silent principle; in others, where the claim is made, the rule of silence has but a partial enforcement; while in comparatively few is the rigidity of the old discipline of absolute non-intercourse maintained in full force. The essential principle of the cellular system is that of a complete bodily separation of the prisoners in labor, recreation, and rest. In the U. S. this system is restricted to the State penitentiary in Philadelphia and a very few of the county prisons of Pennsylvania. In Belgium it has been adopted as the national system of prison discipline, and it is there applied under conditions suited to bring out all the reformatory and healing power which it is capable of exerting. In Holland there is a prevailing public opinion in its favor, but with many dissentients, and the system is steadily gaining ground. A strong, though perhaps not predominant, public opinion favors it in Germany, and in many other European states, particularly France, the cellular system has its partisans and supporters—enlightened, earnest, and able men. The two systems of prison discipline briefly characterized above are marked by important diversities; nevertheless, they have a common basis. Isolation lies at the foundation of both. It is a fundamental principle of both. The difference is one of application, not of essence—of mode, rather than principle. In one, the isolation is effected by an absolute physical separation by day as well as by night, and the labor is performed in the cell; in the other, the labor is done in common workshops, and the isolation, which is simply moral during the day, is effected by the enforcement of an unbroken silence. The bodies of the prisoners are together, but their souls are apart, and while there is a material society, there is a mental solitude. Such is the theory on which the two systems are founded, but in neither do the facts ever fully correspond to the ideal. In truth, if the congregate system could be carried out according to its ideal, it would be worse than the cellular, even in the point to which exception is chiefly taken to the latter; for nothing could be so torturing as for two men to stand or sit side by side for five, ten, twenty years, and never, by word, note, act, look, or token of any sort, exchange a thought or a sentiment; yet such is the theory of the Auburn system. This consideration called into action some forty years ago a rare and noble genius. Capt. Alexander Maconochie, whose name has already been mentioned above, was, on his own application in 1840, invested with the governorship of the British penal colony of Norfolk Island, at that time containing a criminal population of 1500 souls, made up of the worst convicts ever sent out by the mother-country. This great man (for such he truly was) there became the originator and founder of the system of progressive classification as an agent in prison discipline and the reformation of prisoners. The discipline inaugurated by him was called by its author the "social system of prison treatment," because of the play therein given to the social instincts of humanity; but it is commonly known among penologists as the "mark" system, because of the use which it makes of marks in recording the progress of the prisoner in industry, education, order, and virtue. His system rests on four fundamental principles: (1) Instead of a time-sentence, it imposes a labor-sentence, thus setting the prisoners to earn back their freedom by the sweat of their brow. (2) It teaches them self-denial, by enabling them to purchase a speedier liberation through the sacrifice of present gratification. (3) It appeals to their social nature, giving them an interest in each other's good conduct, and thus making them helpers in the maintenance of discipline. (4) It prepares them for a return to society by gradually relaxing restraint and strengthening their powers of self-control. To carry out these principles, Capt. Maconochie sought to make prison life an image of free life, as far as that could be done in consistency with its objects; in other words, to work *with* nature instead of *against* it, as most prison systems have hitherto done. He treated the convict as a laborer, with marks for wages. His marks were made to play the part of money, for with them the prisoner was required to purchase his food, clothes, schooling, etc., while only the surplus of these earnings counted toward his liberation. Under this system the prisoner is not to be sentenced to a certain number of months or years, but to earn a certain number of marks over and above his keep. Maconochie fixed on ten marks as a fair day's wages, the men being paid by piece-work, and not by time, and for every ten marks saved the convict shortened his imprisonment by a day. At the stores he purchased his daily supplies, paying for them in marks. The rations were served out at three rates. The coarsest cost three marks per day, the next four, and the best five. The self-denying prisoner might thus save seven and the self-indulgent five marks each day for the purchase of his liberty. As extra marks were allowed for overwork, it was possible to hoard at the rate of eight or ten a day as the fruit of diligence and self-denial. Moreover, the marks furnished the means of disciplinary punishment, a proportionate fine in marks being the penalty for every act of disobedience or failure in duty. And while, by this machinery of marks, Capt. Maconochie trained his convicts to habits of industry and frugality, he adopted different means to accomplish his other objects. He divided the convicts' sentences into three periods. During the first or penal stage the men worked under a sharp and stringent discipline. At the conclusion of this they were allowed to form themselves into companies of six each—the members of each company being left to choose their own companions—and then they entered into the second or social stage. In this stage the six prisoners forming a company had a common fund of marks, into which common stock the daily earnings of each member were paid, and from which the supplies and fines for the whole company were deducted. They were thus made responsible for each other's conduct, and naturally became watchful both over themselves and their companions; themselves, lest others should suffer through their fault—their companions, lest they should suffer through theirs. By this means, also, Capt. Maconochie, who knew the intense selfishness of criminals, hoped to implant kindly and generous feelings; that is, to cultivate their social affections. In the last or individualized stage the companies were broken up, and, though every man was still kept at work to earn his daily tale of marks, he was in other respects comparatively free. He had his own hut and garden, his own piggery and poultry-yard, the products of which he might sell to the officers of the colony or the ships that touched at the island. By thus giving the probationer property and rights of his own, Maconochie hoped to teach him respect for those of other people. Such is a brief sketch of this remarkable man's system of penal discipline. He was four years on Norfolk Island. He threw himself, heart and hand, into the work of regenerating the degraded beings who formed its population. He built a church, founded schools, imported a catechist, and on Sundays toiled as ministering deacon himself. Day and night his brain was busy devising new expedients to lift his fallen charge out of bestial lust and demoniacal malignity into self-respect, loyalty, and human affection. His success was wonderful, though he was never allowed by the British government to bring all the principles of his system into play, and so give it a full and fair trial. Nevertheless, his own testimony, confirmed by numerous witnesses, is: "I found the island a turbulent, brutal hell; I left it a peaceful, well-ordered community." A truly heroic soul! A few years after Maconochie's retirement from Norfolk Island, Capt. (now Sir) Walter Crofton, following in his footprints, though possessing a far higher organizing and executive genius, devised and established the new system of convict prisons for Ireland, now called after his own name; and rightly so called, for he took his predecessor's principles and moulded them into a practical scheme of prison discipline, capable of being successfully applied by the average grade of official intelligence. Sir Walter, in founding his prison system, adopted the mark system of Maconochie, with modifications which improved it in many important respects, but with curtailments also—resulting, no doubt, from restrictions imposed on him by the law—which in some measure detracted from its completeness and weakened its force. The Crofton system consists of three stages: A penal stage of separate imprisonment, continuing eight months; a reformatory stage, longer or shorter according to the length of the sentence, with separation at night and associated labor by day, in which the principle of progressive classification is applied with a gradual lifting of restraint and

enlargement of privilege, including an increased share in his earnings as the prisoner advances from class to class; and a testing stage, designed to verify the reformatory power of the preceding discipline, and also to serve as a period of natural training which shall gradually prepare the prisoner for full liberty. The Crofton system may be shortly defined as an adult reformatory, in which the will of the prisoner is brought into accord with the will of the prison-keeper, and held there for so long a time that virtue becomes a habit, and where the object is to teach and train the prisoner, during his detention, in such manner that on his discharge he may be able to resist temptation and inclined to lead an upright, worthy life. Now, this must be done by placing the prisoner's fate, as far as possible, in his own hands, and by enabling him, through industry and good conduct, to raise himself, step by step, to positions of increased freedom and privilege; while idleness and bad conduct, on the other hand, keep him in a condition of coercion and restraint. The public opinion of the civilized world is gradually—we think rapidly—taking shape in favor of a system of prison discipline substantially, though not perhaps in all its details, like that outlined above. It is indisputable that such is the direction of opinion in the U. S. England has now the same prison system as Ireland except the third stage. Denmark has adopted this system of progressive classification in its entirety within the last two years, and the other Scandinavian countries, Sweden and Norway, are following in the same wake. Several of the penitentiaries of Switzerland are already conducted upon this plan, and the current of opinion throughout the confederation sets strongly in that direction. The best thought of Spain and Italy favors the Crofton plan, which also counts in its support a strong and influential party in Germany, led by the distinguished Baron von Holtzendorff. Penologists of all shades of belief, the partisans of all systems, are to-day unanimous in the opinion that the foundation-principle of all reformatory prison discipline is *hope*, implanted in the breast of the prisoner the first hour of his incarceration, and kept there as an ever-present, ever-living, ever-active force. Hope is the great inspiration of all human effort in free life. But men remain men inside of prison bars the same as they were outside. Hope, therefore, is just as truly, just as vitally, just as essentially, at the root of all right prison discipline as it is of all free human life. As regards the agencies to be used in applying this fundamental principle, a branch of the subject which has almost endless ramifications, all we can say now and here—and we must say it without a syllable of enlargement—is that work, education, and religion are the three great forces to be employed in the reformation of criminals, as they are in the general progress of society. E. C. WINES.

Prisoners of War. See INTERNATIONAL LAW, *Summary*, by PRES. T. D. WOOLSEY, S. T. D., LL.D.

Prisrend′, fortified town of European Turkey, eyalet of Room-Elee, on the Rieka, contains 10 mosques, a Greek and a Roman Catholic church, and has 26,000 inhabitants.

Prist′idæ [from *Pristis;* Gr. πρίστις, "a saw"], a family of selachians of the order Raiæ, represented by the sawfishes. The body combines peculiarities of the sharks and rays, being elongated like the former, but with the pectoral fins developed and the branchial apertures inferior, as in the latter; the shagreen is very fine; the snout produced into a very long, flat, dagger-like appendage, which is armed on each edge with a row of strong, compressed, straight teeth. The nostrils are inferior; mouth small and transverse; teeth on the jaws minute; branchial apertures inward from the base of the pectoral fins; spiracles large, behind the eyes; dorsal fins two, unarmed, the first more or less behind the ventrals; pectorals with the front margins free, and not extending on the head. Such are the characters of the sawfishes. The teeth which are on the margin of the saw are of peculiar development, and must not be confounded with the true teeth of the jaws; the skeleton of the saw-like appendage has from three to five hollow subcylindrical tubes which taper toward the end, and are encrusted with a grain-like osseous deposit; these found in a detached state have been described before their nature was known as a peculiar animal under the name of *Myriosteon.* The sawfishes are found in all tropical seas, and one species (*Pristis antiquorum*) ascends occasionally high on the eastern coast of the U. S. An East Indian species lives in part in fresh water. THEODORE GILL.

Pristi′na, town of European Turkey, eyalet of Uskup, is beautifully situated among vine-clad hills, and contains several mosques, some of which are of noble architecture. P. 11,000.

Pristiophor′idæ [from *Pristiophorus;* Gr. πρίστις, "saw," and φορός, "bearing"], a family of selachians of the order Squali, in superficial characters closely resembling the sawfishes, but belonging to a distinct order. The body is elongated, but rather depressed forward; the scales very minute; the head with the snout produced in a very long, flat, dagger-like lamina, which is armed along each side with a row of teeth, as in the sawfishes; the nostrils inferior; the mouth small; the teeth small; branchial apertures five, and on the sides in front of the pectoral fins; the spiracles behind the eyes; dorsal fins unarmed, the first in front of the ventrals; no anal fin is developed; the caudal is well developed, and has its upper lobe larger than the lower. The family has but one genus of four species, which are confined to the seas of South-eastern Asia and Australia. Although agreeing with the Pristidæ in such a remarkable and exceptional character as the prolongation of the snout into a saw, it is related to the true sharks, while Pristidæ is related to the rays; this view is accepted without doubt by all naturalists. THEO. GILL.

Pristipomat′idæ [from πρίστις, "a saw," and πῶμα, "a lid"—*i. e.* operculum], a family of fishes established by Günther for a heterogeneous assemblage of perch-like forms, but properly limited to species agreeing in most characters with the Sparidæ. In all the body is compressed and oblong; the scales ctenoid; the lateral line continuous; the head compressed; the opercula generally more or less armed; the cheeks unprotected; the mouth a lateral cleft and terminal; the upper jaw moderately protractile; the supramaxillaries more or less closing under the preorbitals; teeth pointed on the jaws, absent on the palate; branchial apertures continuous beneath; branchiostegal rays generally seven in number; dorsal and anal fins generally folding in part into a scaly basal sheath; the dorsal single, formed by spinous and soft portions of nearly equal length; the anal like the soft portion of the dorsal, and armed with three spines; pectorals with the rays branched; ventrals thoracic, each with one spine and five rays; the vertebræ are developed in typical or nearly typical number ($9 + 14$ to $10 + 16$); the stomach is cæcal; pyloric appendages developed in small or moderate number; the air-bladder is generally simple. The family thus defined is represented by genera whose species live, for the most part, in tropical waters. The typical genera are *Pristipoma, Hæmulon, Orthopristis,* and *Cinodon.* Others have been approximated to those whose systematic position is yet uncertain, and a number of those consigned to it by the founder of the family are now referred to other families. THEODORE GILL.

Privas′, town of France, capital of the department of Ardèche, at the confluence of the Ouvèze and Mezagon, was one of the Protestant strongholds until in 1629 Louis XIII. razed the fortress and expelled the Protestants; has a college, a normal school, and some manufactures of silk and cotton. P. 7836.

Privateer. See INTERNATIONAL LAW, SUMMARY, by PRES. THEODORE D. WOOLSEY, S. T. D., LL.D.

Privateer′, tp., Sumter co., S. C. P. 1679.

Priv′et [Scot. *privie*], or **Prim,** the *Ligustrum vulgare,* an oleaceous shrub of Europe, now naturalized to some extent in the U. S., is chiefly used as a hedge-plant. both in the Old and New Worlds. It makes a close, handsome hedge, though it is not thorny. Its wood, though small, is saved for turners' use in Europe. Its berries yield a pink coloring-matter which is used by map-colorers. There are several rather ornamental species.

Priv′ilege [Lat. *privilegium*], denoted first a law made *against* a particular person, and afterward also a law in *favor* of a particular person. The last is the common use of our word "privilege." It is a power or right conferred on an individual which others or most others do not enjoy. It may be *positive,* like patents and monopolies, or *negative,* like exemption from taxes or from the jurisdiction of ordinary courts, or, as in the case of members of Congress, from arrest to a certain extent. The last furnishes an example of *political* privileges; of the same kind are nobility and suffrage founded on possession of property. Privileges may come from the act of the sovereign or be conferred by express law. They may be *personal* or *real*—that is, connected with a property, as the right of fishery on the border of an estate, or the political right of jurisdiction belonging to a feudal estate, whoever be the owner.

As in republics all are equal civilly, and, with certain qualifications, politically, before the law, privileges are naturally very few, if not entirely prohibited. In other countries they are growing continually fewer in number outside of the political sphere. Privileges in the first (Latin) sense of the word, as given above, are, we believe, now unknown. T. D. WOOLSEY.

Privileges and Immunities. This expression has recently assumed much importance in constitutional law. It is found in the U. S. Constitution in the following connections: "The citizens of each State shall be entitled to

all *privileges and immunities* of citizens in the several States" (Art. 4, § 2); "No State shall make or enforce any law which shall abridge the *privileges or immunities* of citizens of the U. S." (Art. 14 of Amendments).

I. The first of these clauses was first subjected to judicial construction, being found in the body of the Constitution itself. The same expression ("privileges and immunities") was found in the Articles of Confederation, but coupled with other language which led to obscurity of meaning. The intention of the clause in the fourth article of the present Constitution is to confer upon the citizens of one State in another all the general rights which a citizen of the latter would possess at home, such as to acquire and dispose of land and other property, to have recourse to the courts for redress of injuries, to pass through the State for the purposes of profit or pleasure, etc. In other words, the object of the clause was to give to the citizens of any State the same general rights throughout the country that they would have at home. Looked at from this point of view, the clause is of great importance as relieving a citizen from vexatious restrictions, impositions, or embarrassments which might otherwise attend him when absent from his home in other States. Its strong tendency is to give him the same advantages in these respects which he would possess if there was but a single government.

It is, however, true that the privileges and immunities herein referred to are those which are common to the citizens of the State wherein they are claimed. Special privileges enjoyed by citizens in their own State are not secured by this provision to citizens of other States. (See the case of *Paul* v. *Virginia*, 8 Wallace U. S. Reports, 180.) The Supreme Court declines to define or enumerate all the "privileges, etc.," embraced within this clause, but prefers to deal with each case as it comes up. An interesting instance of the application of the rule is to be noted in the case of a law of Maryland which prohibited persons not permanent residents in that State from selling or exposing to sale within specified territorial limits certain goods, either by card, sample, or trade-list or catalogue, without obtaining for a prescribed fee a license from the State authorities. A citizen of New Jersey having proceeded to sell in opposition to this law, and having been indicted, it was decided that the statute was unconstitutional as opposed to the provision now under consideration. The license-fee in such a case is substantially a tax, and it is well settled that while a uniform tax may be imposed by a State on all sales made within its borders, yet a tax discriminating against the commodities of the citizens of the other States of the Union is inconsistent with the clause concerning "privileges and immunities," and accordingly void. (See *Ward* v. *The State of Maryland*, 12 Wallace, 418; *Woodruff* v. *Parham*, 8 Wallace, 139.)

II. The clause in the fourteenth amendment differs in one important respect from that found in the U. S. Constitution. It refers to "privileges and immunities" of *citizens of the U. S.*, instead of those of the respective States. The whole clause of the amendment bearing upon this point for the sake of clearness will be stated: "All persons born or naturalized in the U. S., and subject to the jurisdiction thereof, are citizens of the U. S. and of the State wherein they reside. No State shall make or enforce any law which shall abridge the *immunities* or *privileges* of citizens of the U. S." This amendment plainly refers to another class of citizens, "citizens of the U. S." (See CITIZEN.) Though their "privileges and immunities" are not to be abridged, they are of the same general class as before, and the former construction is to be adopted in ascertaining the meaning of the expression. The rights referred to are fundamental in their nature, and embrace nearly every civil right for the establishment and protection of which organized government is instituted. Accordingly, any citizen of the U. S. would, for example, have the right to come to the seat of government to transact any business he may have with it, to seek its protection, to share its offices, to engage in its administration. So he has right of free access to its seaports, to the sub-treasuries, land-offices, and courts of justice. So he may demand the care and protection of the Federal government over his life, liberty, and property when on the high seas or within the jurisdiction of a foreign government. So he can use the navigable waters of the U. S., however they may penetrate the territories of the several States, or may of his own volition become a citizen of any State of the Union by acquiring a residence therein. It is to be observed that under the clause now under consideration the privileges of a citizen of *a State* are not guarantied, but only those of a citizen of the *United States*. If there is any difference between the two, the former must rest for security and protection where they have previously rested, on other provisions of the Constitution. As deductions from these principles, it has been held that the clause under consideration does not prevent the legislature of a State from granting to a corporation the exclusive rights of maintaining slaughter-houses and yards for enclosing cattle intended for sale or slaughter within a district embracing a large and populous city (New Orleans), and prohibiting all other persons from slaughtering or selling cattle within the prescribed district except at the corporation slaughter-houses and yards. Such an exclusive right as is here the subject of legislation is not one of those fundamental civil rights embraced under the term "privileges and immunities" (*Slaughter-house Cases*, 16 Wallace, U. S. 36). The same general result was arrived at in respect to the right of a woman to practise law in the courts of a State, it having been decided by the State court that women were not eligible to practise under the laws of the State. It was said that the right to practise law is not a "privilege or immunity" depending upon citizenship of the U. S. It has not been made to depend upon citizenship at all; and where it has any relation to citizenship, it rather refers to that of the State than of the U. S. (*Bradwell* v. *The State*, *ib.* p. 130–139). On similar grounds it has been adjudged that the usual and ordinary legislation of the States regulating or prohibiting the sale of intoxicating liquors is not unconstitutional on this ground. A right to sell such property is not one of the "privileges and immunities" within the purview of this branch of the Constitution. In this case the court was unanimous, while in the "slaughter-house cases," before referred to, three judges dissented. These concurred in the liquor case substantially upon the ground that in this instance the claimant was insisting upon his right to violate a mere police regulation, while in the matter of the slaughter-houses there was an attempt by the State under a thin disguise to restrain a citizen from pursuing a lawful avocation and to establish an odious and oppressive monopoly. Finally, in the case of *Minor* v. *Happersett* (21 Wallace, 162) it was decided that a law of a State conferring the right of suffrage exclusively upon males was not unconstitutional as abridging "the privileges or immunities" of female citizens of the U. S. While women born in the U. S. or naturalized here are unquestionably citizens, the right to vote is not one of the necessary privileges, etc., of a citizen of the U. S. It is clear that no such view prevailed when the Constitution was adopted, each State determining for itself who should have the power to vote, and under what restrictions as to age, sex, residence, and amount of property owned, etc., it should be exercised. If, when the fourteenth amendment was adopted, it was intended to reverse all these rules, there would have been clear evidence of intent, and the matter would not have been left to implication. Moreover, the adoption of the fifteenth amendment, setting forth that the right to vote should not be denied or abridged by the U. S. or any State on account of race, color, or previous condition of servitude, would have been unnecessary had the fourteenth amendment had any such sense as was contended for by the advocates of female suffrage. The general result of the discussion before the courts is, that the clause concerning privileges and immunities of citizens of the U. S., as found in the fourteenth amendment, is not intended to withdraw from the States matters that were previously under their control, but rather to secure to all citizens, without distinction of race or color, those great and fundamental rights which American theories of civil government assume as appertaining to citizenship. T. W. DWIGHT.

Privy Council. See CABINET.

Privy Seal, the minor seal of the British government, affixed to papers of minor importance, and also to important documents preparatory to the affixing of the great seal. The privy seal is in the care of a great officer of state, usually one of the cabinet, called the lord privy seal.

Prize [Fr. *prise*], something taken on the sea, as belonging to an enemy in war or to a neutral—*i. e.* to a person resident in a neutral state who is identified with such enemy. A vessel of a nation taken by its own cruisers, if engaged in illegal trade, may also be called a prize. A prize-court is one authorized by the laws of a nation to decide cases of prize. (See INTERNATIONAL LAW, SUMMARY.) T. D. WOOLSEY.

Priz'zi, town of Sicily, province of Palermo, situated near the sources of the river Termini. It is one of the most thriving and industrious towns of Sicily, the inhabitants being largely engaged in the manufacture of iron, copper, cotton, etc. P. in 1874, 8835.

Pro'a, or **Prahu** [Port. *proa*, a "prow"], a canoe-like sailing vessel of the Malays, Ladrone Islanders, etc. The lee side is straight and flat from stem to stern, the other rounded. Both ends are alike. The vessel carries a lug-sail of matting. A framework projects to windward, and counterbalances the effect of the wind upon the sail, which would otherwise upset the craft. Proas are commonly some

thirty feet long and very rapid sailers. They were once much used by pirates. The name is often applied to Malay vessels of other kinds, some propelled by oars and paddles, and some by sails also.

Probabil'ity [Lat. *probabilitas*], **Theory of,** or **Calculus of Probabilities,** as it is usually called, may be defined as the application of mathematical reasoning to the art of judging in cases where only probable evidence can be obtained. The mode in which the judgment may be thus assisted can be best seen if we begin with some simple examples before laying down any general principles. Suppose a die to have two of its six sides painted black, the remaining four being left white, and a person to be required to judge whether, upon the die being thrown, a white or a black side will be uppermost. Common sense will teach him to guess the white side, not because he can certainly say it will be thrown, but because it will be more likely to be thrown. In common language it would be said that the chances were two to one in favor of white. In mathematical language a slightly different expression is used, the probability of an event being a proper fraction of which the denominator is the entire possible number of chances or cases, while the numerator is the number of those cases which favor the proposed event. In the case just supposed, for instance, there are six sides to the die, of which one and one only must be thrown. Four of these sides being white, the probability of white being thrown is $\frac{4}{6}=\frac{2}{3}$, and that of black is $\frac{2}{6}=\frac{1}{3}$. If one of the four white sides were painted yellow, the probabilities would be white $\frac{1}{2}$, black $\frac{1}{3}$, yellow $\frac{1}{6}$. If the event is impossible, there are no cases which favor it, and in the notation just indicated its probability is 0. If all the cases favor it, and its occurrence is therefore certain, the probability is 1. As no degree of probability can exceed certainty, all degrees of probability are somewhere between the limits 0 and 1.

The mathematical solution of problems in probabilities consists, first, in dividing the possible processes or results into elementary and equally probable cases; and, secondly, in finding how many of these cases favor the proposed event. In the case just supposed of a single die, this is very simple, and no one could mistake the mode of arriving at a solution. But when the result depends on the concurrence of a number of circumstances, the reasoning becomes much more complex. Suppose, for instance, that two dice are thrown. Then, any one of the six sides of one die may be combined with any side of the other, making, in all, 36 combinations. To find the probability of any result from the throw of such a pair, we must find how many of these combinations will give rise to the combination in question, and divide the number by 36. In making this calculation there is great room for mistakes; indeed, the subject of probabilities is by far the most slippery one with which the mathematician or logician has to deal. Suppose, for instance, that a sharper should offer to a countryman to give him 3 cents every time two *ones* were thrown with two dice, provided the other would give him 2 cents every time a *one* and a *two* were thrown. At first sight, the countryman might consider the two results equally probable, and therefore feel sure, in the long run, of gaining. But he would be sure to lose, because two different numbers are twice as likely to be thrown as a pair of the same number. To have 2 *ones* each die must fall with *one* uppermost. But to have a *one* and a *two*, one may be a *one* and the other a *two*, or the first may be *two* and the second *one*; so that for this result there are two cases out of 36, while in the first there is but one. It cannot be doubted that an understanding of this calculus would afford a very material aid to the judgment in weighing and estimating the probabilities of events in the affairs of life; for, although these events, or the causes which give rise to them, cannot generally be made the subject of mathematical calculation, yet the examination and enumeration of the various combinations of circumstances which may give rise to an event affords our only means of judging of its probability. The longer a man's experience of worldly affairs and the sounder his judgment, the more nearly he will conform to the rules and methods of the mathematical calculus in estimating probabilities. An eminent writer happily described the calculus of probabilities as common sense expressed in numbers.

One of the most generally useful rules of this calculus is that although an event may be extremely improbable if it has but one opportunity to happen, yet if we increase the number of opportunities indefinitely it will be sure to happen in the long run. By the same principle, if the concurrence of a large number of circumstances is necessary to the production of an event, each of these circumstances may be, in itself, very probable, and yet their concurrence, and consequently the event itself, very improbable. The mathematical rule for determining probability in such a case is that the probability of the concurrence of all the events is equal to the continued product of the probabilities of all the separate events. As one example, suppose that a law requiring the concurrence of the two houses of Congress and the President were as likely as not to be rejected by any one of them, and that each one of the three authorities formed his own opinion independently of the other two. Then, the probability of each authority approving the law being $\frac{1}{2}$, the probability of its passing all three would be $\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}=\frac{1}{8}$. We can get at the same result in this way: Out of 8 laws introduced into the House only 4 would pass and go to the Senate. Out of this 4 the Senate would pass 2, and of these 2 the President would approve 1. On this principle an event which has to pass the ordeal of a great number of small dangers is sure to fail at last, though each separate danger may itself be small. Suppose, for instance, that a bridge has 100 holes in it, and that a person passing over this bridge has 9 chances out of 10 of going safely past each individual hole. Notwithstanding so many chances in his favor for any particular hole, the chance that he would escape them all is only 1 in 37,650. That is, if we take the fraction $\frac{9}{10}$, which expresses the probability of passing any one hole safely, and multiply it by itself 100 times, the result will be about equal to $\frac{1}{37650}$. So small is this probability that if a wild beast should attempt to cross the bridge for the purpose of devouring a man standing at the other end, the latter might wait in perfect composure with the moral certainty that the animal would fall through some hole before he got across. One of the principal marks of the practical wisdom of age and experience is the ability to recognize this principle, and there are plenty of proverbs which are really founded on it. When the young man stops up all the holes in his bridge, so that there is only a small chance of falling into any one of them, he feels comparatively safe. But the older one knows from experience that there are cases in which the mere number of possible mishaps will be very likely to result in the failure of a plan, though the plan may seem almost secure against each of them separately.

One of the most curious and important results of this calculus is seen in what is termed the law of averages, or the tendency of chance events which occur in great numbers to follow regular laws. The life of an individual is proverbially one of the most uncertain things in human affairs. But when we take large bodies, like the population of a State or great city, the deaths follow a law so exact that mathematical tables of their probable number can be formed, and on these tables life insurance companies can arrange their rates of premium with the moral certainty that the death-rate will not vary seriously from that calculated. Not only the total number of deaths, but the proportion of deaths from the most fortuitous causes, follow nearly their regular law. No doubt if we could learn how many men are killed by falling from houses, we should find it wonderfully constant from year to year. In cases like this the constancy of the result is the consequence of some widespread underlying cause, hidden by other accidental causes acting in different ways in individual cases. Thus, a table of mortality is the combined expression of a certain law of the human constitution and certain conditions of the climate. The number of deaths by falling from scaffolding expresses the degree of general carefulness or carelessness which characterizes men engaged in building. The general rule is, that in order that a law of averages may be closely followed it is necessary that the seemingly accidental events enumerated should be the result of two sets of causes, of which one is invariable throughout the whole period of time, while the other is entirely accidental in each individual case. When the variable or chance causes are not purely accidental, but affect large masses or vary from year to year, there is no longer any such exact law. For instance, if a large fraction of the population died from occasional epidemics, there could no longer be an exact law of mortality.

SIMON NEWCOMB.

Pro'bate [Lat. *probatus*], in law, a judicial proceeding before a court possessing the proper authority by which an instrument is established as the last will and testament of the deceased person whose act it purports to be. According to the practice which generally prevails in this country, the alleged will is produced by the executor or by a legatee, who is termed the "proponent;" notice of the application is given to the persons having an interest in the estate; at the hearing the evidence of the subscribing witnesses is taken, and other witnesses are examined if necessary, and the judge renders a decree, either declaring the will valid and admitting it to probate, or pronouncing it invalid and rejecting it. In England prior to 1857 the ecclesiastical courts possessed the sole jurisdiction in testamentary matters, but wills of personal property only could be proved therein; if a will of real estate was dis-

puted, its validity was decided in an action brought to try the title to the lands devised thereby. This jurisdiction was taken from the ecclesiastical courts and conferred upon a new tribunal created in 1857, styled the court of probate and divorce. Since ecclesiastical courts never have formed a part of the judicial system in this country, tribunals have been established in the several States, variously known as courts of probate, surrogates' courts, orphans' courts, and the like, with jurisdiction over the probate of wills, the settlement of decedents' estates, and kindred matters. Their powers and modes of procedure are wholly regulated by statute, and a very great diversity exists in the statutory provisions of the several States. A will of personal property may be proved, and the probate, if regular, is final and conclusive upon the parties interested in every State. Wills of real estate may also be admitted to probate in many if not most of the commonwealths, but such probate is not in general conclusive; it simply determines the *primâ facie* validity of the testament, and casts the burden upon those who dispute it.

John Norton Pomeroy.

Proboscid'ea [from *proboscis*, a "trunk" or "snout"], an order of mammals distinguished by the extension of the nose into a proboscis and the columnar form of the legs and feet, and typified by the elephants of the present epoch. The brain is of the educabilian type—*i. e.* the cerebral hemispheres are comparatively large and overlap in great part the cerebrum behind and the cerebellum in front; the hemispheres are connected by a well-developed corpus callosum and by a reduced anterior commissure; the placenta is deciduate and zonary; the incisors variable in number —$\frac{2}{0}$, or in extinct forms $\frac{2}{2}$ or $\frac{0}{2}$—but always have persistent pulps, and are developed as long tusks curved outward; the legs are extensible in a straight line, and the proximal joints in great part exserted outside of the common abdominal integument; the feet have the palmar and plantar surfaces invested in extended pad-like integuments, which also underlie the toes; the carpal bones are in two regular (not interlocking) rows, and are broad and short; the cuneiform is extended inward, broad, and furnishes a large attachment forward for the ulna, which is antrorsely produced; the unciform is directly in front of the cuneiform, and the magnum directly in front of the lunar; the hind foot has the astragalus at its anterior portion very short, convex, and not deflected inward, articulating in front only with the navicular; the toes are in all the known forms five to each foot, and encased in shallow hoofs. The order is represented by one living family (Elephantidæ), and to it by almost all authors an extinct family (Dinotheriidæ) has been also referred; these are distinguished from each other by great differences in the structure of the skull, as well as in the development of the teeth, the peculiar dentition of the elephants not being shared by the Dinotheriids. (See also Elephant and Dinotherium.) Theodore Gill.

Probus, b. at Sirmium, Pannonia, about 230 A. D.; entered the army very early; attracted the attention of the emperor Valerian by his valor; rose rapidly; commanded with success in Gaul, Germany, Africa, on the Nile, and on the Euphrates, and was made governor-general of all the Roman provinces of the East. On the death of the emperor Tacitus in 276 he was chosen emperor by the armies of the East, and his short reign was a series of brilliant exploits. He drove the Germanic tribes back into their own country, compelled them to give up the plunder they had carried away from Gaul, pacified the whole northern boundary from the Rhine to the Euphrates, and suppressed with great promptness several attempts at revolt in the interior. But having established general peace, he employed the army in works of public utility—the draining of swamps, the planting of vineyards, etc.; and the discontent occasioned thereby grew into an uncontrollable fury when he one day said that a standing army soon would be superfluous. The soldiers immediately turned from their work, attacked him, and killed him in his native city in 282.

Proced'ure (law). Although not a technical word of the common law, *procedure* is employed by modern writers as a generic term to denote all the formal steps and proceedings in the conduct of a judicial controversy, and the legal rules which control their use. Certain uniform principles seem to have determined the nature and moulded the history of procedure in every national jurisprudence that has made a completed progress from rude beginnings to a condition of philosophical and equitable perfection. The earliest stages are always characterized by an intense formalism; the law is almost wholly made up of the arbitrary, technical forms, each appropriate to a particular wrong or remedy, which must be followed with scrupulous exactness; the growth of the jurisprudence for a considerable period consists in the modification of these forms and their extension to new facts and relations; in time, the dominion of form is relaxed, the technical and arbitrary features gradually disappear; and at last the methods of administering justice become simple and are based upon equitable notions. This course of development marked the entire progress of the Roman law (see Law, Civil); it has been exhibited no less clearly in the jurisprudence of England and of the U. S. The most striking feature of the procedure originally prevailing in England is the separation into two distinct and widely-differing systems, the common law and the equitable—the former exclusively used by the courts of law for the enforcement of legal rights in connection with the jury trial; the latter employed by the courts of equity for the enforcement of equitable rights alone without the jury. Of the two, the common-law methods were much the elder. From the earliest periods rights were enforced in the law courts by means of different actions, the most important of which, denominated "real actions," were solely used for the recovery of lands. Prior to Edward I. there existed but three actions for the recovery of money—debt, covenant, and trespass. By virtue of a statute passed in the reign of that king (13 Edw. I. c. 24) other forms were afterward invented. The highly technical real actions were subsequently abandoned, with a few occasional exceptions, and the following actions became established as the ordinary means of enforcing legal rights: "ejectment," to recover possession and to try the title of lands; "detinue" and "replevin," to recover possession of chattels; "covenant," to recover damages for the breach of a sealed agreement; "debt," to recover a fixed and certain sum of money owed by the defendant, not as damages; "assumpsit," to recover damages for the breach of a contract not under seal, whether written or verbal, express or implied; "trespass," to recover damages for a wrongful act of violence to person or property; "case," to recover damages for a wrong to person or property unaccompanied with violence, or when the injury was consequential; "trover," to recover damages for the wrongful detention and conversion of chattels. The rules which governed these actions were technical and formal, and the courts were more often employed in deciding whether the proper kind of action had been brought, or whether the correct formulas of words had been used, than in adjudicating upon the actual merits of causes and determining the real rights of the parties. Inseparably connected with this diversity of actions was the common-law system of pleading; the two reacted upon and supported each other, and the technicalities of the one brought out and strengthened the formalism of the other. The procedure in equity was based upon more simple and natural notions, and, however much it may have become encumbered by dilatory and unnecessary practices, these were not inherent and essential. No forms of actions existed, but a single method sufficed for all kinds of claims, defences, and reliefs. The complainant stated his case with great minuteness of detail in a "bill," the defendant set forth his version in an "answer;" and upon these pleadings and the proofs the chancellor rendered his decree. In this judgment the rights, claims, and liabilities of all the parties were adjusted, and relief could be granted alike to defendants or to complainants. It was, therefore, a cardinal principle of the equity procedure that all persons interested in the controversy and who could be affected by the decree should be made parties to a suit. All these principles, methods, and rules of the common-law and the equity procedure were incorporated into the jurisprudence of the American States; and although they have been modified in many of the commonwealths, in others they are retained to the present day substantially as they existed at the time when Blackstone wrote his *Commentaries*. A revolution has finally been effected in this country and in England in every respect identical with that which took place in the Roman law when the prætor's extraordinary jurisdiction was extended to all kinds and classes of litigations. In 1848 the legislature of New York adopted a code of civil procedure—chiefly planned and created by David Dudley Field—which entirely abandoned all former existing methods, and inaugurated a new system for the enforcement of rights and the recovery of remedies. Its central principle is the abolition of all distinction between actions at law and suits in equity, and of all forms of action, and the establishment of a single judicial instrument called the "civil action" by which all rights are maintained, duties enforced, and reliefs obtained. The barrier which had separated the administration of law and equity is thus broken down. Legal and equitable claims, defences, and remedies may be combined, and the single judgment of the court may determine and establish the final sum of all the rights and interests belonging to the litigant parties. With the common-law forms of action the common-law forms of pleading are also abandoned, and in their stead is substituted one simple and natural mode, adapted to all possible con-

troversies, for it merely requires the parties to state in ordinary language the actual facts which constitute their causes of action or defences. As a consequence of the fundamental principle above mentioned, the equitable doctrine of parties is preferred in place of the legal rules, which were in many instances peculiarly artificial and arbitrary. Finally, the equity doctrines prevail in the rendition of judgments and in the apportionment of relief among all the suitors. The system has been accepted, sometimes with unimportant modifications, but often without any change from the original type, in twenty-three of the States and Territories, and may be styled the "reformed American procedure." Passing beyond the limits of the U. S., it prevails in several of the British colonies, and has recently been adopted in all its essential principles in England itself, where it went into operation by act of Parliament during the fall of 1875. The history of jurisprudence does not present another so remarkable instance of legislation. JOHN NORTON POMEROY.

Procellar'idæ [*Procellaria, procella*, "a storm"—*i. e.* the storm-birds], a family of swimming birds, including the petrels or Mother Carey's chickens, albatrosses, and related forms. These have a gull-like body; the neck rather short: the bill moderate, and composed, apparently, of several pieces; the upper mandible having a decurved convex tip, separated from the rest of the sheath by a groove proceeding from the nasal region; the lower a lateral groove, deflected downward, and also leaving a terminal piece; the nostrils at the end of tubular processes, which are more or less immersed in grooves; the wings are generally elongated and pointed, rarely (as in *Pelicanoides*) short; tail also generally long and forked, sometimes (as in *Pelicanoides*) short and rounded; legs submedian; tibiæ exserted; tarsi variable, covered with small scales; toes three in front, connected together by a broad web, posterior rudimentary or wanting; the skull is schizognathous, and in most respects agrees with that of the gulls and loons, but exhibits some distinctive characters, and has been regarded by Streets as indicating a peculiar sub-family (Nectriomorphæ). The family is generally divided into three subfamilies: (1) Procellarinæ, including most of the small species; (2) Diomedeinæ, comprising the albatrosses; and (3) Pelicanoidinæ, represented by the single aberrant genus *Pelicanoides*. Prof. J. Reinhardt has recently (1873) based a new classification of Procellarinæ on the presence or absence of a sesamoid bone or bones in connection with the humerus, which, when present, have attachments with, and are mechanically subservient to, certain muscles of the fore arm and metacarpus. These sesamoids are present in the puffins, but absent in the fulmars and the typical petrels. By Gray 111 species are recognized. Some one or other of these are found in the high seas and along the coasts of all quarters of the globe, but they extend inland less than most other birds. They vary in size from the dimensions of a small swallow to those of a large goose. THEODORE GILL.

Proc'ess [Lat. *processus*], in law. A generic term, primarily used to designate all the means by which a defendant is compelled to appear and answer to an action brought against him, or to the judgment recovered therein against him, and also the means by which his property is secured or taken in satisfaction of such judgment. It is also sometimes applied to many other judicial writs or orders by which persons are summoned or directed to perform particular duties. In the criminal procedure it denotes the warrants or other writings authorizing and directing the arrest of persons charged with offences. In a more general sense it embraces all judicial writs commanding public officers or private individuals to do a specified act; and, finally, it is used, although not technically, as synonymous with "proceeding." Actions at law were formerly commenced in England by a process called the "original writ," which was issued in the king's name, contained a statement of the complaint, and was addressed to the sheriff, commanding him to summon the defendant. This writ was practically abolished in the reign of William IV., when it was enacted that all personal actions should be commenced by the writ of *capias* if the defendant was to be arrested, and by the writ of "summons" if he was not to be arrested. The former is an order issued from the court directing the sheriff to take the defendant and hold him to bail to answer the plaintiff's claim, or in default thereof to retain him in custody. The latter is a similar order addressed to the defendant himself, commanding him to appear in the suit. The corresponding process in chancery suits was the "writ of subpœna," while that in the ecclesiastical and admiralty courts was termed a "citation;" both were, like the summons, personal orders to the defendant. At present, all actions are commenced in England by a process in the nature of a summons. In the U. S., wherever the reformed procedure has been adopted, all actions in the superior courts are begun by a summons or notice to the defendant directing him to appear and answer within a specified number of days; in several of the States it is issued directly by the plaintiff or his attorney, in others by the clerk of the court in which the suit is brought. In those commonwealths which retain the common-law methods different forms of preliminary process are used, but, under whatever names, they are generally analogous to the writ of summons. A peculiar local practice prevails, however, in New England, of commencing all legal actions by attaching the defendant's property, or so much thereof as may be necessary to secure the expected recovery. Final process is the means by which a judgment is enforced and satisfied, and is of two kinds—that against the property, and that against the person. The former, which is now termed the "execution," but was once generally known as the *fieri facias*, or *fi. fa.*, commands the sheriff to make the judgment out of the debtor's goods and chattels, and if that is impossible, then out of his lands; the latter—the body-execution, *capias satisfaciendum*, or *ca. sa.*—directs the officer, in default of sufficient property, to take the debtor's body. The latter species of execution can only be resorted to in those cases in which the defendant may be arrested. In addition to these preliminary and final steps, there may be, under certain circumstances and in a special class of actions, intermediate proceedings in the nature of process against the defendant—namely, an order or warrant of arrest, by virtue of which he is taken and held to bail or detained, and a warrant or order of attachment, by virtue of which his property is seized and held to wait the final judgment. JOHN NORTON POMEROY.

Proces'sion of the Ho'ly Ghost. This term is based on John xv. 26, where Christ says of the Spirit whom he will send from the Father that "he *proceedeth* from the Father" (*παρὰ τοῦ πατρὸς ἐκπορεύεται*, hence *ἐκπόρευσις, processio*). It designates in the orthodox theology the characteristic individuality (*ἰδιότης, proprietas, character hypostaticus*) of the third Person of the Holy Trinity, as the eternal generation (*γεννησία, generatio*) is the characteristic property of the Son, and the unbegotten paternity (*ἀγεννησία, paternitas*) the exclusive peculiarity of the Father. There is an old difference between the Greek and Latin churches about the *single* procession (from the Father *alone*) and the *double* procession (from the Father *and the Son*). The Nicene Creed (381) asserts only the procession from the Father (*Sp. S. qui ex Patre procedit*), in verbal adherence to the passage in John, and the Greek Church understands this in an exclusive sense (from the Father *alone*). The Latin Church, after Augustine, taught the double procession, and afterward embodied it, without asking the consent of the Greeks, in the Nicene Creed by the insertion of *filioque* ("and from the Son"). This famous clause first appeared in 589, at a synod of Toledo in Spain (in strong opposition to Arianism), and in spite of the protest of Pope Leo III. (809) it was gradually adopted in the Latin Church, from which it passed into the Protestant churches. This difference has caused a great deal of bitter controversy since the days of Photius, patriarch of Constantinople (d. 891). The councils of Lyons (1274) and of Florence (1439) endeavored to settle it, but in vain. The Greek divines plead in favor of the single procession the letter of the Scripture, the original text of the Nicene Creed, and the dignity or monarchy (*μοναρχία*) of the Father as the sole fountain, cause, and root of the Deity; they also make a sharp distinction between the eternal metaphysical *procession* of the Spirit from the Father alone, and the historical *mission* of the Spirit from the Father and from the Son (John xiv. 26; xvi. 7). The former belongs to the Trinity of essence, the latter to the Trinity of revelation, and begins with the day of Pentecost. The Latin divines infer the double procession (taking this term in a wider sense) from the double mission and from the essential unity (or *homoousia*) of the Son with the Father, so that if the Spirit proceeds from the essence of the Father, he must proceed also from the essence of the Son, both being the same. A compromise was suggested by the formula that the Spirit proceeds from the Father *through the Son* (*διὰ τοῦ υἱοῦ*). When Pius IX. invited the Eastern patriarchs to the Vatican Council in 1870, they renewed the old protest against the heretical *filioque*. The Döllinger Union Conference between Old Catholics, Orientals, and Anglo-Catholics discussed this controversy at Bonn in Aug., 1875, and came to an agreement which surrenders the *filioque* as an unauthorized interpolation to the Creed, and endorses the single procession of the Spirit from the Father alone, but through the Son, as taught by John of Damascus, the last of the Greek Fathers. PHILIP SCHAFF.

Pro'cida, town of Southern Italy, province of Naples, on an island of the same name lying between Ischia and Cape Misenum. This little island, not more than 8½ miles

in circumference, is entirely composed of volcanic tufa, and the town of Procida, on the E. side, stands on a high and rugged rock which is itself almost surrounded by water. The principal edifice, besides the churches, is the royal palace of the Bourbons, who frequently came here for health or amusement. Procida was originally a Greek settlement, and it is said that, in spite of the long Roman domination, of the devastations of the Saracens, of Spanish and English occupations, the women still retain much of the Greek physiognomy and something of the Greek costume. The inhabitants are occupied partly in agriculture (the cultivable portions of the island being wonderfully productive), partly in tunny fishing, and about 400 men are annually employed in the search for coral. The whole population of the island is about 14,000, most of whom live in the town of Procida.

Pro'clus, b. Feb. 8, 412 A. D., at Byzantium; educated at Xanthus in Lycia, from which his family descended; studied at Alexandria and Athens, and became a celebrated teacher of philosophy in the latter city, where he d. Apr. 17, 485. He was the last member of the Neo-Platonic school who acquired any celebrity. In modern times he has not commanded any great interest. There is no complete edition of those of his works which are still extant. That by Cousin (6 vols., Paris, 1820–27) contains the treatises on *Providence and Fate*, the *Ten Doubts about Providence*, the *Nature of Evil*, and the commentaries on the *Alcibiades* and *Parmenides*. There are translations in English by Thomas Taylor of the *Commentaries on the Timæus*, the *Theology of Plato*, the first book of Euclid, and of *Five Hymns*.

Procon'sul [Lat.], a magistrate in the ancient Roman government who exercised consular authority over a province or an army, but not over Rome. In many cases he was a consul, who after the expiration of his term of service was sent to control a province, but sometimes the proconsul was not even of consular rank.

Proco'pius, b. at Cæsarea, Palestine, in the beginning of the sixth century A. D.; studied at Constantinople; accompanied Belisarius as his secretary on his campaigns in Asia, Africa, and Italy, and held after his return to Constantinople the highest dignities in the civil service of the Byzantine government. Of his works are still extant *Historiæ*, a representation of the history of his own time, clear, trustworthy, and interesting, translated into English by Henry Holcroft (London, 1653); *Ktismata*, a work on the public buildings erected during the reign of Justinian; and *Anecdota*, translated into English under the title of *The Secret History of the Court of the Emperor Justinian* (1674). His authorship of the last work is questioned, however. Complete edition by W. Dindorf (3 vols., Bonn, 1833–38).

Procopius the Great, to be distinguished from PROCOPIUS THE LESS (a friend and companion of his), b. of a rich and noble Bohemian family: received a careful education; travelled in Italy, Spain, France, and the Holy Land, and was ordained a priest after his return to Bohemia, but on the outbreak of the Hussite war he joined the army, and distinguished himself so greatly that after Ziska's death in 1424 he was chosen commander-in-chief by the Taborites. On the approach of the German armies of crusaders the different Hussite parties, among which were the Orphans under Procopius the Less, united under the leadership of Procopius the Great, and a war ensued (1427–32), remarkable at once for the eminent valor and the unheard-of cruelty which the Hussites evinced. They made campaigns into Saxony, Silesia, Moravia, Hungary, Austria, and Bavaria. The German armies which were sent against them were utterly defeated, towns and villages were burnt and their inhabitants massacred, and an immense amount of booty was carried back to Bohemia. The emperor's offers of concessions were rejected, but a momentary calm was produced when in 1432 Saxony bought a truce of two years for a large sum of money. In 1433 the Hussites consented to send eight delegates to the Council of Bâle. Procopius was one of them, and he took part with great energy in the debate, but after the lapse of fifty days the Bohemian delegates grew tired and returned to Prague. Papal commissioners followed them, and at last a compromise was brought about between the Roman Catholics and the Callixtines. The Taborites, however, refused to have anything to do with the pope, and thus arose a controversy between them and the Callixtines which soon grew into open warfare. At the battle of Bömishbrad (May 30, 1434) a sudden panic seized the Taborite army; it was utterly defeated, and both Procopius the Great and Procopius the Less fell.

Procrus'tes [from the Gr. Προκρούστης, the "stretcher"], a surname commonly given to the famous robber Polypemon or Damastes, who used to place all persons that fell into his hands on an iron bed, and cut off or stretched out their limbs until they fitted the bed. He was slain by Theseus on the Cephissus in Attica.

Proc'ter (BRYAN WALLER), familiarly known under his pseudonym of "Barry Cornwall," an imperfect anagrammatic combination of the letters of his name, b. in Wiltshire Nov. 21, 1789; educated at Harrow, with Byron, Lord Palmerston, and Sir Robert Peel as contemporaries; studied law in Wiltshire; removed to London, where he was admitted to the bar in 1831, but, though a diligent student, did not attain prominence as a counsel. The lucrative position of commissioner of lunacy, however, which he held for many years, supplied the means as well as sufficient leisure for the culture of his literary and poetic tastes; in 1819 published a volume entitled *Dramatic Scenes and other Poems*, which was the beginning of his literary career, and written, as claimed by him, to try the effect of a more natural style than that which had for a long time prevailed in our dramatic literature. In 1821 his tragedy of *Mirandola* was produced at the Covent Garden Theatre with much success. But it is as a writer of refined, melodious, and inspiring songs that he is best remembered and esteemed, and it is said that with the exception of Coleridge he was the most genuine poet of love that modern English literature has seen. Among his published works are *Marcian Colonna, an Italian Story*; *Three Dramatic Scenes and other Poems*; *A Sicilian Story*, with *Diego de Mantillo and other Poems*, both issued in 1820: *The Flood of Thessaly and other Poems and Poetical Works* (1822), *Effigies Poeticæ* (1824), *English Songs and other Small Poems* (1832), *Essays and Tales in Prose* (1851), *Lives of Edmund Kean* (1835) and of *Charles Lamb* (1866), and *Memoir of Shakspeare*. D. at London Oct. 5, 1874. His *Poetical Works* have had wide circulation in England and America.—His daughter, ADELAIDE ANNE PROCTER, b. at London Oct. 30, 1825; wrote 2 vols. of verse (1858 and 1860). D. at London Feb. 2, 1864. Her works were reissued in 1865, with an introduction by Charles Dickens.

Proc'tor [a contraction of the Lat. *procurator*, "a deputy" or "agent"], in law, an officer of the admiralty and ecclesiastical courts in England empowered to bring and conduct proceedings therein on behalf of suitors, corresponding to the attorney and the solicitor of the ordinary tribunals. From an early day a body of men were attached to these ecclesiastical and admiralty courts who had the exclusive authority to appear therein, and to bring or defend all causes in the same manner that actions at law and suits in equity are brought and managed by attorneys and solicitors. Admission to the body was obtained, after a long clerkship, by means of a commission issued in the name of the archbishop of Canterbury. The class of professional men who actually tried or argued the causes or performed other duties before the court itself—whose functions, in other words, were similar to those of the barristers or counsel—were termed "advocates." Proctors as a distinct branch of the legal profession have been almost if not entirely abolished in England by recent legislation. All jurisdiction over divorce, matrimonial, testamentary, and other kindred matters having been taken from the ecclesiastical courts and conferred upon a new tribunal created about 1857, and styled the "court of probate and divorce," it was then enacted that all attorneys and solicitors might practise as such in this tribunal; and in 1859 the same provision was adopted in reference to the admiralty courts. There are no proctors, as a separate order or class, in the legal profession of this country, although the designation is often assumed by attorneys in admiralty cases or when practising before surrogates or courts of probate. "Proctors of the clergy" in the English ecclesiastical law are the delegates or representatives of cathedral and other collegiate churches, and also of the common clergy in every diocese, appointed to sit in the convocation of the Church. JOHN NORTON POMEROY.

Proctor, tp., Crittenden co., Ark. P. 650.

Proctor, p.-v., cap. of Lee co., Ky., on Kentucky River. P. 100.

Proctor, tp., Wetzel co., Va. P. 2102.

Proctor (HENRY A.), b. in Wales in 1765; came to Canada in 1812 as colonel of the 42d regiment; repulsed Gen. Hull at Amherstburg; gained the victories of Brownston and the river Raisin; was repulsed from Fort Meigs by Gen. Harrison May, 1813, and from Fort Stephenson (Lower Sandusky, O.) by Major Croghan Aug. 2, and totally defeated by Harrison at the battle of the Thames, Oct. 5, 1813, for which misfortune he was court-martialled and suspended from the service, but was soon reinstated, and rose to the rank of lieutenant-general. D. at Liverpool, England, in 1859.

Proctor (RICHARD ANTHONY), b. at Chelsea, England, Mar. 23, 1837; entered King's College, London, in 1855,

and St. John's College, Cambridge, in 1857, taking the degree of B. A. from the latter in 1860. His first literary effort was an article on *Double Stars* in the *Cornhill Magazine* for Dec., 1863. Soon after this he published his first book, *Saturn and its System*, which was soon followed by his *Gnomonic Star Atlas*, and in 1866 by his *Handbook of the Stars*. In 1867 he published *Constellation Seasons;* in 1868, *Half Hours with the Telescope;* in 1869, *Half Hours with the Stars;* in 1870, his most celebrated work, *Other Worlds than Ours;* in 1871, *The Sun, Elementary Lessons in Astronomy*, and the first series of *Light Science for Leisure Hours;* in 1872, *The School Atlas of Astronomy, Essays on Astronomy, Orbs around us*, and *Elementary Lessons on Physical Geography;* in 1873, *Light and Science, The Moon, The Border Land of Science, The Expanse of Heaven*, and *The Universe and the Coming Transits*. In the winter of 1873–74, and again in 1875–76, he visited America, and lectured in the larger cities of the U. S.

J. B. Bishop.

Proc'torsville, p.-v., Cavendish tp., Windsor co., Vt., on Black River and Vermont Central R. R.

Proc'torville, p.-v., Caldwell co., Mo. P. 60.

Procyon'idæ [from *Procyon;* Gr. *προκύων*, "one who snarls like a dog"], a family of mammals represented by the raccoons and the coatimundis. They belong to the order of Carnivora and the section or super-family typified by the bears (Arctoidea). The teeth are in number 40 (M. $\frac{2}{2}$, P.M. $\frac{4}{4}$, C. $\frac{1}{1}$, I. $\frac{3}{3} \times 2$); the last molar of the upper jaw is more or less transverse and compressed forward; of the two molars in the lower jaw, the first is broadest; the last premolar of the upper jaw and the first molar of the lower are tubercular; the lower jaw is moderate or slender, and has a moderate symphysis, and the coronoid process is recurved and extended upward to the angles, which are near the condyles; the foramen lacerum posticum of the skull is introrse from the antero-posterior angle of the tympanic bone; the carotid canal nearly at or in advance of the middle wall of the auditory bullæ; the auditory bullæ are well developed, and there is a short bony floor to the auditory meatus; the paroccipital process is short and blunt, somewhat hooked, and generally contiguous to the bulla at the base; the alisphenoid canal is wanting; the snout is more or less slender; the feet elongated, and with separated digits capable of grasping in a hand-like manner. The family includes two sub-families: (1) Procyoninæ, with the genus *Procyon*, or the raccoons, and (2) Nasuinæ, with the genus *Nasua*, or the coatimundis. They are peculiar to America, and naturally to the warmer regions, although, as is well known, a species of raccoon ascends far to the northward in the U. S. (See also Raccoon and Coati.)

Theodore Gill.

Profert. See Oyer.

Pro'file House, p.-v., Franconia tp., Grafton co., N. H., near the celebrated Franconia Notch.

Prof'its [Fr. *profit*, from the Lat. *proficio, profectus*], an advantage which proceeds from effort. The term is popularly used in a loose way to express any benefit proceeding from any kind of exertion, as we speak of the profit of study, of exercise, of social intercourse, etc. More strictly, it stands for the proceeds of industry, the fruits of business enterprise. Its chief importance appears in its use as a term of political economy. Yet in the treatment of that science it is employed with much looseness and ambiguity. Most writers define profits to be the *remuneration paid for the use of capital*, which is equivalent to interest. At the same time they insist that, in estimating the cost of any product, interest at the current rate on the capital employed shall be reckoned in, thus confusing gross proceeds with net proceeds under the same term. It would simplify matters if the word *profits* was held strictly to mean the net proceeds, the surplus after the proper expenses of a business have been deducted. In this sense it is as applicable to the laborer and the manager or superintendent as to the capitalist. If a laborer whose wages are $30 per month can support himself on $25, he has a profit of $5, which he may, if he will, deposit in a savings bank as the nucleus of a capital. A man of acquired skill and executive ability may command a salary of $10,000 a year as superintendent of a factory. This gives him a large margin of profit, none the less really profit though he may choose to spend it for present gratification in a luxurious style of living. One who has accumulated a capital of $1000 may start a business independently, and be himself laborer, manager, and capitalist. In estimating the results, he should set down one portion of the proceeds as wages for his labor, another as interest for his capital, and another to cover taxes for the government and insurance on his risks. Whatever remains after deducting these is properly counted as his profits. The same rule is applicable to all the complicated arrangements of productive industry where different parties, representing different interests, are united. In agriculture, manufactures, commerce, banking, and joint-stock companies for railways, or whatever, in all alike, only the surplus of proceeds above outlays, including interest on capital, can properly be reckoned as profits. The ambiguity above referred to has perhaps arisen mainly from the prevalent usage in stock companies of making their dividends to stockholders cover both interest on capital and shares of the real profits. If actual proceeds are insufficient to cover all expenses, including interest on the capital, it is a sign of a losing business, and capitalists are ordinarily the first to feel the loss. In such a case the declaring of dividends unearned, to be paid with borrowed money, is simply a falsehood and a fraud.

Holding to this meaning of the term, it is evident that profits can be legitimately increased only by one or both of two means—*i. e.* by reducing expenses or by increasing production. Hence, the amount of profits will be varied by whatever affects favorably or unfavorably either the efficiency and fruitfulness of industry or the expenses of carrying it on. Absolute constancy can never be realized. It is customary to express the rate of profits in a business by a percentage on the capital invested. This comes naturally from the mistake noticed in the outset. But it is always an indefinite, almost unmeaning way of stating the matter. In many cases the labor is of more account than the capital. A laborer may realize a profit from his industry without any capital of his own. A retail grocer with a capital of $500 may, by close attention and untiring diligence, make his capital yield 100 per cent. each year, and yet get no proper return for his labor. His business yields really no profit. With 20 per cent. on $500,000, invested in a business done on a large scale, provision may be made for good wages to all employed, with a margin for large profits. Hence, often, so far as mere profit is concerned, an individual will find it better to work for wages in connection with a large establishment than to attempt an independent business. Whether, on the whole, it is for good or for evil, we must recognize it as truth that "it is in the nature of trade and manufacture that great capital drives small capital out of the field: it can work for smaller returns." The rate of interest on capital loaned is determined, in measure, by the general average of profits in a community. It is an accepted principle of political economy that profits tend to an equality in all places and in various employments, for self-interest prompts both capital and labor, when free, to flow into that locality or that form of industry which promises the largest gains. The proposition must be understood, however, as affirming a *tendency* rather than an actual fact. Many influences are continually counteracting the tendency, the most powerful of which are monopolies, whether natural or artificial. Great inequalities continue to exist despite the general law. Where the proceeds of a business are extraordinarily increased through the special sagacity and energy of its manager, the special advantage should mostly be set down as his, being in reality a larger remuneration for his genius, though incidentally the general profits of the establishment may also be increased.

A. L. Chapin.

Progres'sion [Lat. *progressio*], a series in which each term is derived from the preceding one by a uniform law.

An *arithmetical progression* is a series in which each term is formed from the preceding one by the addition of a constant quantity called the *common difference*. If the common difference is *positive*, each term is greater than the preceding one, and the progression is said to be *increasing;* if the common difference is *negative*, each term is less than the preceding one, and the progression is said to be *decreasing*. From these definitions we see that every increasing progression when taken in a reverse order becomes a decreasing progression, and that every decreasing progression when taken in a reverse order becomes an increasing progression. An arithmetical progression is said to be *given* when we know one term and the common difference: thus, if one term is 9 and the common difference 5, we have, by the continued addition of 5, the series 9, 14, 19, 24, etc.; in like manner, by the continued subtraction of 5, we have the series 9, 4, -1, -6, etc. These two series written in proper order, form a single progression, as follows:

$$\ldots, -6, -1, 4, 9, 14, 19, 24, \ldots$$

If this series is read from right to left, it is decreasing; if read from left to right, it is increasing; in either case the number of terms is infinite. Although the number of terms of every progression is infinite, we may regard a finite number of them as a progression, which may be called a *limited* progression. Any term of a limited arithmetical progression, whether increasing or decreasing, is equal to the first term *plus* the product of the common dif-

ference by the number of terms that precede the term in question. The sum of all the terms of such a progression is equal to half the sum of its extremes *multiplied* by the number of terms.

A *geometrical progression* is a series in which each term is equal to the preceding term multiplied by a constant quantity called the *ratio of the progression*. If the ratio is *positive* and greater than 1, each term is greater than the preceding one, and the progression is said to be *increasing;* if the ratio is *positive* and less than 1, each term is less than the preceding one, and the progression is said to be *decreasing;* if the ratio is negative, the terms of the progression are alternately positive and negative. In all cases if two consecutive terms are given, we can find the ratio by dividing the second by the first. The following series, extended to an infinite number of terms in both directions, is an example of a geometrical progression:

$$\ldots\ldots, \frac{1}{4}, \frac{1}{2}, 1, 2, 4, 8, 16, \ldots\ldots$$

In this progression the ratio is 2, and this being given, together with any term of the series, the progression may be extended to any desired limit. If we consider a finite number of terms as constituting a limited geometrical progression, the nth term of the series, n being any positive whole number, is equal to the first term *multiplied* by the $(n-1)$th power of the ratio; the sum of all the terms is equal to $\frac{lr-a}{r-1}$, in which l is the last term, a the first term, and r the ratio.

An *harmonical progression* is a series such that of any three consecutive terms the first is to the third as the difference between the first and second is to the difference between the second and third. The reciprocals of the terms of an arithmetical progression form an harmonical progression; thus, from the arithmetical progression, 2, 4, 6, 8, etc. we form the harmonical progression—

$$\ldots\ldots, \frac{1}{2}, \frac{1}{4}, \frac{1}{6}, \frac{1}{8}, \ldots\ldots$$

Taking the first three terms, we see that

$$\frac{1}{2} : \frac{1}{6} :: \frac{1}{2} - \frac{1}{4} : \frac{1}{4} - \frac{1}{6}, \text{ or } \frac{1}{2} : \frac{1}{6} :: \frac{1}{4} : \frac{1}{12}.$$

W. G. Peck.

Progression, in music, the same as onward movement, or the advance from one note to another. Progression is of several kinds: (1) *melodic*, or the progression of a single part or solo, or that of any one part in a harmonized composition; (2) *harmonic*, or the movement proper to two or more parts in harmony. There is a third kind of progression, usually called "motion," which has respect to the movement of any two parts or voices when compared together, as *equal* motion (sometimes called *direct* or *parallel*), when both parts move the same way, either upward or downward; *contrary* motion, when one part ascends while the other descends; and *oblique* motion, when one part moves either up or down while the other remains stationary. (See Harmony, Inversion, Melody, and Music.) William Staunton.

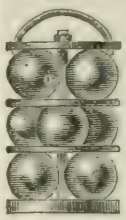
Project'ile [Lat. *pro*, "forward," and *jacere*, to "throw"], a missile thrown from a weapon, instrument, or engine, generally for war-purposes, as the arrow from the bow, the dart from the catapult, stones from the ballista, and stone or iron bodies from cannon. A more modern and limited definition is, a body intended to be projected from a cannon by the force of an explosive agent, such as gunpowder. In the case of small-arms, as the musket or pistol, the projectile is called a bullet. A rocket, however, is a projectile which is set in motion by a force residing within itself. (See Rocket.) "A projectile is intended to reach, strike, pass through, or destroy a distant object." The early history of this subject will be found sufficiently comprehended under the head of Artillery, but it may be well to premise that after the general introduction of cast-iron projectiles in the sixteenth century, and up to within a period of thirty or forty years, although the art of gun-construction made considerable progress at times, little improvement was made in projectiles, which consisted mainly of spherical masses of iron called shot when solid, and shell when made hollow for the reception of a bursting-charge.

The most general classification of projectiles is into smooth-bore or spherical and rifle or elongated projectiles, the former being mainly intended for smooth-bores, and the latter more exclusively adapted to rifled guns. In many cases the spherical projectile may be fired with good effect from the rifle, but the elongated projectile cannot be used successfully in the smooth-bore gun, although attempts have been made in this direction. Smooth-bore projectiles are generally classified into shot, shell, and case-shot. *Spherical shot* are cast solid. American 15-inch shot are made of the best quality of gun iron, having a density close upon 7.300 and a tensile strength of at least 30,000 pounds per square inch. To ensure greater solidity and uniformity in casting them of so high a grade of iron, they are cast in vertical clusters of four or five, and afterward turned in a lathe. (Fig. 1 represents such a cluster of 15-inch shot.) *Spherical shell* are cast with a core of sand, which is afterward removed, leaving the projectile hollow. The thickness of the walls varies according to the character and uses of the shell. For the same calibre the mortar-shell is usually lightest of all, and contains the largest bursting-charge; the gun-shell is somewhat thicker; and the battering-shell, used against hard resisting objects, is little inferior to the solid shot in strength. When served in guns they are generally strapped with tin strips to a wooden "sabot" or circular block, the object of which is to prevent the shell from turning in the bore and thus exposing the fuze to the direct action of the discharge. The flame of discharge is intended to pass over the shell and to the front, thus igniting the fuze. The sabot is unnecessary in mortars. *Case-shot* are a collection of small projectiles enclosed or bound together in a case or envelope. There are three principal kinds of case-shot in use—*i. e.* grape, canister, and shrapnel. A *grape-shot*, or stand of grape, is composed of a number of cast-iron balls (in the U. S. service usually *nine*, disposed in three layers of three balls each), bound together in such shape as to fit the bore of the gun. Grape-shot are used in siege and sea-coast services, but are not adapted to field service; the effective range is moderate. A *canister-shot* (Fig. 3) consists of a large number of cast-iron or lead balls, enclosed usually in a tin cylinder, the interstices between the balls being filled with sawdust. A *shrapnel-shot* may be of spherical or elongated form, according as it is intended for a smooth-bore or rifled gun; in the former case it is generally called a spherical case-shot. Projectiles of a somewhat similar character were used by France during the seventeenth century, but spherical case-shot were first used successfully by the English in the Peninsular war, the credit of perfecting them being ascribed to Col. Shrapnel of the British army. Spherical case-shot (Fig. 4) consist of a cast-iron shell of sufficient strength and thickness to resist the shock of discharge, filled with musket-balls, and the interstices filled up by pouring in melted sulphur or resin, in order to solidify the mass. A hole is then bored through the mass of sulphur and bullets of a size to accommodate a bursting-charge just sufficient to produce rupture. Like the gun-shell, it is strapped to a sabot. The charge is ignited by a time-fuze, which is regulated to cause explosion at any desired point of flight. Shrapnel may be adapted to guns of any calibre, and has the longest "effective range" of any form of case-shot. Practically, its range is only limited by the power of the gun, since it is arranged to explode only when it strikes its object or arrives within close proximity thereto. *Carcasses* are shells filled with a burning composition, which escapes through holes bored for the purpose in the case; they are used for incendiary purposes. *Chain-shot* consist of two hemispheres or spheres connected together by a chain, formerly used for cutting, at short ranges, the spars and rigging of vessels. *Bar-shot* are similar to chain-shot, except the mode of connection, which is a bar instead of a chain: obsolete. *Grenades* are intended to be thrown from the hand or rolled down ramparts against troops in mass, and are simply light cast-iron shells containing a bursting-charge and provided with time or percussion fuzes. Ordinary gun-shells may be used for the purpose.

Fig. 1.

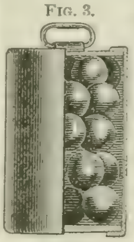
Solid Shot, in cluster.

Fig. 2.



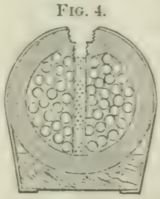
Stand of Grape.

Fig. 3.



Canister.

Fig. 4.



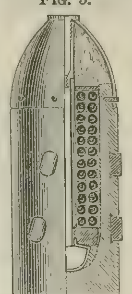
Spherical Case-shot.

An elongated projectile to be successful must keep point foremost throughout its flight. There are apparently two principal plans for attaining this end: (1) To so fashion the projectile that its centre of gravity will be much in advance of its centre of figure, as in the arrow; (2) to impart to the projectile a rapid motion of rotation about its longer axis. (See Gyroscope.) The first plan is considered of more than doubtful utility; the second plan, rotation

of the projectile, has been sought to be accomplished by three principal methods: *First*, in a smooth-bore gun to employ an elongated projectile having crooked channels or spiral webs or flanges upon its exterior, with a view to securing rotation by the powerful rush of the gases of the discharge past them during the passage of the projectile through the bore. *Second*, in a smooth-bore gun to provide the projectile with spiral-shaped wings or vanes which spring out from the body of the shot as soon as it has cleared the restraint of the bore, and are immediately operated on by the air. *Third*, to "rifle" the bore of the gun with spiral grooves or rib it with spiral bands, and by an appropriate device upon the projectile or by its form cause it to "follow" this spiral as it leaves the gun. The first and second methods have proved inadequate; the third only will be here considered.

Rifle projectiles are classified into *shot, shell, battering-shell* or *cored shot*, and *shrapnel*. The shot are solid castings; the shell have full capacity for a bursting-charge; the battering-shell have small capacity, thick walls, and strong heads, and for large calibres may be stronger than solid shot, as the presence of a small interior cavity in the casting neutralizes in a measure the injurious strains of cooling. Shrapnel for rifled guns were until recently constructed similarly to spherical case-shot, but a prevailing plan is to confine the bursting-charge to the rear or bottom of the shell, to connect it by a small tube with the fuze at the head of the shell, and to dispense in some cases with the sulphur between the bullets, in order to prevent their separating into cemented clusters. (Fig. 5 represents an English shrapnel-shell in partial section and elevation.) A rifle projectile is usually associated with a particular form of rifling best adapted to it, and this association of the projectile and rifling is called a "system." There are three prominent systems of the present day—namely, (1) *The flanged system*, embracing all projectiles upon the cylindrical portion of which are projections, which, in loading, are intended to be inserted into corresponding grooves in the bore of the gun. These projections may be studs or buttons, ribs or flanges. In this system the rifling usually consists of a few deep grooves, which are rounded at their bottom edges with a view to "centring" the projectile, as rotation is imparted, by causing the studs or flanges to "ride" up the inclined side of the groove. Studded projectiles and rounded grooves constitute the present adopted system of England—a system almost identical with that employed by France when, at the battle of Solferino in the Italian campaign of 1859, the immense superiority of rifled over smooth-bored cannon was for the first time conspicuously shown. A number of bronze studs (Fig. 5) are disposed circumferentially about the projectile, both front and rear, and about equidistant from its centre of gravity. English battering-shells are usually of cast iron, with chilled heads, struck with a radius of $1\frac{1}{2}$ diameters. The "ogeeval" head of this angle is claimed to be best adapted to penetration of iron plates. Guns for studded projectiles are rifled with from three to nine grooves (according to calibre), 0.15 to 0.25 inches deep. (2) *The compressive system*, embracing all projectiles which are loaded in a chamber, and then forced by the action of the powder through the bore of the gun, the diameter of which, across the lands (*i. e.* omitting grooves), is less than the superior diameter of the projectile. Projectiles for breech-loading guns have heretofore been of this class, the most prominent of which are those used in the well-known rifles of Krupp and Broadwell.

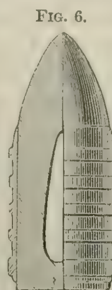
Fig. 5.



English Shrapnel, muzzle-loading.

These consist of the usual cast-iron or steel projectiles encased about their cylindrical portions with leaden jackets having a number of horizontal corrugations or ribs. The lead is secured to the projectile by a chemical solder, or it may be cast into under-cuts in the body of the shot. As the projectile is forced from the chamber into and through the rifled portion of the bore, an impression of the rifling is cut out of the ribs, and the lead thus displaced from the ribs finds room in the grooves between them. The character of the rifling best suited to lead-coated projectiles consists of a great number of grooves, shallow and smoothly cut. (Fig. 6 represents a Prussian breech-loading projectile of large calibre.) The bores of the large guns are rifled with 26 to 76 grooves, from .05 to .08 inches deep, and slightly narrowing toward the muzzle, to allow for the sheering or slip of the lead upon the bearing side of the grooves. Attempts are now making, with good promise of success, to substitute for the leaden jacket two or more narrow bands or rings of soft copper encircling the projectile, and in this country expansive projectiles similar to that illustrated below, but modified to suit the altered conditions, have been used in breech-loading guns with entire satisfaction. (3) *The expansive system*, embracing all projectiles which in loading are inserted in the gun without respect to the rifling, but which "take the grooves" by the action of the gases of discharge upon a device or feature of the projectile, which is readily expanded thereby into the grooves of the gun. This system requires for its rifling fewer grooves than the compressive (breech-loading) system, but a somewhat greater number perhaps than the flanged or stud system. It has been used so exclusively in the U. S. that it is sometimes called the "American system." Among the projectiles of the expansive class used during the civil war were the familiar Parrott, Dyer, Hotchkiss, Schenckle, James, Reed, Blakely, Stafford, and others.

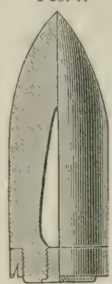
Fig. 6.



Prussian Cored Shot, breech-loading.

In the past few years marked improvement has been made, and a former objection—that expansive projectiles cannot sustain heavy charges—no longer obtains, heavy projectiles of this class being now fired with charges of one-fifth, instead of one-tenth, the weight of the projectile as formerly. Fig. 9 represents one of the large projectiles now used in the U. S. service. It consists of the usual cast-iron body, having a brass or copper ring or "sabot" attached to the base. A deep annular groove divides this otherwise solid ring into an upper and a lower flange or lip. The sabot may be cast or screwed upon the projectile. For experimental firing the screw-thread is preferred, as it affords an opportunity of attaching a new sabot and firing the same projectile several times. This projectile is inserted at the muzzle of the gun and rammed "home" to the charge; when the gun is fired the powder-gases enter the annular groove in the sabot, and while the lower or inner flange is pressed down upon the projectile, the upper or outer flange or lip is forced into the rifling of the gun, and is kept thus distended during the passage of the projectile through the bore. The depth of the rifling seldom exceeds a tenth of an inch (but little deeper than that in breech-loading guns). For 8-inch, 10-inch, and 12-inch rifles, fifteen, seventeen, and twenty-one grooves, respectively, have been employed, the lands and grooves being of about equal width. The length of rifle projectiles varies from two to three diameters, usually 2.50 diameters. The weight does not usually exceed three times the cube of the semi-diameter. The velocity with which they are projected varies in different calibres from 1100 feet to 1550 feet per second. (For a detailed description of various systems of projectiles and rifling, many of which are obsolete, others experimental, see *Ordnance and Armor*, by Holley; *Ordnance and Gunnery*, by Benton; *Reports of English Select Committee on Ordnance; Projectiles and Rifled Cannon*, by Butler, etc.) J. G. Butler.

Fig. 7.



U. S. Cored-Shot, muzzle-loading.

Projec'tion [Lat. *projectio*], the representation of a magnitude on a plane or other surface made in accordance with some geometrical law. There are two principal methods of projecting a magnitude on a plane; in the first method the projection is made by a system of parallel lines, and in the second it is made by a system of lines diverging from a common point. The former method is the one usually employed in descriptive geometry and its applications; the latter in perspective and in many kinds of spherical projections. In both methods the projecting lines are called *projectors*, and the plane on which the drawing is made is called the *plane of projection*. In descriptive geometry two planes of projection are used at right angles to each other, and the projectors are perpendicular to these planes. One plane is assumed to be horizontal, and the representation of the magnitude on this plane is often called the *plan*; the drawing on the vertical plane is then called the *elevation*. In perspective and spherical projections only one plane of projection is used, and then the point common to all the projectors is called the *point of sight*. We may regard the method of parallel projections as a particular case of radial projections, in which the point of sight is at an infinite distance—that is, at a distance so great that the projectors may be regarded as parallel to each other.

Spherical Projections.—This name is applied to the representation of the principal points and lines of a spherical surface on a plane. When the entire sphere is to be represented, the projection is usually made on the plane of a great circle; this circle is called the *primitive circle*,

and its plane is called the *primitive plane*. There are three principal methods of projecting the entire sphere: (1) When the eye or point of sight is taken in the axis of the primitive circle, and at an infinite distance from the centre of the sphere. In this case the projectors are perpendicular to the principal plane, and the projection is then said to be *orthographic*. In making an orthographic projection of the sphere the hemisphere nearest the eye is first projected, after which the other hemisphere is revolved around a tangent to the primitive circle through an angle of 180°, and from this position it is projected on the primitive plane. (2) When the eye is taken at the pole of the primitive circle; this is called the *stereographic* projection. In making a stereographic projection of a sphere the hemisphere farthest from the eye is first projected, after which the other hemisphere is revolved as before, the eye is taken at the opposite pole, and then the projection is completed. (3) When the eye is taken in the axis of the principal circle, and at a distance beyond the surface equal to the radius of the sphere into the sine of 45°; this is called the *globular* projection. A globular projection of a sphere is made in a manner entirely similar to that followed in making a stereographic projection.

In projecting a sphere by any of the preceding methods the principal circles are first projected to form the basis of the map or chart; these circles are the *equator*, the *tropics*, the *polar circles*, a certain number of *circles of latitude*, and a sufficient number of *meridians* or *hour circles;* for astronomical charts the *ecliptic* is also projected. The projections of the prominent points to be laid down on the chart or map are then determined, either by absolute projection or by reference to the lines already established.

In the orthographic projection, circles parallel to the principal plane are projected into equal circles, circles perpendicular to the principal plane are projected into straight lines, and all other circles are projected into ellipses whose principal axes are respectively equal to the diameters of the circles, and whose secondary axes are equal to these axes multiplied by the sines of the inclinations of the several circles. In the stereographic projection, circles whose planes pass through the eye are projected into straight lines, and all other circles are projected into circles. In the globular projection, circles parallel to the principal plane are projected into circles, those whose planes pass through the eye are projected into straight lines, and all other circles are projected into ellipses. In each of the three classes of projection there is a certain amount of distortion; that is, points that are equidistant on the surface of the sphere are not necessarily equidistant in projection. In the orthographic projection, points in the region of the poles of the primitive circle are fairly represented, but points near the primitive circle are crowded together. In the stereographic projection the points near the primitive circle are fairly represented, and those near its poles are crowded together. In the globular projection the crowding occurs in an intermediate zone. There is less distortion in the globular than in either of the other projections, but this projection is more difficult to make than the others, and for this reason it is less used than the stereographic, which is the easiest of all the projections to execute.

When only a portion of the surface of a sphere is to be projected other methods of projection are used, of which the following are some of the most important:

The *gnomonic projection*, in which the eye is taken at the centre of the sphere and the plane of projection is tangent to the sphere. This method gives a map of a limited portion of the sphere with but little distortion. Mr. Richard A. Proctor has constructed a series of star maps on this principle; he first circumscribed the sphere by a regular dodecahedron, and then projected the entire sphere gnomonically upon the several faces of the dodecahedron. (For an account of the method of making the projection see Proctor's *Star Maps on the Gnomic Projection*.)

The *polar projection*, in which the eye is at the centre of the sphere, and the plane of projection coincides with that of one of the polar circles. This method has been used to represent that portion of our earth which lies in the neighborhood of the Arctic circle.

The *conical projection*, in which the eye is at the centre of the sphere, and in which the projection is made on the surface of a cone tangent to the surface of the sphere, along the middle circle of the zone represented, or sometimes on a secant cone passing through two circles of the zone equidistant from each other and from the bases of the zone; after the projection is made the conic surface is developed, or rolled out, on a tangent plane.

The *cylindric projection*, in which the eye is taken at the centre of the sphere, and in which the projection is made on the surface of a cylinder which is tangent to the sphere along the equator; after the projection is made the cylinder is developed on a tangent plane. This method is applicable to the case in which a map of the equatorial regions is to be made.

The *polyconic projection*, in which each parallel of latitude is developed symmetrically from an assumed meridian by means of a cone tangent to the surface along that parallel. This is the method of projection used by the U. S. Coast Survey in projecting small maps and charts. (For a more complete account of the different kinds of projections consult Appendix 39 of *Annual Report of U. S. Coast Survey 1853*, by the late Maj. E. B. Hunt, corps of engineers, U. S. army.) W. G. Peck.

Projection, Method of, in geometry, by J. G. Barnard. See Appendix.

Prolap′sus U′teri, falling of the womb or uterus, its descent below its normal position in the pelvis; in extreme cases a protrusion of part or the whole of the organ from the body. Enlargement of the uterus by inflammation, uterine and abdominal tumors, relaxation of the tissues which are the anatomical supports of the organ, rupture of the perineum by instrumental delivery, sudden violence in falling or jumping, are the chief causes of prolapsus.
E. Darwin Hudson, Jr. Revised by Willard Parker.

Prome, town of British Burmah, in Pegu, on the eastern bank of the Irrawaddi, is surrounded with a brick wall, has some manufactures, especially of paper, and carries on a considerable trade with Rangoon. P. about 30,000.

Prome′theus, one of the most interesting creations of Greek mythology, was a son of Japetus and Clymene, Themis, or Asia, the brother of Atlas, Menoitios, and Epimetheus, and father of Deucalion. The myths relating to him are very variously told by Hesiod, Æschylus, and later poets and philosophers, but there are nevertheless certain fundamental traits in which all the different versions agree. They all represent Prometheus as a benefactor of the human race. According to some, he was the creator of man; according to others, he only brought to him fire and the arts depending on the use of fire. Next, they all agree that those benefits which he conferred on the human race for some reason excited the wrath of Zeus, who chained him to a rock and sent a vulture to feed daily on his liver. From these sufferings, under which the Titan did not succumb, Hercules at last delivered him by shooting the vulture and unlocking the chains, after which Prometheus returned to Olympus. Of Æschylus's trilogy only the middle piece, *Prometheus Bound*, is still extant. The ancient myth received a most remarkable treatment in modern times from Shelley in his *Prometheus Unbound*.

Prom′ise [Lat. *promissum*], in law, a unilateral undertaking to do or not to do some specified act. Promise is to be carefully distinguished from agreement or contract, of which it is only the one half—the act of one party. An agreement or contract implies the assent of two parties—the promise by one of them, and something proceeding from the other which forms the consideration. A promise is the written or spoken formula by which the undertaking of one person is expressed, and it is a necessary element in the legal conception of a contract. A promise without a consideration—a naked promise—however morally binding, does not in general create a legal obligation; but when contained in a sealed instrument the common law did not permit the consideration to be denied. This doctrine has been modified in many of the States by statutes which make the seal presumptive evidence only of a consideration, and allow such presumption to be overcome by proof. The term *implied promises* is also used in the law, and is applied to a large class of legal obligations arising from various acts, omissions, and relations where there has been no express undertaking by the party, but he is considered liable in the same manner and to the same extent as though he had made an actual promise. This designation was invented by the judges at an early day in order that the class of obligations which it denotes might be enforced by the form of legal action known as assumpsit. (See Contract.) John Norton Pomeroy.

Prom′issory Notes. According to the general law-merchant, unaffected by statute, a promissory note is the written, unsealed, absolute promise of a person, called the "maker," to pay a certain sum of money at a certain time to a designated person, termed the "payee," or to his order or to the bearer. From this definition the following requisites are indispensable: The promise must be written, unsealed, and signed by the maker; it must be absolute, not depending upon any contingency; it must be to pay money in a certain amount, or in an amount capable of being made certain by computation; the time of payment must be certain, or such as will become certain, but when no time is expressed the law implies that payment is due immediately, and the time in such case is certain within the meaning of

the rule; lastly, the promise must be accompanied by words of negotiability—that is, it must be made payable to a designated payee or to his order, or to bearer. Contracts without some one or more of these requisites may be perfectly valid, but they do not possess the peculiar qualities which belong to promissory notes. These instruments came into use among merchants in connection with, but somewhat later than, bills of exchange, and had grown to be so common in England under the name of "goldsmiths' notes" that they attracted the attention of the courts and received a judicial construction in the time of Sir John Holt, who was lord chief-justice during the reign of William III. and a part of the reign of Anne (1689–1709). By the common law, things in action were not assignable so that the assignee could sue upon them in his own name. An exception to this rule had been established in the case of bills of exchange inland and foreign; but when the same indulgence was asked first for promissory notes, the courts under Lord Holt refused to sanction the innovation. Parliament, however, intervened (3 and 4 Anne, c. 9, 1705), and enacted that promissory notes should be placed upon the same footing as inland bills of exchange. It has been held, however, in several American cases that this declaratory legislation was unnecessary, and that notes, as well as bills, possessed all the qualities of negotiable paper at the common law, thus rejecting the opinion of Chief-Justice Holt. The most important attribute of promissory notes, bills of exchange, and other instruments of the same class, which distinguishes them from all other contracts, is their negotiability. Negotiability consists of two entirely distinct elements or branches—*first*, the power of transferring the paper from one owner to another, so that the assignee shall acquire a complete title and be able to sue in his own name; *second*, the effect upon the rights of the parties produced by such a transfer when made before maturity in the regular course of business for a valuable consideration to a purchaser in good faith and without notice of any defect or defence, whereby all defences of the maker (with a few exceptions) are cut off, and the holder becomes absolutely entitled to recover. The rules of the law pertaining to notes and relating to their indorsement and transfer, the time and place of payment, the demand for payment and notice to the indorsers of non-payment, the liability of the maker and indorsers, the rights of the holder, the defences between the original parties and in case of a transfer—in short, all the rules which determine the rights and liabilities of the parties and the measures by which they must be enforced are identical with those pertaining to inland bills of exchange; the same regulations apply to both kinds of negotiable paper with the single modification that the "maker" of the note is substituted for the "acceptor" of the bill, and with the single exception that there is no presentation of the note to the maker for acceptance, the note is identical in its legal condition with a bill after acceptance. As these various rules have been fully stated in the article on BILL OF EXCHANGE, they are not here repeated. These general doctrines have been variously modified by statute in a few of the American States, and a local derangement is thus produced in a branch of the law which ought to be uniform throughout all commercial communities. Among these changes are the abolition of days of grace, the alteration of the indorser's liability by rendering his contract absolute instead of conditional, or by requiring a judgment to be first recovered without effect against the maker, and the restricting the effect of "negotiability" upon the maker's liability to notes made payable at banks, so that in all other classes the defences are not cut off by a transfer to a *bonâ fide* holder. In the operations of modern finance a new form of negotiable obligation has come into general use, to which the legal qualities belonging to promissory notes have been given by the American courts—the ordinary coupon bonds issued by municipal and other corporations. (See BILL OF EXCHANGE.) JOHN NORTON POMEROY.

Prom'ontory, v., Box Elder co., Ut., at the highest point of Union Pacific R. R. P. 43.

Promp'ton, p.-b. and tp., Wayne co., Pa. P. 394.

Prong-Horn. See ANTILOCAPRA.

Pro'nouns, a class of words which derives its name from the Latin *pro*, "for," "instead of," because as parts of speech the pronouns take the place of the noun. They are divided into personal, relative, interrogative, demonstrative, and possessive pronouns, of which the first class is used exclusively as nouns, the last exclusively as adjectives, the others partly as nouns, partly as adjectives.

Pronuncia'tion [Lat. *pronunciatio*] treats of the spoken form of words and the mutual influence of their component parts. In condensing two words into one they are often modified, as in uniting *gentle* and *man* or *men*, which in Old English were the distinct words "gentille men," of which the adjective was pronounced *genteel'*, in accordance with the Latin *gentīlis*. At a later period, as in Chaucer,

"For gentil men they wer, of gret estat," . . .
"As longeth to a gentil man," . . .

the accent changed, but the word had not acquired its modern form, *gen'tleman*—

"And one old gentleman stares and stands."—TH. HOOD.

Until recently, the laws of speech, apart from the laws of language, have not attracted much attention, and in the absence of science literary experimenters undertook to bring language into correspondence with the imperfections of the spelling-book, instead of investigating the living speech. Although căt-aract and plăt-itude are strictly English, as were Căt-o, Plăt-o, and Străb-o in the last century, it is said that Garrick (1716–79) changed these names to Cay-to, etc., according to some pretended analogy; for it is not according to English analogy to give the perverted power of the English alphabetic name in all such cases. It is not strictly correct to say that "*c* before *e* and *i* has the power of *s*," for *Celt* is pronounced "Kelt," and archæology has the term *cist-vaen* or *kist-vaen* (a coffin made of stones), of which the initial part, according to English analogy, would not become "sist," but *chist* or *chest*. Leigh Hunt has *Petrarcist* and *Petrarcian*, based on *Petrarca;* Waterton says that apes are "mimicers of man," and we find such newspaper forms as *ipecacing*, *picniced*, *mosaiced*, *scientificest*, where the addition of a suffix should not affect the original word. Mineralogists pronounced the *c* as *k* in *cyanite* to distinguish it from *sienite*, which induced the lexicographers to spell it with *k*.

There is a difficulty in English pronunciation due to the fact that it has two systems of accent—the Teutonic and the Romanic—the conflicting influences of which have not had time to produce uniform results. While Latin monumēnt'um gives *monument'* to German, in accordance with Teutonic analogy, English treats *mon'ument* as an entire Latin word, and carries with it (dētrīmēntŭm) *det'riment* and (dēspērātus) *des'perate*. Although a Latin word cannot have a final accent, we have a valid reason for saying *proceed'* and *decay';* and while that language cannot have an accent behind the antepenult, we have *elu'cidator*, where *crea'tor* should give *elucida'tor*, and (Lat. ōrā'tor) *or'ator* should give *elucid'ator*. In long words the accent seems to be left to chance, as in *per'emptory* and *peremp'tory; per'egrinator, peregrina'tion; clas'sificatory* (*Webster*), *classifica'tory* (*Hyde Clarke*); *procura'tor* (*Knowles*), *procur'ator* (*Cull*), *proc'urator* (*Donald*). In the last century such un-English forms as *ac'ademy*, *rec'eptacle*, *ref'ractory*, and *pro'fessor* had their advocates. In many cases the accent on the first of four syllables (as in *nom'inative*, *ter'ritory*, *al'legory*, *an'timony*) has arisen from a secondary accent overpowering a primary; in other cases it is due to the preservation of the radical accent (as in *yel'lowishness*, *appro'priateness*)—a practice which is natural in the Teutonic tongues; but when the root and the primary accent are unknown the words may take a rhythmic form, as in *Memphremagog*, *Michilimackinac*.

Lecturers on anatomy use the words *cervī'cal* and *poplitē'al*, which the dictionaries pervert to *cer'vical* and *poplit'eal*, as they pervert *capibâra* to *capib'ara*, and *spinel'* of the mineralogists into *spī'nel* and *spin'el;* while the tendency toward the antepenult accent is perverting *muse'um*, *lyce'um*, *pyrī'tes*, and Mr. R. W. Emerson has perverted *oppo'nent* into *op'ponent* in a public lecture.

As a Teutonic language, English tends to the preservation of the radical accent, which a false classicism and an incorrect view of syllabism have injured. *Cal'yx, chal'ice; pet'al, pet'iole; sep'al, sep'arate; pat'ent, pat'ulous, path'os; sen'ate, zen'ith* (Mod. Greek, *ζενίθ*), *a-men'able; min'im, min'us*, conform strictly to the genius of English, and the vowel of *want* must occur equally in *squal-id* and *squal-or*. The disagreeable clash of two *e*-sounds in *medieval* might have been avoided by using the root-vowel as it stands in *longevity* or in *a-ge*.

It was unfortunate that the English name of the universal *u* (oo) should have become *yoo* (spelled thus by Nares in 1784), and attempts have been made to force this power into places where English speech cannot accept it, particularly after *j, ch, sh, r, s;* and the endeavor to say s-yoo-gar, s-yoo-r, is-s-yoo, has caused the *s* and *y* to coalesce upon *sh* at the intermediate point of formation, resulting in the now legitimate pronunciation of *sugar, sure, issue*—ish'oo (*Donald*, 1868), is-sew (*Buchanan*, 1760), ish-yoo (*Knowles, Cull*). The attempt to make use of this spurious *y* throws some speakers upon "shootable" for *suitable*, and "prezhoom" for *presume*, while others avoid the difficulty legitimately by rejecting the parasite and producing *pursoo*, *sootable*, *prezoom*. Similarly, the traditional speech-words *tooter* and *dooty* are better than the factitious book-words *tshootor* and *dzhooty*.

When *ci, ti, si* become *sh* before a vowel, a syllable is lost, turning ad-vent-i-ti-ous and per-ni-ci-ous into ad-vent-ish-us and per-nish-us, where "iti" spells *ish*, and not *ishi;* and as that which has been *i* or *y* has been advanced up the palate to form *sh*, it cannot remain to represent a vowel, as when Mr. Cull puts two spurious elements in j*y*oo-dish-*i*-us (for joo-dish-us), partly under a false rule which states that *t, s, c* "have the sound of *sh* before *e* or *i* and another vowel." Under some such view he gives us gra-shi-us, a-shyoor, ex-pe-dish-i-us, o-she-an, col-li-er-y, ho-zhi-er, and the like. *The law of speech* in such cases is, that the presence of *sh* removes the *i* or *y;* and, reversely, the presence of *i* or *y* prevents the formation of *sh*. Hence, *i* and *y* in e-lec-trish-*i*-an of Cull, and e-lec-trish-*y*an of Donald are wrong, while e-lec-trish-un of Worcester and Knowles is proper.

By theory, Sheridan's pro-nun-sha-shun is better than Walker's pro-nun-shi-a-shun, Smart's pro-nun-si-a-shun being perhaps better than either; and in-gra-shate, ne-go-shate, pro-pish-ate of Buchanan are better than the forms in-gra-shi-ate, etc., based upon false spelling in the school-room. The practice of Knowles agrees very nearly with correct theory, and while he adopts some perversions like in-gra-shi-ate and of-fish-i-ate as probably too firmly established to be disturbed, he gives gla-seal or gla-shal, sa-she-ate or sa-shate, e-ma-se-ate, ex-pa-se-ate, in-is-e-ate, ap-pre-si-ate, and o-se-an-ic. To the word *satiety* (from the French *satiété*, with *ti* as *si;* Provençal, *sacietat;* Low Lat. *sacietas*) has been assigned the forms satī′ety, sasī′ety, sā-shi′ety, sāsh′ety, sāciĕty (*Chapman*); to which sashī′ety and sash′ety might have been added. The ĭ of *similar* (sĭmĭlĭs, sĭmŭl) some would pervert to ī in *simultaneous*, and we find *tru′culent* for *truc′ulent* (trŭcŭlentŭs), in which the natural form is adapted to the root and affixes. The Latin quantity has not much to do with modernized forms, and *pitu′itous* must conform to *gratu′itous*, although the third Latin syllable has *i* long in the former and short in the latter.

The lettered classes may know less about the laws of speech than the illiterate. Starting with a rule about "the article *an* before a vowel," and having been told that "*u* is a vowel," we find authors using such expressions as "an universal" (*Boyle*, 1675; *Swift, Ch. Kingsley, North Brit. Rev.*, 1865); "an uniform conduct" (*Gibbon*); "an European Field" (*Croly*); "an usurpation" (*Hallam*); "an euphonic vowel" (*Sir George C. Lewis*); "an unit" (*Byron*); "an usurper" (*Edin. Rev.*, 1856); "an eulogium" (*Th. Moore*); "an useless waste" (*A. H. Sayce*).

Where the letter *k* does not exist, some nations use *qu*, as in French *liqueur*, the meaningless *u* of which appears in writing *quay* (kee), *musquito, quinine* (kee-neen′), *coloquintida*, in which the lexicographers pronounce *u* without inquiring how *kyn* (kün) of the Latin *colocynthis* and Greek *κολοκυνθίς* could become *kwin*. The most agreeable and musical of all the vowels, that of *arm*, is assigned to *alms* and *almond;* and although this power is enforced by *h* in *dahlia*, this name has been perverted to *dalea* in ignorance of the fact that Dahl, a Swede, is commemorated in the former, and Dale, an Englishman, in the latter. The vowel of *arm* occurs in palâver, cantâta, sonâta, capibâra, banâna, cassâva, tomâto (Portuguese *tomâte*, whence *tomat′*), Tâtar (which fell into *Tartar*), yataghân, pâlm. Some use âmen, and strâta was used by American geologists until the year 1842, when some followed the practice of Mr. Lyell. The dictionaries join the incompatibles *z-h*, giving *egz-hort, egz-haust, egz-hibit*, where *egz-* requires the exclusion of *h*, or *h* requires the presence of *eks-*, giving either *egz-aust or eks-haust*.

Stability in English pronunciation cannot be attained until the alphabetism of the primer is replaced by a study of the laws of speech. Under the former an *e*-sound may be turned into an *i*-sound if the accidental spelling is of a certain kind. *Break* and *great* may be called *breek* with Buchanan and *greet* with Enfield, Buchanan (1766), probably on the "analogy" of *wear*, turns *weary* into *wary*, *meadow* into *mee-doo* (which would justify the *modern* rhyming perversion of mĕad to *meed*), *neigh* into *knee*, and *neither* into *nī-ther*. The pronouncing dictionaries are in most cases correct, and they are useful in a wide-spread language like English, with a vocabulary so extensive that the reader may be familiar with many book-words which he never heard from persons who had learned them as speech-words. (See the extensive work of A. J. Ellis, F. R. S., *On Early English Pronunciation, . . . from the Anglosaxon Period to the Present Day*, London, 1868–75.) S. S. HALDEMAN.

Pronunciation of Greek is allied to that of Latin, but differs in several particulars. The Greek long η and short ε are heard in *thêre* and *met*, the former being French *ê*. Greek wants the Latin *u* (*oo*), which has υ (French *u*) instead; and when the Latin sound was to be represented, the Greeks used their diphthong ου (*o-w* in *no-wonder* pronounced quickly), a sound which became that of *ooze* in later and modern Greek. The long ω as in *old*, short ο, the same pronounced quickly: θ as in *thin;* ρ a trilled *r;* ῥ a whispered aspirate *r*, like Welsh *rh;* σ, ς the hissing *s;* φ akin to *f*, but formed with the lips alone; χ like German *ch* in *doch;* ψ like *ps* in *ellipse* and *bs* in *Robson*. The sound of *n* in *anger* is represented by γ (gamma) before γ, κ, ξ, χ. In the diphthongs each element must be heard, but -υ is then slightly modified, so that αυ is heard as in Ger. *braun*, Eng. *brown;* ευ like *e-w* in *Edward*. The word υἱός (*son*, with υ long and ο short) is often perverted to *hwee-os*, but the proper sound is represented by the German elements in *hüj-os*, French *hu-yos*. With these points in view, the ordinary Greek grammars may be consulted for the general alphabet. (See GREEK LANGUAGE, by PROF. F. D. ALLEN, PH. D.) S. S. HALDEMAN.

Pronunciation of Latin is based upon the descriptions of the Latin grammarians, who have described every letter. With some variations in minor points, the following powers have been inferred. The long and short vowels differ only in length, and not in quality, and the English vowels of *fat, met, fit, not, hut*, are rejected. The Latin long and short vowels are heard in ārm, ărt; wēigh, wĕight; marîne, deceĭt; ōld, ŏ-bey; rūle, fŭll; *y* (in Greek words) is Danish *y*, French *u*, German *ü*. The diphthong *æ* or *ae* is like English *eye*, the affirmation *ay* or the *ae* of *Shanghae;* *œ* or *oe* like *o-y* in *showy*, or *oe* in *coequal* when pronounced in one syllable; *ei* much like *e-i* in *preying;* *ui* much as in *ruin;* *au* or *av* like *ow* in *now*, German *au;* *eu* much like *e-w* in *they-want*. Of the consonants, *c* is always like *k;* *g* as in *get, give, go;* *j* (*yay*) like English *y*, or *j* in *hallelujah;* *m* as in *may*, but when final it only nasalizes the preceding vowel, like final French *n* in *bon;* *n* as in *no*, but before *c* (*cay*), *g* (*gay*), *x* (*aiks*), like *n* in *anger* or *ng* in *singing;* *qv* or *qu* as in *quart* (Lat. qvârtŭs or quârtŭs, *fourth*); *r* distinctly trilled, as in French and German; *s* as in *hiss*, never as in *misery, mission;* *t* always pure, never as in *notion;* *v* as English *w;* *z* (in Greek words) like English *zd*, or *sd* in *wisdom*. When letters are doubled, as *ll* in pâllĭdŭs (pale), each must be heard, as in *all-loving*. (See Haldeman, *Latin Pronunciation* (1851); Richardson, *Roman Orthoëpy* (1859); Blair, *Latin Pronunciation* (1873); and the *Latin Grammars* of Roby (1872) and Bartholomew (1875).) S. S. HALDEMAN.

Propagan′da (*Congregatio de Propaganda Fide*), a congregation of cardinals at Rome, first fully established in 1622 by Gregory XV., for furthering the spread of the Roman Catholic religion among the heathen. The Congregation sustains a great college (Collegium Urbanum), often called The Propaganda, for training missionaries. It has also a library and printing establishment.

Proper′tius (SEXTUS AURELIUS), b. in Umbria near the frontier of Etruria; lost while still a youth most of his fortune by some agrarian law, and lived in Rome in rather pinched circumstances; devoted himself to poetry; attracted the attention of Mæcenas, and resided on the Esquiline in familiar intercourse, as it seems, with Mæcenas, Virgil, and Ovid. The exact dates of his birth and death are unknown. His *Elegies*, which appear to have been much appreciated in antiquity, have come down to us only in a very corrupt text, and are by themselves less enjoyable than the similar productions of Tibullus and Ovid on account of their style, which is cumbersome and obscure. There are editions by W. Hertzberg (Halle, 1843), Keil (Leipsic, 1850), and Haupt (Leipsic, 1853), and a translation into English verse by Charles Robert Moore (Oxford, 1870).

Propeller. See NAVIGATION, OCEAN STEAM.

Prop′erty [Lat. *proprietas*], in law, the right of ownership which a person may have in anything capable of being owned, as opposed to the mere possession or the mere right to the possession. In common discourse, and even in legal treatises of high authority, the word is often employed to describe the thing itself which is the object of ownership, so that the same term is made to denote the physical thing, the land or chattel which is the object of the right, and the very right itself. This double use even occurs in the definition of personal property given by Chancellor Kent in his *Commentaries*, and the confusion of thought which it indicates and produces is complete, while the definition itself is logically without meaning. Property is a right capable of various degrees or grades, and fully recognized and protected by the law. The speculations as to the origin of property have been numberless, and have engrossed the attention of many generations of juridical writers. The theory generally adopted by the jurists of the eighteenth century, formulated with great minuteness of detail by Blackstone, and repeated since his time by the ordinary legal text-writers, represents property as having its origin in the physical act of occupancy. It

pictures a so-called "state of nature," with no society and no law, when the earth gave its products alike to all, and everything was common to all. In this primeval condition an individual chooses a spot of land, occupies it, and from that act a suggestion of a transient right thereto arises, which gradually deepens into the conception of a permanent right; and finally the notion of complete property or absolute ownership is developed. This fanciful theory has been wholly rejected by modern scholars. It is utterly irreconcilable with two controlling facts—the physical condition of the earth itself before it was subdued by organized human labor, and the primitive condition of mankind as shown by the most ancient historical records and by all the traces which have been preserved of the earliest institutions and traditions. So far from property taking its origin in the occupancy of specific tracts of land by particular persons, it is certain that the notion of a separate, individual ownership arose at a comparatively recent date, as the result of great social changes, and as the termination of a progressive development reaching through vast epochs of time. Among the Aryan nations the earliest form of property was that of communities—groups of persons acknowledging a common kindred and possessing a common religious worship. Village communities owning in common still exist in Hindostan, and are mentioned in the earliest writings of the Hindoos. Evident traces of the same ownership have been preserved in Europe within the range of modern observation. Following this community property, came the property vested in the family. Whether this institution grew out of the former, or whether it sprang up on an independent basis as a modified product of the same causes, it may not be possible to determine; it is certain, however, that in the earlier stages of the Roman state, and in the corresponding periods of the Grecian cities, while the family was the social unit, property was considered as a right belonging to the family in its collective capacity. Although the head of the family, the *pater familias*, had the undisputed control, he was not the absolute owner in the modern sense of that term; he represented the household as its trustee, and at his death this right of representation devolved upon his successor. That the same institutions prevailed among the Saxons and other German nations, and among the Celts, has been demonstrated by modern research. From this stage of undivided property in the family, by gradual changes in social customs, by the abolition of inheritance by the eldest son and the admission of inheritance among all the children, by the growth of trade, and by all the other influences which tended to elevate the individual, the notion of private and personal property was developed, and finally became firmly established in the law, and has remained as one of the foundation-stones upon which the structure of modern society is erected.

Property is divided by the English and American law into various classes. The first capital division, which is one of the peculiar features of the common law, separates all property into real and personal, or that in lands, things real, immovables, and that in chattels, things personal, movables. Although many of the ancient distinctions have been removed by modern statutes, still, the differences which remain are very striking, the most important being the wholly dissimilar modes of succeeding to real and to personal property on the death of an owner, the former passing directly to his heirs or devisees, the latter passing to his administrators or executors for distribution among creditors, next of kin, and legatees. Property is also separated by an entirely different line of division into two classes, absolute and qualified. Absolute property is the complete and perfect right of ownership, free from any interest held by another, and with no limitation except that imposed by the law upon all owners for the public welfare. It involves the possession, the power to use in every lawful manner, and to transfer. When the object is land, it is termed an estate in fee simple. Qualified property embraces all species that are not absolute. The qualification may inhere in and result from the intrinsic nature of the right itself, or it may be connected with and result from the restricted length of time the right is to endure. The interest of the pledgor and the pledgee in an article pledged, that of an administrator or executor in the personalty of the decedent, and that of a trustee, are illustrations of the former species of qualified property. The qualification depending upon the element of time may consist either in the limited duration of an interest which has begun, or in the commencement of the interest at a future day, or in both, and may be either certain or contingent. The law recognizes two classes of qualified property limited in its duration—that for life, either of the holder or of some other person, and that which is to last for a specified and certain number of years or other period. The holder of qualified property is restricted in his use of the thing according to the nature of the qualification, and cannot transfer a higher interest than that which he himself has.
JOHN NORTON POMEROY.

Proph'et [Gr. προφήτης], (1) he who speaks for another, *proclaimer*, preacher; or (2) one who predicts future events. We find in all nations from the most remote antiquity traces of men who claimed, and were believed to have, special and immediate intercourse with the Deity. The most remarkable and familiar instances of these phenomena appear in the nations of the East, more particularly among the Hebrews. In the Old Testament they are called נביא "speaker," "interpreter—*i. e.* revealer—of the divine will to man" (in no case does it mean predicter of future events), Ex. iv. 16; vii. 1. Comp. ראה, חוה, "seer;" שמר, צפה, מצפה, "look out," *i. e.* for the signs of the times; also, מטיף, נביא יהוה, "איש", "מלאך".

In the earlier ages they appear chiefly as seers (ראה, 1 Sam. ix. 9), leading a contemplative life apart from the world. About the time of Samuel, with whom the prophetic age begins, they seem to have been organized into communities, known as בני אלהים (comp. *Darwîs* of the present day), established in various places under the charge of old and experienced prophets, devoting their time to the study of the sacred writings and ecstatical religious exercises. After the Exile we lose all trace of these organizations; the prophets appear separately and at intervals, and from Malachi to John the Baptist there arose no prophet in Israel. The prophets led in the main an ascetic life, supported by the contributions of the charitable (2 Kings iv. 42), by the gifts of those who sought counsel from them (1 Sam. ix. 7; 1 Kings xiv. 3; 2 Kings v. 15, 16 ff.; *ib.* viii. 8), or by fruits, herbs, etc. gathered by themselves (2 Kings iv. 38; Matt. iii. 4). Their costume was a mantle of skin (Zech. xiii. 4; 1 Kings xix. 13) girded around the loins (2 Kings i. 8; Matt. iii. 4).

The call to the prophetic office was an inward one from God, but those so called were not at all times in a state of inspiration, nor was this under control of their will. The divine revelations were not received in a state of ecstasy (Montanists, Hengstenberg), but in visions or in an elevated though entirely rational condition; so distinguished from μάντεις. The form in which the prophecies were communicated to the people depended entirely on the age and the individuality of the prophet, whether by verbal communication, symbolic actions which were mostly unreal, or by writings (Isa. xl. ff., and some of the later prophets). The prophets had mainly in view the reformation and elevation of the people, and but incidentally point out future calamity or deliverance as an aid to present guidance.

Prophets, Books of the. See BIBLE, by PROF. W. G. SUMNER, A. B.

Proph'etstown, p.-v and tp., Whitesides co., Ill., on Chicago Burlington and Quincy R. R., 12 miles S. of Morrison, has 2 school-houses, 1 church, 1 bank, 1 newspaper, 2 hotels, a grain-elevator, and Masonic and Odd Fellows halls. Principal business, farming and stock-raising. P. of v. 276; of tp. 1274. A. D. HILL, ED. "SPIKE."

Propion'ic Acid. This acid, which is $C_3H_6O_2$, was called *metacetonic acid* by Gottlieb, its discoverer—a name which is now, however, entirely lost sight of for reasons that are not apparent. Propionic acid is the third in the series of the "fatty-acid" homologues (see the article HOMOLOGY), whose homologic formula is $O_{2 \cdot n}H_2C$. It seldom occurs in nature, though found in some wines. One point of interest is, that the English chemist Wanklyn succeeded in its synthesis directly from *carbonic acid*, the only case of the kind yet known. The substance called ethylide of sodium in acting upon CO_2 forms *sodic dipropionate* directly:

$$2(Na.C_2H_5) + 2CO_2 = Na_2O.2(C_3H_4O).H_2O.$$

It has been formed by several other methods. At normal temperatures it is a solid, soluble in water in all proportions. It melts readily, and boils at 140° C. Its smell is singular, but remotely resembles that of butyric acid.
H. WURTZ.

Prop'olis [Gr. πρόπολις, "before the town," because it is used to close small approaches to the hive], a resin which the honey-bee collects upon its posterior tibiæ and carries to the hive, where it is used in filling crevices, finishing combs, and the like. In this country it is mainly collected from the buds of the birch, the horse-chestnut, and the balsam-poplar.

Propor'tion [Lat. *proportio*], in æsthetics, is one of the constituent elements of beauty. A lack of proportion in the form may be concealed by the brilliancy of the expression, but if the disproportion becomes so great as to approach to deformity, beauty is gone. During the latter part of the eighteenth century, and caused by the enthusiastic study of ancient Greek art, whose specimens

were found to be masterpieces of proportion, the question arose, What is, then, properly speaking, proportion in æsthetics? All people felt that it was not something arbitrary or merely conventional; but every attempt at reducing it to definite ideas, such as fitness, symmetry, harmony, etc., failed. Some passages in Plato's *Timæus*, and the singular, half-unintelligible speculations of the Pythagoreans concerning numbers, made people believe that the ancient Greeks had been possessed of some definite rule of proportion; but Greek literature contained no demonstration of any such rule—did even not mention its existence. Also, the Gothic church buildings astonished people. With respect to their proportions they were most wonderful. They looked as if they had shot forth from the ground, free creations of Nature herself, and at the same time they seemed to rise in proportions measured out with the rod. But the writings of the architects, speaking copiously of everything else, said not one word about proportions. At last, the German philosopher A. Zeising, in his *Æsthetische Forschungen* (Frankfort, 1855), succeeded in finding out and demonstrating the fundamental rule of proportion—that rule in obedience to which nature grows and art works; and, as might have been supposed, it proved to be as simple as universal. It depends on that elementary geometrical operation which Plato calls "the golden cut," and which consists in dividing a line into two unequal parts, so that the larger part forms the mean proportion between the whole line and the minor part. When A is the line, and a and b the two unequal parts into which it is divided, the proportion $A : a :: a : b$ is the proportion of beauty; and wheresoever this proportion is carried out, one of the essential elements of beauty is present; while, on the other hand, neither nature nor art can wholly disregard it without producing deformity. Take, for instance, the human body. At the navel it is divided into two parts, of which, with males, the lower part from the navel to the sole of the foot, and with females the upper part from the navel to the crown of the head, forms the mean proportion between the whole body and the remaining part. A glance at the Apollo Belvedere and the Medicean Venus will show what the most minute measurements have confirmed. And in exactly the same manner every single part of the human body is subdivided—the face, the arm, the hand, the finger, etc. The distance from the top of the forehead to the base of the nose is the mean proportion between the whole length of the face and the distance from the base of the nose to the tip of the chin; if the proportion is reversed, the expression of the face becomes extremely mean and cynical. And again, the distance from the top of the forehead to the base of the nose must be divided in the same proportion. If the nose and the forehead are equally long, the expression of the face is dead, petrified, or satanic; if the inequality is too great, the expression becomes idiotic. When once the eye becomes wholly familiar with this proportion, it seeks and finds it everywhere—in nature, in crystals, plants, etc.; and in art in statues, Greek temples, Gothic cathedrals, etc.; and it soon learns to distinguish between the slight deviations which are the cause of individual characterizations of the form and the real infringements whose effect is ugliness. CLEMENS PETERSEN.

Proportion, an equality of ratios. Four quantities are said to be in proportion when the ratio of the first to the second is equal to the ratio of the third to the fourth. A proportion may be written in either of two ways; thus, if the ratio of a to b is equal to the ratio of c to d, the equality may be indicated by either of the following expressions:

$$\frac{b}{a} = \frac{d}{c}, \text{ or } a : b :: c : d.$$

Either of them may be read *a is to b* as *c is to d*. The first and third terms are *antecedents;* the second and fourth terms are *consequents;* the first and fourth are *extremes;* the second and third are *means*. The first ratio is called the *first couplet*, and the second ratio is called the *second couplet*. Two varying quantities are said to be reciprocally proportional when their product is constant; thus, x and y are reciprocally proportional when $xy = m$, m being any constant quantity. A continued proportion is an expression of continued equality between three or more ratios; thus,

$$\frac{b}{a} = \frac{d}{c} = \frac{f}{e}, \text{ etc, or } a : b :: c : d :: e : f \ldots, \text{ etc.},$$

is a continued proportion. The terms of a geometrical progression form a continued proportion.

The principles of proportion are employed in comparing quantities either in algebra or in geometry. The primitive comparison lies between two quantities of the same kind, and the result of this comparison is a *numerical* ratio; if the quantities compared are commensurable, their ratio is *exact;* if they are incommensurable, their ratio is *approximate;* and in all cases of this kind the degree of approximation may be made as close as desirable. Taking this view, the operations for transforming proportions become purely numerical.

The following are some of the ways in which proportions may be transformed: (1) The antecedents may be made consequents, and the consequents antecedents; the proportion is then said to be transformed *by inversion*. (2) Antecedent may be compared with antecedent, and consequent with consequent; the proportion is then said to be transformed *by alternation*. (3) The sum of the antecedent and consequent of each couplet may be compared with either the antecedent or consequent of the corresponding couplet; the proportion is then said to be transformed *by composition*. (4) The difference of the antecedent and consequent of each couplet may be compared with either the antecedent or consequent of the corresponding couplet; the proportion is then said to be transformed *by division*.

The most important principles of proportions are the following: (1) If four quantities are in proportion, the product of the means is equal to the product of the extremes; *conversely*, if the product of two quantities is equal to the product of two other quantities, the first two may be made the means and the other two the extremes of a proportion. (2) If a couplet in each of two proportions is the same, the remaining couplets will form a proportion. (3) If four quantities are in proportion, they will also be in proportion by inversion, by alternation, by composition, or by division. (4) Equimultiples of two quantities are proportional to the quantities themselves. (5) In a continued proportion the sum of all the antecedents is to the sum of all the consequents as any antecedent is to the corresponding consequent. (6) If the corresponding terms of two or more proportions are multiplied together, the products will be in proportion; consequently, like powers or like roots of all the terms of a proportion are in proportion.

Harmonical Proportion.—Four quantities are in harmonical proportion when the first is to the fourth as the difference between the first and second is to the difference betweeen the third and fourth; thus, 24, 16, 12, and 9 are in harmonical proportion. Three quantities are in harmonical proportion when the first is to the third as the difference between the first and second is to the difference between the second and third; thus, 6, 4, and 3 are in harmonical proportion. W. G. PECK.

Propor'tional Representa'tion. The general term "minority representation" has been very commonly used in political debate in recent years as properly covering various plans proposed for the more full and complete representation in government of popular constituencies and electoral bodies. But it is inaccurate and misleading, because it fixes attention upon one feature only of the plans in question, and to the ignorant and unreflecting appears to antagonize those plans to the principle—accepted by all persons devoted to free, popular government—that the majority shall rule. Hence the word "proportional" or "proportionate," and other words indicating completeness or totality, have been preferred by many writers to the word "minority" as a generic designation to comprehend all of the plans proposed for representing electoral masses or bodies by *all* their principal divisions or parts. And by Mr. Hare of London and by others the term "personal representation" has been used as fitly characterizing a plan, or the results of a plan, intended apparently to emancipate voters from the despotism of political parties, and from being restricted to small district divisions in selecting candidates upon whom to bestow their votes.

Accepting the fact that political society and electoral bodies generally, in all free countries, are almost invariably divided by interest or opinion into separate or distinguishable parts, it seems to be the dictate alike of good sense and of justice that when any such society or body is to be represented in government, provision should be made for representing its parts or divisions, inasmuch as this is absolutely necessary to the representation of the whole. A representative house, convention, or board in theory, and properly, stands in the place of its constituency, and should embody in its composition all the essential elements of the constituent mass. But this result is not accomplished, and cannot be accomplished, upon the ancient plan of taking the sense of the electors at elections. By that, substantially, the largest division of the electors—whether a majority or a plurality—is alone regarded, and representation is assigned to it, not in proportion to its magnitude as a part of the constituency, *but as if it were the whole constituency*. It gets its own share of representative power, and in addition an unjust share or shares of power that

ought to belong to other electors. Need we feel surprised when we learn that elections based upon this plan become costly and corrupt? that the strong motive to grasp at unjust power which the plan creates operates to debauch electors and degrade elections?

Of the several plans of proportional representation by which amendment of electoral systems is sought to be effected, two only will be considered in this article, and they are selected simply because, beyond others, they have been subjected to trial in England and the U. S. What is said upon them will be mostly explanatory, and not argumentative. For the general reasoning in their support, and for answers to possible objections against them, the careful student is referred to the authorities cited at the end.

The Limited Vote.—The limited vote obtains where the voter is forbidden to vote for the whole number of persons to be chosen, but is authorized to give votes singly to each of a less number or a single vote to one. The most conspicuous instance of its application to popular elections is furnished by the English Reform bill of 1867, relating to the election of members of Parliament. The ninth clause of that bill, adopted after full debate in each house, is as follows: "At a contested election for a county or borough represented by three members no person shall vote for more than two candidates." The next following clause of the bill further provides that "at a contested election for the city of London" (which is entitled to four members) "no person shall vote for more than three candidates." In the U. S. the limited vote has been often resorted to in recent years, as affording the means of facilitating or securing constitutional or legal reforms. In the election of members of the New York constitutional convention of 1867, 32 members at large were by means of it divided equally between the two political parties of the State, a regulation in the convention act being that no voter should vote for more than 16 candidates, and that the 32 highest in vote should be chosen. This plan of electing was still more thoroughly applied in the Pennsylvania constitutional convention act of 1872. By that statute (*Laws*, 1872, p. 53) it was provided that 28 members of the convention should be elected by the voters of the State at large, and that in their election no voter should vote for more than 14: that 6 members should be chosen from the city of Philadelphia, in the choosing of whom no voter should vote for more than 3; and that 99 additional members should be chosen from the senatorial districts of the State (being three times the number of senators in the legislature) in manner following: In single senatorial districts each voter to vote for no more than 2 of the 3 persons to be chosen; in the Allegheny district (including Pittsburg) each voter to vote for no more than 6 of the 9 persons to be chosen; and in the Luzerne, Pike, and Monroe district, entitled to 6 members, no voter to vote for more than 4 persons. Thus, all the members of the convention, whether from the State at large, from Philadelphia, or from senatorial districts, were chosen upon the plan of the limited vote. The result was satisfactory. More complete representation of the people than would have been possible under the old plan of voting was secured, intelligent, independent men were mostly chosen for members, and party feeling and party debates were excluded from the proceedings of the convention. The constitution framed by the body thus constituted contained numerous new and important provisions, and upon being submitted to a popular vote was adopted by a majority of 145,000 on Dec. 16, 1873. The same convention act contained in its eighth section a novel but convenient provision for the filling of vacant seats in the convention caused by death, resignation, or otherwise, which was strictly conformed to the principle of proportional representation, and furnishes an example for imitation in future cases of like character. It was, that those members chosen from the State at large "who shall have been voted for by the same voters, or by a majority of the same voters, who shall have voted for and elected the member whose place is to be filled, shall fill such vacancy," and "the appointment to fill a vacancy shall be made by the members at large aforesaid, or by a majority of them, in writing; and all such written appointments shall be filed among the convention records." Under this provision seven or eight vacancies of membership in the convention were promptly and fitly filled without the inconvenience and expense of fresh elections, and with complete preservation of party representation in the convention as fixed by the people. The Pennsylvania constitution of 1873 applied the limited vote to the election of judges of the supreme court whenever two or three judges are to be chosen together for the same term of service (art. v. § 16); to the election of county commissioners and county auditors, three of each to be chosen every third year (art. xiv. § 7); and to inspectors of elections (art. viii. § 14), two of whom are chosen annually in each election district to constitute, with a judge, the election board of the district. This last-mentioned provision gave a constitutional sanction to a plan of choosing inspectors which had obtained in that State, under statute law, from the year 1839. The same constitution applied the limited vote to the choice of magistrates in Philadelphia; they are to be chosen for five-year terms, and in their election no voter is to vote for more than two-thirds the whole number (art. v. § 12).

By an amendment to the constitution of New York (art. vi. § 2), proposed by the convention of 1867, the court of appeals of the State was to consist of a chief judge and six associate judges, to be chosen by the voters of the State at large, and at the first election of judges each voter might vote for the chief and for four only of the associate judges. By means of that arrangement the political minority of the State, at the first election under the amendment, secured two of the six associate judges of the court. A similar provision was made by the Illinois constitution of 1870 (Schedule, § 7) for an election of judges for Cook county (including the city of Chicago), and another similar one by the Pennsylvania constitution of 1873 (Schedule, § 18) for the election of two common pleas judges in the city of Philadelphia.

The Free Vote.—This has been described as obtaining at plural elections, when the voter has assigned to him a number of votes equal to the number of persons to be chosen, and is permitted to distribute them among, or to concentrate them upon, one or more candidates, as he shall think fit. Mr. Lowe's amendment, proposed in the House of Commons to the Reform bill of 1867, and applicable to any county or borough whenever two or more seats of members of Parliament therefrom should be vacant, was in the following words: "Every voter shall be entitled to a number of votes equal to the number of vacant seats, and may give all such votes to one candidate, or may distribute them among the candidates, as he thinks fit." And in the bill reported by a select committee to the U. S. Senate Mar. 2, 1869, embodying a proposed plan for electing members of Congress, we have the free vote expressed as follows: "In elections for the choice of Representatives to the Congress of the U. S., whenever more than one Representative is to be chosen from a State, each elector of such State, duly qualified, shall be entitled to a number of votes equal to the number of Representatives to be chosen from the State, and may give all such votes to one candidate, or may distribute them, equally or unequally, among a greater number of candidates, and the candidates highest in vote upon the return shall be declared elected." But Mr. Droop of London has shown that it is by no means necessary to the plan that the voter shall be allowed a number of votes precisely equal to the number of persons to be chosen, and that it may sometimes be advantageous to allow a different number. For instance, when five persons are to be elected, it would be convenient to allow each voter to cast six votes instead of five, in order to avoid an awkward fraction in voting an equal support to three candidates. For, as will presently appear, the casting of fractional votes to a certain defined extent ought to be permitted in order to the complete operation of the free vote, though they are not indispensable to its use, and do not seem to have been contemplated in the earlier discussions of the subject either in this country or abroad.

The free vote is often spoken of as the "cumulative" vote, but the latter term is inaccurate, because the plan involves or permits the distribution as well as concentration of votes, and that, too, even *singly* among candidates. In the Illinois constitution of 1870 (art. iv. § 7), we have it, in an important application, exhibiting all its characteristic features. The section referred to is as follows: "The house of representatives shall consist of three times the number of the members of the senate, and the term of office shall be two years. Three representatives shall be elected in each senatorial district at the general election in the year 1872, and every two years thereafter. In all elections of representatives aforesaid each qualified voter may cast as many votes for one candidate as there are representatives to be elected, or may distribute the same, or equal parts thereof, among the candidates, as he shall see fit, and the candidates highest in vote shall be declared elected." This section, as rightly construed and applied by statute, permits the giving of one vote to each of three candidates, or of two votes to one candidate and one to another, or one vote and a half to each of two candidates, or three votes to one.

In the Bloomsburg act of Mar. 4, 1870 (*Pennsylvania Laws*, 1870, p. 343), which is believed to have been the first act ever passed applying the free vote to popular elections, we find more elaborate provisions. They are

contained in the 4th and 5th sections of the act, and are as follows: "*Section* 4. To the end that the electors of Bloomsburg may exercise their right of suffrage freely and without undue constraint, and may obtain for themselves complete representation in their local government, the plan of the free vote shall be lawful, and is hereby authorized, in the elections for officers of said town, and for all officers to be chosen by them exclusively. In any case when more persons than one are to be chosen in said town to the same office, for the same time or term of service, each voter duly qualified shall be entitled to as many votes as the number of persons to be so chosen, and may poll his votes as follows, to wit: *First*, when two persons are to be chosen, he may give one vote to each of two candidates or two votes to one; *second*, when three persons are to be chosen he may give one vote to each of three candidates, two votes to one candidate, and one to another, one vote and a half to each of two candidates, or three votes to one; *third*, when four persons are to be chosen, he may give one vote to each of four candidates, one vote and one-third to each of three, two votes to each of two, or four votes to one; *fourth*, when six persons are to be chosen, he may give one vote to each of six candidates, one vote and a half to each of four, two votes to each of three, three votes to each of two, or six votes to one. In every case the candidates highest in vote shall be declared elected. Whenever a voter shall intend to give more votes than one, or to give a fraction of a vote, to any candidate, he shall express his intention distinctly and clearly upon the face of his ballot; otherwise, but one vote shall be counted and allowed to such candidate. *Section* 5. Vacancies in any of the offices of said town may be filled by appointments to be made by the court of quarter sessions of the peace of Columbia county, except as herein otherwise provided; but any appointment so made shall be of an elector of the said town who shall have voted for the officer or person whose place is to be filled." These provisions of the Bloomsburg act have been, by subsequent statutes of Pennsylvania, applied to many other towns and boroughs in that State. They seem, however, to fall short of the principle of the free vote in not allowing the voter, in most cases, to give an *unequal* support to the candidates he votes for when he supports more than one. But upon the first trials of the new plan it was perhaps prudent to define specifically the manner in which votes might be cast, and not to extend the specifications too far.

In England the free vote has had an extensive trial in recent years under the act of Parliament which applied it to the election of school boards throughout the country; and we believe it has been used in this country in some cases in the choice of delegates to nominating bodies. A more conspicuous application of it has been to stockholder elections for choosing certain officers of incorporated companies. Several State constitutions of recent adoption have made provision for such application of it, beginning with that of Illinois of 1870. We quote from that constitution (art. xi. § 3): "The general assembly shall provide by law that in all elections for directors or managers of incorporated companies every stockholder shall have the right to vote, in person or by proxy, for the number of shares of stock owned by him, for as many persons as there are directors or managers to be elected, or to cumulate said shares and give one candidate as many votes as the number of directors multiplied by his number of shares shall equal, or to distribute them on the same principle among as many candidates as he shall think fit; and such directors or managers shall not be elected in any other manner." The same provision is to be found in the constitution of West Virginia (1872, art. xi. § 4); in that of Nebraska (1875, art. xi. Mis. Cor., § 5); in that of Missouri (1875, art. xii. § 6); and in condensed form in that of Pennsylvania (1873, art. xvi. § 4).

References.—Mill on *Representative Government*, ch. vii.; *Thoughts on Parliamentary Reform*, by same (2d ed.); Earl Grey on *Parliamentary Government* (ed. of 1864, p. 203); Buckalew on *Proportional Representation* (Phila., 1872); *Minority or Proportional Representation*, by Dutcher (New York, 1872); *Parliamentary Debates on Reform Bill of 1867*, under date of July 4 and Aug. 8 in the House of Commons, and July 30 in the House of Lords (Hansard, 3d series, vols. clxxxviii. and clxxxix.); *Cong. Globe* (1st Sess. 40th Cong., 575); *Report of Select Committee to U. S. Senate*, 1869 (*Cong. Globe*, 3d Sess. 40th Cong., Appendix, 268). These references are given upon the two plans of proportional representation presented above, rather than as references upon the general subject of representative reform, or as covering the whole field of inquiry and debate properly open under the heading of the present article. CHARLES R. BUCKALEW.

Proposition. See LOGIC, by PROF. W. D. WILSON, LL.D., L. H. D.

Prosecution. See PROSECUTOR.

Pros'ecutor [Lat.], in law, one who institutes and prosecutes a criminal proceeding against another in the name of the government. In England the enforcement of the criminal law, so far as it involves the trial and conviction of offenders, has been left, under all ordinary circumstances, to private prosecutors, there being no public officials specially charged with that duty. The injured party has generally been suffered, and indeed required, to make the complaint, procure the indictment, employ counsel to conduct the trial, and in fact to bear all the burden of vindicating the law against its violators. It is true that in the case of political offences, such as treason, sedition, and public libels, the government takes the initiative and maintains the prosecution, and that when the crimes are of peculiar magnitude and importance it will also sometimes defray the expenses; but these are exceptional instances. In the U. S. a very different and much wiser policy has been pursued. Under the national administration an official is appointed by the President for each judicial district, called the U. S. district attorney; and in the several States a similar officer is elected or appointed for each county, termed the district or prosecuting attorney; they have exclusive charge of prosecutions, and their special duties consist in overseeing the finding of indictments and the trying thereof when found within the limits of their local districts. Private prosecutions, except for petty offences and in the lowest courts, are almost unknown in this country. The injured person may lodge a complaint before the committing magistrate or the grand jury, and thus procure the suspected party to be arrested, examined, held to answer, or indicted, but there his functions end. The public officer alone can act with the grand jury in framing the indictment, and has entire control of all further steps in the prosecution. In particular instances he may admit the aid of private counsel employed by the injured person, and he may even surrender the actual control of the case into their hands, but they would still act as his delegates by virtue of an authority conferred by him, and not under an independent claim of right. Partial exceptions to these methods may exist in some of the States, but the course of proceeding thus described generally prevails throughout all the commonwealths. JOHN NORTON POMEROY.

Pros'elytes [Gr. προσήλυτος, a "new-comer"], among the post-exilic Jews, were Gentiles who conformed to Judaism. The rabbins speak of "Proselytes of the Gate," who simply observed the seven precepts of Noah; and "Proselytes of the Covenant" or of "Righteousness," who were circumcised, baptized, and allowed all the privileges of the Jews; but Lardner recognized only the latter.

Pros'erpine [Gr. *Persephone*], in classic mythology, a daughter of Zeus (Jupiter) and Demeter (Ceres); was carried off by Pluto to Hades, but afterward permitted by him to spend half of the year in the upper world. She was worshipped in all Greek towns, generally in connection with her mother, as the goddess of vegetation, and the myths relating to her seem to have formed the foundation of the Eleusinian mysteries. By classic art she is generally represented either as the wife of Pluto, the queen of Hades, sitting on a throne, severe and cold, or as the young daughter of Demeter.

Prosim'iæ [from *Prosimia*, a proper name], a sub-order of the order Primates according to most, but according to others an order of the class of mammals, containing the lemur, tarsius, and the aye-aye. These agree with the monkeys and lemurs in the development of a calcarine sulcus on the inner wall of the cerebrum, which gives rise to the hippocampus minor within the posterior corner of the ventricle; in the exsertion of the proximal joints outside of the common abdominal integument: the enlarged great toe of the foot; the scrotal testes; and pendulous penis: they differ, however, in that the cerebrum does not extend so far backward over the cerebellum, a considerable portion of the latter being uncovered, and the posterior corner of the lateral ventricles being very small; the skull is also quite different; the lachrymal foramen is situated in the cheek outside of the orbit; the orbits are open behind; the ears are more or less produced outward, pointed, angulated at their extremities, and without distinct lobules. The female has a two-horned uterus and the clitoris perforated by the urethra; the placenta is bell-shaped and the allantois very large. The group includes three well-marked families — Lemuridæ, Tarsiidæ, and Daubentoniidæ or Cheiromyidæ—which are represented by existing species. Pachylemuridæ, Limnotheriidæ, and Lemuraridæ are families based upon extinct forms that have also been referred to this group. The living forms are peculiar to Africa and Asia, and especially developed in the island of Madagascar. The Pachylemuridæ lived in the Tertiary epoch

in Europe, and the Limnotheriidæ and Lemuraridæ in the early Tertiary of North America. THEODORE GILL.

Pros′ody [Gr. προσῳδία] treats of the structure and laws of verse, which is to be studied like other physical phenomena within reach, and it is not to be adapted to ancient systems, the details of which are of difficult application. The prosody of Greek and Latin depends primarily upon the distribution of long and short syllables—that of English upon strong and weak effects, due chiefly to the presence or absence of accent; and in both systems the metric foot is composed of two or of three syllables. Emphasis upon monosyllables has the same rhythmic effect as the accent stress, and in a line of monosyllables the alternation of strong and weak effects becomes obvious to the listener if the longer or the more important words occupy the accentual points, as in—

"And smooth′ or rough′, with them′, is right′ or wrong′."—*Pope.*

In comparison with this the line of Keats—

"Where had he been, from whose warm head out flew"

has unaccented places occupied by the strong syllables *where* and *warm*, to the injury of the rhythm.

According to the classic system, "hăr′mŏnӯ" and "păr mŏn′ĕy" are dactyls, having one long syllable followed by two short ones, and they could replace each other without spoiling the rhythm, which, however, would be injured by replacing either with the three short syllables of "pĭt′ĭfŭl." In Greek prosody, besides being a dactyl, "par mon′ey" is also a paroxytone, in having the accent next the end syllable, while "har′mony" is a proparoxytone, a word like "dĕcāy′" or "rēfĭt′," with a final accent, being an oxytone; and these are the proper terms for the feet in English versification. But as oxytone and paroxytone are equally applicable to dissyllabic and trisyllabic feet, we should be able to distinguish them; and for this purpose we may prefix *di-* to the former and *tri-* to the latter. As two accents cannot occur together without destroying the rhythm or altering the metre, the feet here given as containing them are but hypothetic. The weak or unaccented place is indicated by a small circle:

°′ DI*oxytone.*—I thought′ | I heard′ | some min′ | utes past′. |
′° DI*paroxytone.*—Sounds′ as | of′ a | cas′tle | bell′.—*Coleridge.*
°°′ TRI*oxytone.*—I have found′ | out a gift′ | for my fair′. |
°′° TRI*paroxytone.*—I | have found′ where | the wood′-pi | geons breed′.
′°° *Proparoxytone.*—But | let′ me that | plun′der for | bear′.—*Shenstone.*
′°′ *Amphitone.*—Where′ through groves′ | deep′ and high′. | —*Scott.*

In the longer names, *tone* may be omitted. The following theoretic forms are added to complete the scheme of possible accentual feet. In their length some of these names recall the Greek names "proceleusmaticus" and "hegemoscolios:"

°′′ *Trioxyparoxy.*— | the broad′ wheels′ | . . .
′′° *Paraproparoxy.*—Like′ death′ at | tends thee on this fatal plain.—*Dryden.*

The foregoing lines from Shenstone are really alike; and, judged by the poem in which it occurs, Scott's line was intended to be:

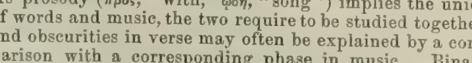
Where′ through groves | deep′ and high; | —

but in this case strong words in weak places obscure the rhythm.

When the syllables seem to exceed three in a foot they may be disposed into shorter feet, or massed as bits of prose or as recitative groups, of which examples occur in songs, such as—

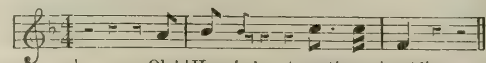
"I lov′d′ her, and′ she might′ have been′
The happ′iest in′ the land′,
But she fan′cied a for′eigner who play′d′ the flageolet′
In the mid′dle of a Ger′man band′."

As prosody (πρός, "with," ᾠδή, "song") implies the union of words and music, the two require to be studied together, and obscurities in verse may often be explained by a comparison with a corresponding phase in music. Binary music is often adapted to triple verse, and triple music to binary verse, but in all adaptations the foot and measure must commence with an accented syllable, so that in oxytonic lyrics the first unaccented syllable is cut off as an anacrusis. (See METRE.) In rare cases the latter part of a measure is emphasized in our music, as in the first measure or foot of Moore's—



but this final accent does not make it what is falsely called iambic (˘ ¯), because the syllables have the same length, and would be (¯ ¯) spondaic.

Thomas H. Bayly's ambiguous "I'd be a butterfly" admits of a binary or a triple division, but the words are $\frac{6}{8}$ adapted to $\frac{3}{4}$ music, and agree note for note, but neither in accent nor rhythm, with "Oh! Heaven! tempt me not," in the opera of *La Sonnambula*—



This song of Bayly's is defective in wanting uniformity between corresponding lines of the stanzas, for, according to the *Leys d'Amors*, "it is a fault to commence with a rhythm, and not continue it." In the first stanza the final foot of the first line is completed in the second line, making these two lines *dependent:*

I'd′ be a | butterfly | born in a | *bower-*
Where | ro′ses, and | lilies, and | violets | meet, ⌝‖
Roving for | ever from | flower to | *flower,-*
And | kissing all | buds that are | pretty and | sweet; ⌝‖

while the corresponding first and second lines of the second stanza are *independent:*

Oh′ could I | pilfer the | wand of a | fairy, ⌝‖
I'd′ have a | pair of those | beautiful | *wings:-*
Their | summer day's | ramble is | sportive and | *airy,-*
They | sleep in a | rose when the | nightingale | sings. ⌝‖

The amount of poetic license in prosody should be little, and it is not to be judged from writers whose sense of rhythm is deficient. In the Greek theatre, although the general audience were ignorant of the rules of versification, if a line was offered to their ear with a single syllable too much or too little it was received with disapprobation from all parts of the house; and the very close correspondence of the Greek strophe and antistrophe demonstrates a high degree of rhythmic cultivation. Great excellence was attained by the Troubadours, as shown in the Provençal work on versification, *Las Leys d'Amors*, completed in 1356; and the Minnesingers of Swabia had a wonderful development of the rhythmic sense. (See *The Minnesinger of Germany*, by A. E. Kroeger, New York, 1873.) One of these, Ulrich von Lichtenstein, was a knight of great prowess, born about 1200–05, and being ignorant of the arts of reading and writing, after composing the words and music of his artistic productions he called upon his secretary to record them. According to Kroeger (p. 180), "Poetical composition was at that time held as a true art, requiring hard study and great experience—such a study of rhythm, language, and music as even the most thorough poets of modern times do not undertake. And Ulrich's songs are particularly distinguished by almost perfect purity of rhyme and great elegance of rhythmical construction."

Prosodic license is legitimate when used for an obvious purpose. In Dryden's *Virgil* (bk. 5, l. 359) a wounded snake is described in a narrative which glides into long quantities in the fourth line, then hurries through two lines with short neutral (unaccented) feet, to avoid the measured march of accent, and closes with a stately Alexandrine adapted to the change of subject:

"As when a snake, surpris'd upon the road,
Is crush'd athwart her body by the load
Of heavy wheels; . . .
In vāin, with lōosen'd cūrls, she crāwls alōng;
Yet, fiĕrce abŏve, she brăndishes her tŏngue,
Glares′ with her eyes′, and bris′tles with her scales′;
But, grov'ling in the dust, her parts unsound she trails."

Here the license extends to the use of an alliteration (*along, tongue*) instead of a rhyme, because the one line is better with a long vowel and the other with a short one. (For the principal subdivisions of prosody see HEXAMETER, METRE, QUANTITY, RHYME, RHYTHM, and SONNET, by the author of the present article.) S. S. HALDEMAN.

Pros′pect, p.-v. and tp., New Haven co., Conn. P. 551.

Prospect, p.-v. and tp., Waldo co., Me., on Penobscot River, opposite Bucksport. P. 886.

Prospect, p.-v., Trenton tp., Oneida co., N. Y., on W. Canada Creek, above Trenton Falls, and near Utica and Black River R. R. P. 312.

Prospect, p.-v. and tp., Marion co., O., on Scioto River. P. 1280.

Prospect, p.-v., Franklin tp., Butler co., Pa. P. 271.

Prospect, b., Taylor tp., Cambria co., Pa. P. 576.

Prospect Ferry, p.-v., Prospect tp., Waldo co., Me.

Pros′tate Gland [Gr. προστῆναι, to "stand before;" it stands before the bladder in man], a glandular mass

which surrounds the neck of the bladder and urethra in the male. It is about the size and shape of a horse-chestnut, and secretes a milky fluid. In old age it is liable to obstructive enlargement, which is often a cause of much distress.

Pross'nitz, town of Austria, in Moravia, on the Rumsa, manufactures brandy, rosoglio, linen and woollen fabrics, and has a large trade in grain, flax, cattle, and geese. P. 12,542.

Pro'tagon [Gr. πρῶτος, "first," and γονή, "procreation"], a phosphurreted fatty compound which, according to Liebreich, its discoverer, forms the chief constituent of nervous tissue. It is prepared from brain-substance, first washed with water and ether, by the action of warm alcohol, in which it is soluble. At melting ice the protagon precipitates from the alcoholic solution, and may be obtained crystallized by further purification and resolution. The composition assigned is $C_{116}H_{291}N_4PO_{22}$. *Neurine* is a derivative from it. H. WURTZ.

Protag'oras, b. about 480 B. C. at Abdera; was instructed by Democritus; lived afterward at Athens, where he was the first who taught philosophy and rhetoric for money, and assumed the title of *sophist*, "teacher of wisdom," but was banished on account of his frivolous statements concerning the existence of the gods, and d. in exile 411 B. C. None of his works are extant.

Protea'ceæ [named from the genus *Protea*], a natural order of exogenous trees and shrubs found chiefly in the dry and hot regions of Australia, Africa, and Chili. Not one is North American. They are mostly very handsome evergreens, and are allied to the laurels. For greenhouse shrubbery no plants are finer. Some are useful timber trees, and a few bear edible nuts.

Protec'tion, as a term in political economy, means the promotion of home industry by imposing duties on the importation of the products of foreign industry. It differs in *method* from the system of bounties, premiums, and subsidies on the one hand, and from the system of prohibition on the other. It differs in *principle* from free trade, which rejects all but the most general and indirect forms of governmental influence upon industry. The practice of protection is much older than the science of political economy, which took its place among the political sciences about a century ago. Nearly all the English economists, and many in America and on the continent of Europe, regard the science as having proved that protection is an unscientific and short-sighted policy. (See FREE TRADE.) But no nation, except England, has ever heartily assented to this view and accommodated its practice to it, while a minority among the English and a majority of the civilized and enlightened nations have always maintained the opposite view. This article is meant to be a summary of the reasoning by which the protectionists have defended their position.

(1) The industrial state consists of three classes—the agricultural, the manufacturing, and the commercial. When these are in a right or normal condition they are in a sort of equilibrium or balance of production and consumption. The first, which is also the fundamental class, provides for the most urgent physical needs. But all agriculture, except the very rudest, produces a surplus of food beyond what the farmer's household requires, and thus a part of the population is set free to produce by manufacture other necessities, comforts, and luxuries. With every improvement in agricultural methods the number needed to produce food for all is diminished; with every advance in manufactures there in an improvement in the quality and quantity of the commodities which the farmer gets in exchange for food. Between these two classes, and between the several sub-classes of each, stands the commercial class as exchangers of their products, and therefore as saving time and trouble to the producing classes. When the manufacturers and traders are numerous enough to consume the farmer's ordinary production of food, and the farmers are numerous enough to supply food for all, then there is a balance of the industries. By the operation of the laws of demand and supply these classes continually approximate toward this equilibrium. A bad education or a wrong state of public opinion may offer hinderances by drawing an undue proportion of young men to commerce or to other unproductive employments. But ordinarily the tendency, when undisturbed by foreign interference, is toward the right relation; and upon this fact Adam Smith based his argument that the sole duty of government toward industry is to "let it alone." For where this balance exists the prosperity of a people and their advance in all forms of industrial development are secured. The division of industry is promoted; its methods are perfected; the various forms of production fertilize one another; the individual members of the productive state enter into closer interdependence, and attain that mutual helpfulness which distinguishes civilization from the isolation of barbarism. As M. Chevalier says, "Combination of varied effort is the one and only condition of national progress."

(2) Were the world in an ideal state of harmony and equality, and were all its peoples equally strong in accumulation of industrial capacity and of capital, in intelligence, and in freedom from burdensome taxation, then the "let-alone" policy would be the right one. But the actual world is full of inequalities and disadvantages; and experience shows that unrestricted trade between its stronger and richer and its weaker and poorer countries puts very great hinderances in the way of the latter. For the former, by an undue concentration of their attention and resources upon manufacturing, can produce a surplus of articles which are easy of transportation, and can be sold in those other countries cheaper than if made there. The individual buyer goes to the cheapest seller; the interest present to his mind is that of spending to the best advantage the money he has in hand. And thus the foreign competition crushes out the home production of all but the rudest and coarsest articles of manufacture, and prevents the establishment of a varied industry, unless the government interfere, as the personification of the nation and its co-ordinating power, to restore the equilibrium by discouraging these imports. Especially is this difficulty experienced in new countries, whose settlers bring with them the Old World's appreciation of modern appliances, comforts, and luxuries, while the home industries needed to supply these wants are still undeveloped. Until such a country has attained a diversified industry, advanced at nearly all points to a full equality with that of the most advanced nations, its manufacturing class are, in the absence of protection, at the mercy of their foreign competitors. If we could consider the citizens of such a country merely as purchasers and consumers of such commodities, then it might seem that they simply gained by free access to the foreign producer. But they have also to produce something to be given in exchange, and find a market for that. "To buy in the cheapest and sell in the dearest market" accessible is the unreflecting instinct of everybody; but when the former is furnished by the foreigner, it is generally found that the home producer has no "dearest market" to sell in, but only a "cheapest" market for that purpose also. And when he reckons up his purchases and sales, or considers his transactions as an exchange of commodities, he will find that he has lost far more than he has gained, for "far fetched is dear bought" the world over. His country may be getting its commodities for the time at cheap rates, but it is bartering for them the very power to produce such commodities—the power to create on its own soil the home-markets whose relative cheapness or dearness will be in favor of all classes.

(3) Commerce between the richer and the poorer nations is little more than the exchange of raw materials and the precious metals for manufactured goods more or less elaborate. That the two former always go together, that the balance of trade is steadily in favor of the manufacturing countries, and that the gold and silver of the civilized world move on the same lines and in the same direction as the exports of wheat, wool, cotton, and the like, shows how unequal these exchanges are. There was an old saying that the English in trading with the Dutch "sold the hide for sixpence, and bought back the tail for a shilling;" and it has not yet lost all significance. The producers of raw materials send to the great centres of wealth, population, and industry the cotton to be spun and woven into cloth, and the food to feed the spinners and weavers, and they receive in return so small a proportion of the product that they must spend what money they have in purchasing more to supply their necessities. They had better have the work done at home, even though they had to send every web to Manchester before using it. For then they would save the heavy tax of transportation on bulky articles, and the profits of the long line of traders through whose hands these pass. The cost per yard would be greater, especially until the habits of manufacture are formed, but the exchange of raw cotton and wheat for chintzes and drillings would be on terms far more favorable to the producers of the former. For the prices of raw materials and of manufactured goods approach each other most nearly in the neighborhood where the one is converted into the other. At the paper-factory's door, for instance, a pound of rags is worth nearly a pound of paper; with every mile's distance their prices diverge more widely, until in Alaska paper is dear and rags nearly worthless. Free trade would, in a greater or less number of cases, remove to the other side of the Atlantic the points where the lines of price almost converge, and bring our whole country into the area of wide divergence. Now, without united and national action there is no possibility of correcting this state of things.

"It cannot be expected that individuals should at their own risk—or, rather, to their certain loss—introduce a new manufacture and bear the burden of carrying it on until the producers have been educated up to the level of those with whom the processes have become traditional." (*John Stuart Mill.*) But through their organ, the government, the people can say to the home manufacturer, "Build your factory and put in your machinery; we will buy of you. We choose to possess a varied industry on our own soil, and to destroy the monopoly now possessed by the foreigner, that we may have the choice between two markets, the home and the foreign. Our aim is to destroy a monopoly, not to create one; for this industry shall be open to all of us—to the foreigner himself if he choose to become one of us." By this decision, and by the tariff of duties for protection which embodies it as law, the nation refuses to exist on the low level of industrial uniformity; it resists the influences which might else prevent its industries from attaining the equilibrium which is their normal condition; it refuses to keep its farms and plantations on one continent and the workshops and factories which supply them on another. It lays the foundation of industrial and financial independence, without which political independence is unreal and unsatisfactory.

(4) Protection is a boon to the agricultural class as much as to that engaged in manufacturing. It aims at bringing the artisan and the farmer into neighborhood, and thus to secure to the latter an abundant, steady, and remunerative market for his crops. The farmer whose customers are in the far distance must spend a bushel of wheat in getting three to market, and the price he gets depends upon the double contingency of the character of the foreign harvests and of his own. He is forced to exhaust the fertility of his land by growing the same staple year after year, without having any means at hand to make adequate returns to the soil. He is an "earth-butcher," continually engaged in injuring or wearing a valuable instrument whose utility is capable of indefinite increase. The farmer whose market is at hand can keep up and increase the wealth of the soil by rotation of crops, and by the large returns to the soil which are rendered possible by the neighborhood of town and factory with their demand for dairy products. He can produce those lighter and finer staples which bring large and immediate returns. He has a steady market and steady prices, and little or no cost of transportation to pay. But the Western farmers, it is said, would be supplied with foreign manufactures of certain classes one-third cheaper under free trade than they can now buy them of the home manufacturer. Suppose this statement to be correct, what are the people now employed by the home manufacturer, and fed by the farmer, to do when the latter is supplied from abroad? They will have nothing to work at but farming; they will be transferred from the wheat-consuming to the wheat-producing class; and what will become of the home-market for Western wheat? In 1871, for instance, the West shipped 163,000,000 bushels of wheat, of which only 34,000,000, or between a fourth and fifth, went out of the country, and the rest was consumed by the manufacturing population at home. Will the promised reduction in the price of dry goods and hardware compensate the West for the loss of a considerable proportion of these home customers and their conversion into rivals? Will the West gain by selling one-fourth as much grain as now, and buying at two-thirds of present prices? The foreign market for breadstuffs is not only the most uncertain of foreign markets, but so long as the American farmer depends on it, so long as our agriculture produces more than our other classes consume, the prices received for the mere fraction that is sent abroad will keep down the price of what is sold at home. What wheat brings in our corn-exchanges depends on what it brings in Mark Lane, or rather what the exporters will pay for it, who will have to sell it at Mark Lane prices after paying for transportation. The remedy for this is manifestly to be found in the extension of our manufacturing industries by persistent protection until we attain such an equilibrium of those industries as will provide a home-market for all our breadstuffs.

(5) Protection is a boon to the working-classes, who have not commodities, but labor to sell. It creates for them alternative occupations, in the absence of which—as a British economist has observed—there is rarely any competition between employers for labor. As is shown by the contrast of Walloon with Flemish Belgium, of the midland and northern with the south-western shires of England, and of the three north-eastern counties of Ireland with the rest, even agricultural labor is poorly paid wherever there is no manufacturing. Wages are nearly twice as high a few miles S. of Liège as at the same distance N. of it. Between 1770 and 1850 farm-wages doubled in Lancashire and rose one-seventh in Wiltshire. In the former, two employers are running after every workman; in the latter, two workmen are running after every job of work. In a merely agricultural country, again, there is employment only for able-bodied men in the open air. The rest of the poorer classes—the sickly, the weakly, the crippled, women, and children—must live in idleness and dependence on the earnings of the few who have work. But a varied industry employs all sorts of labor. To find work for all is the chief economic problem for any nation. "If every man, woman, and child returned as a worker in the census had full employment at full wages for forty-eight weeks out of the fifty-two, England would be a perfect paradise for working-men. We should be in the millennium." (*Dudley Baxter.*) The amount of involuntary idleness is greatest in merely agricultural countries, while every approximation to an equilibrium of the industries brings us nearer to the solution of the problem. This is the very tap-root of Ireland's poverty—"the disproportion of the opportunities of employment to population." (*Lord Dufferin.*) "From the absence of alternative employments at least half the adult population are compelled by the coercion of hunger to agree to any terms which will secure them the use of the soil." (*The Spectator.*) The State of Maine was a byword for poverty when farming and lumbering were the sole employments of her people; since she began to make use of her matchless water-power, she has had work for all her people, and has outstripped many of her sister States. Similar was the condition of the poor whites in the South, even in the mountain-districts, where the virus of slavery had not reached the minds of the people and made work disgraceful. Furthermore, by establishing varied industry free play is given to varied gifts and capacities of the working-class. The man who could have lived by farming if there were nothing else to do, may do vastly better at an employment more to his liking. For instance, the mechanical ingenuity and audacity of the American people, which have added so greatly to the working power and the wealth of the world, would have been hid under a bushel, comparatively, if we had been content to be a nation of farmers and traders. Every protected industry, beginning with cotton-culture and Whitney's gin, has served to bring these powers into exercise; and it is a Manchester loom-lord that reminds us "in nearly every branch of manufacture and machine-making the most successful and serviceable inventions have for many years been American." (*Greg.*) And a Swiss writer says, "No nation can boast of having accomplished so much toward the general progress of industry as the American."

(6) It is objected that "on this theory we should restrict domestic as well as foreign trade by tariffs. Less-developed districts of our own country, such as Alabama, should be protected against the manufacturers of New England if the latter need to be protected against their British competitors." Every true protectionist shares in Colbert's hatred of restrictions on domestic commerce. He believes that nations are not "a necessary evil" (*Cobden*), but a part of the world's providential order, and that they are industrial as well as political wholes—that their industrial power and independence are essential to their political power and independence. National boundary-lines restrict the movements of capital and the capitalist as does nothing else; while, on the other hand, a nation's wealth ordinarily tends to diffuse itself over the whole country, and to create a certain equality of industrial condition and capacity. Under protection the newer and less developed portions of our country have come forward in manufacturing far more rapidly than the others. While the national increase between 1860 and 1870 was 124 per cent., that of the seven principal Western States was over 400 per cent. The South also exceeded the national average, in spite of the losses of the war and the political and social obstructions which still retard its progress. Both the West and the South might have done still better, and possibly they would, but for the impression created in some quarters—not by the protectionists—that the tariff was a law for the benefit of the North and the East.

It is objected that "the equilibrium of its industries would make every country self-sufficient, and put an end to commerce and to the beneficial intercourse between the nations which it fosters. It would build Bishop Berkeley's 'wall of brass' around each country." Protectionists want to see a whole, sound skin on the body politic, in order that the vital circulation may go on and complete itself within the body in a healthful way. Natural commerce, the commerce which moves along the meridians and exchanges the productions of different climates, they would not restrict; they urge the removal of all duties on the importation of commodities which cannot be produced at home. Equally natural is the commerce which supplies articles of manufacture to peoples devoid of any ability or

desire to produce them, or which furnishes fine goods to those whose capacity of production is for the coarser sorts only, or the like. But the transport of bulky articles along the parallels of latitude, between countries of the same productive capacity, is, on the face of it, an absurd and unnatural business, as well as a waste of human energies in the most laborious and the least humanizing of occupations. As to international intercourse, protectionists would gladly see perpetuated every sort of intellectual intercourse, and also the interchange of those highly elaborated products which carry with them the expression of the life and thought of a people; though even here there is a danger that excessive foreign influence may thwart or retard the national growth of art and literature, as did the Gallomania a century ago in half Europe.

"But the providential plan of the world is clearly not the protectionist plan, since some countries have been made dependent upon others for such articles of prime necessity as breadstuffs." Some countries, by destroying the balance of their industries at home, by rending the yeoman class from their holdings and crowding them into the towns, have made their agriculture unequal to the task of supplying food to their enormous manufacturing population. Were, for instance, the English and Welsh land now under cultivation, to be tilled as the small farms of Flemish Belgium are, it would feed 47,000,000 people; and over two-fifths of Great Britain is not cultivated, nor even enclosed as parks and game-preserves; 7,500,000 acres S. of the Scottish border lie idle, and much of it is in the most fertile parts of the island. Very little of it is as poor as Flemish Belgium, and hardly any is as bad as the mixture of peat and gravel which composes the Kempen, and which its people are steadily turning into a garden. There is no such waste of good land, and no such disproportion of the farming to the manufacturing class, in any other part of Western Europe. In 1500 the ratio was 2 to 1; in our times it is 1 to 3. England's necessities are her own work; she is "like a vast city, to which the less-peopled parts of the civilized world are an agricultural country, which is glad to send its overplus of provisions" and of raw materials "in exchange for the luxuries and conveniences of a manufacturing region." (*Thorold Rogers.*) "England's position is not that of a great landed proprietor, with an assured revenue. . . . It is that of a great merchant, who by immense skill and capital has gained the front rank and developed an enormous commerce, but has to support an ever-increasing host of dependants. He has to encounter the risks of trade and face jealous rivals. . . . The future rise of the U. S. into a great manufacturing and naval power appears the most probable and certain cause which will place a limit to our national increased prosperity." (*Dudley Baxter.*)

It is objected that "protection favors the producer at the expense of the consumer. All legislation should be for the benefit of the consumer, since his interest is that of society at large, while the interest of the producer is a class-interest merely." Society and the classes which compose it do not differ in identity, but this argument assumes a false antithesis between them. Society is organic; its members live in mutual interdependence, and whatever helps or hurts one member is a help or a hurt to all the rest. And in the industrial state the producing classes are fundamental; on their prosperity depends the welfare of the whole body. If, then, as we have shown, neither of the two great producing classes can prosper without protection, the prosperity of the whole industrial state demands its enactment.

It is objected that "everything should stand according to the life or energy there is in it, and not according as it is or is not bolstered up by acts of Congress. Let us be rid of hothouse industries, which cannot endure the free, fresh air of competition." It was a free trader who suggested that this argument applies with great force to the costly business of raising children in America—a business which is bolstered up by marriage laws, laws against infanticide, and school laws, although grown men could be procured so much cheaper from Europe. Children grow up into men, and become able to take care of themselves; protected manufactures do the same. There is not to-day in the possession of any civilized nation a great branch of manufacture competing for the markets of the world which does not owe its very existence to protection or some equivalent form of legal fostering. England persisted in protection for five centuries, and until 1845 her statute-books were burdened with enactments which either prohibited or heavily taxed the importation of foreign manufactures, and forbade the export of machinery and the emigration of skilled artisans to other countries. She crushed the industries and burdened the commerce of her colonies; she legislated out of existence the woollen and nearly all the other industries of Ireland, and also the vast and beautiful manufactures of cotton goods in India. She ruined the industries of Portugal (1701–1839), France (1786–89), Germany (1815–20), Russia (1815–20), and Turkey (since 1812); and she is now doing the same thing in Japan. Having by "immense skill and capital gained the front rank," she would fain discredit the methods by which she reached her present position.

And be it remembered that nobody asks that protection as a system shall be permanent. Its chief purpose is to give our manufactures a chance to show "what life and energy there is in them;" for when our industrial growth shall have brought us abreast with rival nations it will no longer be needed except in rare cases, such as Belgian competition with the English iron-men in the British market. Protection with this object has the sanction of the greatest free-trade economists. Adam Smith surlily concedes that a manufacture may sometimes be naturalized more readily in this way than in any other. Of his French disciples, Say, Blanqui, Rossi, and Chevalier make the same concession more fully and heartily. The last-named says: "Every nation owes to itself to seek the establishment of diversification in the pursuits of its people, as Germany, England, and France have already done; and this is not an abuse of power on the part of the government. On the contrary, it is the accomplishment of a positive duty. . . . Governments are, in fact, the personification of nations, and it is required that they should exercise their influence in the direction indicated by the general interest." John Stuart Mill says: "The superiority of one country over another in a branch of industry often arises only from its having begun it sooner. A country which has the skill and experience to acquire may, in other respects, be better adapted to the production than those earlier in the field. . . . A protecting duty, continued for a reasonable time, will sometimes be the least inconvenient mode in which a country can tax itself for the support of such an experiment." Prof. Thorold Rogers, scolding Mr. Mill for this mischievous concession, adds that the circumstances of the U. S. and the British colonies "exactly square with the hypothesis of Mr. Mill. The countries are young and rising—industries as yet nascent are thoroughly suited to the natural capacity of the region and of the people, the latter being of the same stock with the mother-country. . . . There is no reason, apparently, except that of priority in the market, why the industry of the old country should not be transplanted to the new."

Literature of the subject: Henry C. Carey's works, especially *The Harmony of Interests* (1851), *Principles of Social Science* (3 vols., 1858), and *The Unity of Law* (1872); Hon. E. Peshine Smith's *Principles of Political Economy* (1853); Dr. Wm. Elder's *Questions of the Day;* Horace Greeley's *Essays on Political Economy;* Joseph Wharton's *International Industrial Competition* (1870) and *National Self-Protection* (1875); John L. Hayes's *Protection a Boon to Consumers* (1867), *The Protective Question Abroad* (1870), *The Solidarity of the Industries* (1870); the collected speeches of Hon. Andrew Stewart and Hon. William D. Kelley; David H. Mason's *How Western Farmers are benefited by Protection* (1875); and Prof. R. E. Thompson's *Social Science and National Economy* (1876). Of foreign writers, see F. List's *Gesämmelte Werke* (3 Bde., 1850), and his *National System of Political Economy* (English translation, with Introduction by Stephen Colwell, 1853); Dr. E. Dühring's *National- und Socialökonomie* (Berlin, 1873); Dr. F. Stöpel's *Freihandel und Schutzzoll* (Frankfort, 1876); Judge Byles's *Sophisms of Free Trade* (10th ed. 1872), and John Maclean's *Protection and Free Trade* (Montreal, 1868). (See also TARIFF.) R. E. THOMPSON.

Protec′tor, a title several times conferred by the Parliament of England upon some individual other than the legitimate sovereign, usually accompanied with extraordinary powers to meet a crisis. Among those who have borne this title were Richard, duke of Gloucester, afterward Richard III.; Edward Seymour, duke of Somerset, uncle of Edward VI.; Oliver Cromwell, and Richard Cromwell, his son.

Prote′idæ [after *Proteus*, the changeable god], a family of amphibians of the order Gradientia, represented only in certain cave-streams of Southern Europe. The form is elongated and somewhat snake-like, with no contraction till near the end of the tail; the legs are very far apart and weak; the front feet have three toes, and the hinder two each; the eyes are very small; the gills well developed externally on three stalks on each side; in the skull the pterygoids are present; the orbito-sphenoids are elongated, and do not enter into the palate; the maxillary is wanting; carpus and tarsus cartilaginous; the vertebræ are biconcave. The family is composed of eel-like salamandroids peculiar to the regions already indicated, and which, according to some authors, form but one species,

and according to others as many as seven. Fitzinger has named seven, and has based his determination on 479 specimens. According to him, specimens of the genus have been obtained from not less than thirty-one localities in Carniola and Dalmatia. No two of the species are found in the same grotto, although the same species may be found in different ones. Six of the species come from grottoes of Carniola, and one from a cave of Dalmatia. They differ chiefly externally in size; the tint of the skin, whether rosy or yellowish; the shape of the head, whether pear-shaped, triangular, or sub-globular in form; and also as to the eyes, in some these being much larger than in others, and also differently placed. Prof. Cope has also pointed out some osteological peculiarities. The species vary in size from about nine to twelve inches when full grown. They are celebrated for the large size of the blood-globules; these are elongated and oval, measuring about $\frac{1}{727}$th of an inch in their long diameter and $\frac{1}{460}$th of an inch in their short diameter. In this respect, however, they really do not differ much from the allied forms *Amphiuma* and *Siren*. THEODORE GILL.

Proteids. See ALBUMINOIDS, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D., M. N. A. S.

Pro'teine [Gr. πρωτεύειν, "to be the first"]. Mulder applied this term to a product of the metamorphosis of ALBUMINOIDS (which see) by the action of caustic potash, which he believed to constitute the basal molecule of all the proteids. Its formula, according to him, is $C_{36}H_{26}N_4O_{10}$. Although this theory has fallen, the name *proteids*, being very convenient, remains still in use. H. WURTZ.

Protel'idæ [from *Proteles*; Gr. πρό, "in front," τέλος, "extremity"], a family of mammals of the order Feræ, closely allied to the hyænas. They agree in form with the hyænas, and also in the structure of the skull and the development of the foramina at its base and about the auditory bullæ, but have very peculiar teeth; these are in number 32 (M. $\frac{1}{1}$, P. M. $\frac{3}{3}$-$\frac{4}{4}$, C. $\frac{1}{1}$, I. $\frac{3}{3}\times 2$), and are extremely small and remote from each other; no functionalized suctorial molar is developed. The family is represented by a single species, *Proteles cristatus*, the aard-wolf or gray jackal of the Cape of Good Hope colony. (See AARD-WOLF.) THEODORE GILL.

Protest'ant, a general name comprising all the various Christian denominations, in contradistinction to the Roman Catholic and Eastern churches, came into use after the second Diet of Spires, Germany, in 1529. The majority of the diet passed a resolution that all alterations in religious matters, especially in the celebration of the Lord's Supper and the mass, should cease until an œcumenical council could be convoked and decide the questions at issue. Against this resolution the elector of Saxony, the margrave of Brandenburg-Anspach, the duke of Brunswick-Lüneburg, the landgrave of Hesse, the prince of Anhalt, and fourteen free cities of the empire made a solemn "protest," hence the name. Subsequently, it was applied also to the non-German Reformers, and used collectively of all denominations which emancipated themselves from and protested against the authority of the pope.

Protestantism. See PROTESTANT.

Pro'teus [Lat.], a name applied to *Hypochthon anguinus*, a perennibranchiate batrachian of certain deep Austrian caves. It has rudimentary eyes, is a foot long, white or pinkish, and has four feeble legs. It is very active in its habits, and carefully shuns the light. It is possibly the permanent larval condition of some higher form. It has both lungs and gill-tufts. Several other species or varieties are described.—PROTEUS is also a name sometimes applied to some of the lowest of the microscopic PROTOZOA (which see).

Proteus, in classic mythology, a subject, or according to some versions a son, of Poseidon, whose flocks of seals he tended, was gifted with the power of foretelling the future, but as he disliked prophesying, he used to escape from those who succeeded in catching him when he came up from the depths of the sea to sleep among the rocks, by assuming the most horrible or disgusting shapes.

Protococcus, an ill-defined genus of unicellular algæ, under which Kützing includes a number of species placed by Rabenhorst and others in *Pleurococcus*. The species of *Protococcus* consist of collections of single cells of a spherical shape, which are detached from one another and do not adhere together in fours or in aggregated groups. There is reason to suppose that most if not all the species are nothing but states of Chlamydomonos and other related algæ, in which there is a conjugation of zoosphores. According to those who adopt Schwendener's view of the alo-fungal nature of lichens, it is the genus *Protococcus* which supplies the so-called gonidia of the lichen genera *Usnea, Cladonia, Parmelia, Leconora, Lecidea*, etc. W. G. FARLOW.

Protog'enes, b. at Caunus, Caria, in the middle of the fourth century B. C.; lived mostly at Rhodes, and was one of the most celebrated painters of his time, though he was a middle-aged man when Apelles brought him into notoriety. When Demetrius Poliorcetes besieged Rhodes he refrained from attacking one of the weakest points because here was found the masterpiece of Protogenes, *Ialysus*. This picture was still at Rhodes in the time of Cicero. When Pliny wrote it was in Rome. Another celebrated work of his was *The Satyr*.

Pro'togine [Gr. πρῶτος, "first," and γίνεσθαι, "to be born"], a kind of granite or gneiss in which the mica is wholly or largely replaced by talc. It is found in Cornwall and other parts of Europe, and affords feldspar for the porcelain-makers.

Protohippus. See HORSE, FOSSIL, by PROF. O. C. MARSH, A. M., M. N. A. S.

Protonops'idæ [from *Protonopsis*; Gr. πρότονον, "a cord," and ὄψις, "resemblance"], a family of salamandroids represented by several large species in North America and Eastern Asia. The species want an anterior axial cranial bone; teeth are developed on the anterior margin of the palatine bones; the prefrontals and pterygoids are both developed; the frontals are embraced by the prolonged parietals and prefrontals; the orbito-sphenoid is separated from the proötic by a membranous wall; the occipital condyles sessile; premaxillaries separated; the vertebræ biconcave; the carpus and tarsus cartilaginous. The family has been thus defined by Prof. Cope for the reception of the genus *Protonopsis* (=*Menopoma*) of North America, and the *Megalobatrachus* of Japan and China. The former has a gill-slit on each side of the neck, but in the latter, although nearly allied, there is none. The family embraces the largest of living salamanders, the species of *Protonopsis* (*P. Alleghanensis* and *P. fuscus*) sometimes attaining the length of about two feet, while the *Megalobatrachus maximus*, or gigantic salamander of Japan, exceeds three feet in length. The *Protonopsis Alleghanensis* is popularly known as "hellbender," and at Pittsburg as "alligator." It is destructive to the spawn of fishes. THEODORE GILL.

Pro'tophytes [*Protophyta*, the "first plants"], a name for a section of the lower grade of the cryptogamic portion of the vegetable kingdom, which includes the Algæ and Lichenes—plants of the simplest structure, and which draw their support directly from the air and water; the counterpart section being Hysterophytes, or Fungi, which live upon decomposing or lifeless or living organic matter. The term was introduced by Endlicher, but is now rarely used. A. GRAY.

Pro'toplasm [Gr. πρῶτος, "first," and πλάσμα, "form"], the fundamental living substance, the lowest form of life, is an albuminoid matter belonging to the class of protein compounds, varying considerably in its chemical composition according to circumstances, existing in forms of different degrees of density from fluid to solid, but exhibiting under the microscope in all its forms an almost perfect homogeneity, and possessing the power of spontaneous motion, of growing through the assimilation of matters from the surrounding media, and of reproducing its kind by separating into new individuals. (See HISTOLOGY, EVOLUTION, and COMPARATIVE ANATOMY; and Huxley, *Protoplasm* (1868); James Ross, *Protoplasm* (1874); John Drysdale, *Protoplasmic Theory of Life* (1875); H. C. Bastian, *Evolution and the Origin of Life* (1875). J. H. Stirling, *As regards Protoplasm* (1869), is a criticism of the theory.)

Protopterus. See FOSSIL FISHES.

Protozoa. See COMPARATIVE ANATOMY.

Protract'or [Lat. *protractum*], an instrument for laying off angles in plotting. It may be semicircular, circular, or rectangular.

Proudhon' (PIERRE JOSEPH), b. at Besançon July 15, 1809. His parents were very poor, and he had to break off his education at the college of his native city very early, and seek employment in a printing establishment in order to aid in the support of his family. The punctuality with which he discharged his duty as a workman, the energy with which he employed his spare time for his further education, and the noble independence he showed by declining in 1830 an offer of an editorship of a journal because its ideas did not coincide with his own,—every trait of his earlier life shows him to have been a man of great earnestness and integrity. In 1837 he became a partner in a printing business, and in 1838 the academy of Besançon gave him a stipend of 1500 francs yearly for three years as a reward for an essay on general grammar which he had written and added as an appendix to a new

edition of Abbé Bergier's *Eléments primitifs des Langues.* He went to Paris with his stipend, and sent in 1840 two essays to the academy of Besançon—namely, *La Célébration du Dimanche* and *Qu'est-ce que la Propriété?* In the latter he assumes that simply by being born into the world every man has a right to a share of what the world contains of necessaries, comforts, and enjoyments; and from this assumption he develops his famous definition of property: "La propriété, c'est le vol." The academy was, of course, utterly scandalized. It withdrew the stipend, and even threatened him with a prosecution, from which, however, it was restrained by M. Blanqui, who declared the essay to be perfectly innocent. From 1843 to 1847, Proudhon lived in Lyons as superintendent of some carrying business on the rivers Saone and Rhone, but his two large works from this time were published in Paris, *De la Création de l'Ordre dans l'Humanité* (1843), in which he gives a new theory of political organization; and *Système des Contradictions économiques* (1846), in which he criticises the different schools of political economists in France and England very severely. When the revolution of February burst out in Paris, he immediately repaired to that city, and (Apr. 1) began the issue of a daily paper, *Le Représentant du Peuple*, in which he set forth the most radical opinions, and which in a short time made him immensely popular. It was not his idea, as sometimes stated, to abolish capital, but to abolish interest on capital, and thereby transfer it from individuals, in whose hands it accumulates by impoverishing the mass, to the community. He was elected a deputy to the Constituent Assembly, but he soon discovered that he could do nothing there with his ideas, as nobody would hear him when he spoke, and he consequently returned to the press. He was fined for his outrageous sarcasms and personalities against his adversaries, but his readers paid the fines. His paper was suppressed for its anarchical tendencies, but he started a new one. But in Mar., 1849, he was sentenced to three years' imprisonment for illegal publications, and he fled to Geneva. Shortly after, however, he returned and delivered himself up to the police. During his imprisonment he wrote *Confessions d'un Révolutionnaire, Gratuité du Crédit*, and *La Révolution sociale démontrée par le Coup d'état*, in which latter book he showed that anarchy and Cæsarism were the two only alternatives which France had to choose between at the moment of the *coup d'état*. After his liberation he lived retired for a long time, but he had to flee once more after the publication of *De la Justice dans la Révolution et dans l'Église* (1858), for which book he was sentenced to three years' imprisonment and a fine of 4000 francs. In 1860, when Napoleon granted an amnesty for all press offences, he returned to Paris. D. at Paris Jan. 19, 1865. Proudhon was an eminently talented man, but, like many gifted men who have read much in a desultory way, but never enjoyed a systematic education, his powerful reasoning led him utterly astray, because his premises were wrong. If it were true that to be born in the world involves by itself a right to a share of the world, the conclusion that our present institution of property is only a sort of robbery would be perfectly valid. There is no break in Proudhon's reasoning. But the premise is wrong. How can natural existence give to man a right which it does not give to the tiger? Or if man shall begin society by giving to the tiger what is the tiger's due, how much will there be left to himself? Proudhon's style is striking and pithy, but never eloquent, and sometimes the singularly mechanical movement of his reasoning produces nothing but empty and almost absurd paradoxes.

CLEMENS PETERSEN.

Prout, Father. See MAHONY (FRANCIS).

Prova'na di Collegno (GIACINTO), b. at Turin in 1794; d. at Baveno in 1856. He made, as captain of artillery, the Russian campaign with Napoleon, and on the fall of the emperor he retired to Piedmont, where he devoted himself to physical and military science. Prince Carlo Alberto made him his equerry, and he endeavored to inspire the prince with those liberal ideas which were proclaimed in the movements of 1821. Being compromised in these movements, he was forced into exile, and, with other liberal Italians, fought in Portugal, Spain, and Greece. At a later period he was appointed professor of geology at Bordeaux; in 1841 established himself in Florence, where he pursued his geological researches till 1848, when he hastened to the battle-field in Lombardy. After acting some time as minister of war, he was elected senator of the Subalpine kingdom, and was one of the deputation which carried to Carlo Alberto, then in Oporto, the address of the Subalpine Parliament. In 1852 was appointed minister from Piedmont to Paris. On his return to Italy he took command of the military division of Genoa. Collegno wrote various papers on geology, which were published at Paris between 1838 and 1844. In 1847 appeared at Turin his *Elementi di Geologia pratica e teorica.*

Provençal' Language, called also **Langue d'Oc** (the "language of *oc*"), because *oc* was its word for "yes," instead of the *oui* (formerly *oïl*) of the Northern French, which was called the *Langue d'oïl.* The Provençal was the most important of the so-called Romance languages. It is still a spoken tongue. There are in France (*Gotha Almanach*, 1873) some 10,655,000 people who speak Provençal and its dialects, besides 35,000 Catalans in Rousillon and vicinity; and in Spain the languages called Catalan, Valencian, Mallorquin, and Minorquin are full of Provençal elements. It was once spoken in Northern Italy. It is a much softer and more flowing language than the true French, and abounds in Latinisms. Its extensive poetical literature is a thing of the past; at present it is chiefly a colloquial tongue. (See FRENCH LANGUAGE AND LITERATURE, and TROUVÈRES, by PROF. J. R. LOWELL, D. C. L.)

Provence', an old province of France, bounded E. by the Alps and S. by the Mediterranean, and now divided into the departments of Var, Bouches-du-Rhône, Basses-Alpes, and Vaucluse, derived its name from the Latin *Provincia*, by which the Romans pre-eminently designated it. After the fall of the Roman empire Provence came into contact with the Goths and the Arabs, and during the Middle Ages it was ruled by independent counts. In the twelfth century this land, celebrated for its delightful climate, its beautiful air, its roses, and its fruits, produced the famous Provençal songs. In 1481 it was annexed to the French crown by Louis XI.

Prov'erbs [Lat. *proverbium*], popular sayings which give a general idea in a concentrated, pithy, and striking form. It is the form which makes a saying popular and establishes it as a proverb, not the idea. The idea is in many proverbs, even the most frequently used, rather trivial, a mere truism, but when the form is captivating by its witticism or suggestive by its queerness, people take pleasure in repeating the saying, though perhaps only in a humorous or ironical way. Thus, proverbs become invaluable as materials for the study of languages, and especially for that of style. There is no better means of ascertaining the inner psychological structure of a language, the turn of its imagination, the color of its feeling, its genuine power of expression, its idiom, its style, than the study of its proverbs; and to follow a proverb in its wanderings from one language to another gives the most curious hints with respect to the individual character of these languages. Nevertheless, as the idea of a proverb generally is the result of a long and frequently repeated or otherwise striking and decisive experience, the proverb is often used by the people as a moral or prudential rule, and thus it becomes an historical document of considerable interest. The proverbs referring to the Roman Catholic clergy in the fifteenth century, to the French physicians in the sixteenth and seventeenth, to the lawyers of the German imperial chancellery in the seventeenth and eighteenth, to the English game-laws, and to the officers of the Russian or American civil service in our days, are rough but powerful historical illustrations; and the study of a good collection—for instance, of Hebrew, Latin, French, Spanish, or Danish proverbs—gives a rich insight into the respective characters of those nations. It was Erasmus who in modern times brought proverbs into fashion. His *Adagia* were published in Paris in 1500, and were soon followed by collections of national proverbs almost in every country; as, for instance, Peter Laale, *Adagia Latino-Danica* (Copenhagen, 1506); Johan Agricola, *Gemeine Sprikwoerde* (Wittemberg, 1528); Ferdinand-Nuñez de Guzman, *Refranes y Proverbios* (Salamanca, 1555); Florio, professor in the Italian language at the University of Oxford, *Giardino di Ricreatione* (1591), containing about 6000 Italian proverbs, etc. From time to time these collections were enlarged and revised, or superseded by new ones, of which there exists a great number in French, English, and German literatures, and which at different times seem to have been favorite reading with many people. The paramount importance which the idea of nationality obtains in the civilization of the nineteenth century has made the proverbs of the different nations an object of special study, and called forth collections of proverbs not only from China, Hindostan, Persia, and Arabia, but from almost every nook and corner of the world. One of the most interesting of these collections is the Finnish, *Suomen kansan sananlaskuja* (Helsingfors, 1842); and one of the most useful results of the whole movement is the dictionary of German proverbs by Wander, *Deutsche Sprichwörter Lexicon*, of which the first volume was published in 1867, containing about 45,000 German proverbs, with about 15,000 corresponding proverbs from the Bohemian, Danish, English, French, and other languages. As,

however, passionate industry and abstract enthusiasm, mixed together into a sort of collector mania, are not enough to make a good collection of proverbs, it cannot be denied that most modern collections contain a great deal of trash, and the rich materials now gathered still wait for a new Erasmus to select, arrange, and illustrate.

CLEMENS PETERSEN.

Proverbs, Book of. This title comes through the Vulgate from its Greek equivalent, Παροιμίαι, in the Septuagint. The term proverb, however, as applied to the species of divine utterance which the book contains, must be taken in its widest acceptation in order to make it embrace all the varieties of expression comprised in the collection. The original Hebrew term (*mashal*) means properly a "comparison," and in this connection has reference to the relations which the various subjects touched upon have to divine or human truths or concerns, and which are most naturally expressed by comparisons. But as every utterance of a truth involves a comparison, we find included in the book apophthegms, maxims, enigmas ("dark sayings" in the English version), and sometimes longer connected discourses of the same didactic nature.

It is said in 1 Kings v. 12 that Solomon spoke 3000 proverbs. Those of them which, uttered under the guidance of the Spirit, were of essential and permanent spiritual and moral worth were compiled into one collection, including chs. i.–xxix. of the whole book. A superscription prefixed to each of their three main divisions assigns it to Solomon. The first division (chs. i.–ix.) is devoted to a description of wisdom and an exhortation to its pursuit. The second (chs. x.–xxiv.) contains individual proverbs, and in its latter part brief proverbial discourses. The third (chs. xxv.–xxix.), though written by Solomon, was not edited by him, but only compiled by a learned society under Hezekiah (ch. xxvi.). In chs. xxx. and xxxi. we have three appendices. The first is by an author known to us only by the name Agur given to him in ch. xxx. 1; the second (ch. xxxi. 1–9) contains precepts for a King Lemuel given by his mother. *Lemuel* ("one belonging to God") is clearly only a symbolical name, and a general resemblance in style would seem to indicate that this, as well as the final section (ch. xxxi. 10–31), was also written by Agur.

While the Psalms represented the inner religious experience of God's people under the Law, the Proverbs exhibit the results of reflection upon the moral and spiritual value of its precepts in the concerns of life. Their enforcement and manifold illustration of the practical bearings and utility of the previous portions of revelation account for the insertion of the book in the canon, and the selection and inspiration of Solomon as its chief author. This collection of proverbs differs from all others, national or individual, not merely in its more profound wisdom, but also in its exhaustive treatment of religious and moral themes, which it occupies as an exclusive field. J. F. MCCURDY.

Prov'idence [Gr. πρόνοια; Lat. *providentia*], in theology, the doctrine which teaches that God upholds, preserves, and governs the entire universe which he has created. Like the Latin word from which it is immediately derived, it implies not only foresight, but forethought, preparation, or provision for, and therefore control, government. The scriptural doctrine affirms at the same time the omnipotent power of God and the liberty and responsibility of man. It is removed equally, on the one hand, from Stoicism and the rigid doctrine of Fate, and on the other from the Epicurean affirmation that it is an unworthy condescension of the Deity to concern himself about the affairs of men. (Pliny, *Hist. Nat.*, ii. 4 *seq.*) It includes the two essential ideas of preservation and of government. Preservation is to be distinguished from a continuous creation, into which some resolve it, since (1) this would confound two ideas essentially distinct; (2) would deny the reality of second causes; (3) would logically destroy the responsibility of man; and (4) refer everything to the immediate act of God. The scriptural affirmation is, that God upholds all things by the word of his power—that his agency is everywhere seen in the continued existence of his creatures and in the operations of nature. "By him all things consist," Col. i. 17; "In him we live and move and have our being," Acts xvii. 28. The *extent* of providence is unlimited. It includes all the creatures of God, intelligent and non-intelligent, since nothing is so high as to be above his control, nor anything so minute as to be beneath his notice. The *end* of providence is the realizing of the divine plan in the universe. The end is infinitely wise, holy, and beneficent. The means are such as are best adapted for the certain accomplishment of this end. Instead of chance, or necessity, or inexorable fate, to which gods and men are equally subject, the doctrine of the Scriptures substitutes the intelligent control of the omnipotent and omnipresent Jehovah, in accordance with designs as gracious as they are vast and inscrutable. The *method* of providence—*how* it is that God governs the world consistently with the liberty of rational beings—is to us incomprehensible.

That there are powers, unseen and supernatural, operating to sustain and control both nature and man seems to be the instinctive faith of the race, aside from the special teaching of revelation. This imparts a deep significance to many fables of ancient mythology. The belief in a providence of some kind seems wellnigh universal. It is affirmed or implied in the writings of ancient classical poets and philosophers, although disfigured with crude and unworthy conceptions of the divine nature or character. Cicero in his dialogues, *De Nat. Deorum*, states at considerable length the speculations of the most distinguished philosophers among the Stoics and Epicureans on the existence, attributes, and providence of a Divine Being. In lib. ii., while allowing the principle of pantheism—that God is the Universe and the Universe is God—he affirms the existence of minor deities, and then argues in favor of the divine government and providence—(1) from the existence of the gods, which implies their actual control of the world; (2) from the laws of nature—nature, properly interpreted, being another name for God; and (3) from the order, harmony, beauty, and wisdom manifested in the works of creation. Although not very complete or satisfactory, the argument shows the tendency of philosophic thought unaided by revelation. (See also *Tusc.*, Disp. i. 49 *et al.*)

The doctrine of providence was affirmed with great unanimity by the most distinguished early Christian Fathers, and maintained with equal subtleness of discrimination and strength of argument. The objections, too, early brought against the doctrine, were nearly the same as those revived and reaffirmed in our day. By some it was held to be unnecessary, or an implication of imperfect work on the part of the Creator, rudely supplemented afterward. Others "maintained that God concerned himself only about the genus, but not about the species," distinguishing between a general and a special providence—*gubernatio generalis* and *gubernatio specialis*. Still others held it to be derogatory to the Supreme Deity to suppose that he would condescend to notice the small concerns of men. Origen represents Celsus as affirming that God interferes as little with the affairs of men as with those of monkeys and flies. The opposite and Christian view of this article of faith was eloquently maintained in the East and the West by Chrysostom and Theodoret, by Augustine and Salvian. Augustine especially objects to the comparison of God to a master-builder, whose work remains though he himself withdraws. "The world would at once cease to exist," he says, "if God were to deprive it of his presence." Nearly two centuries earlier, about A. D. 230, Minucius Felix, in his apologetic dialogue entitled *Octavius*, in a passage of singular beauty, says: "Nec nobis de nostra frequentia blandiamur; multi nobis videmur, sed Deo admodum pauci sumus; nos gentes nationesque distinguimus; Deo, una domus est mundus hic totus. Reges tantum regni sui per officia ministrorum universa novere; Deo indiciis non opus est. Non solum in oculis ejus, sed et in sinu vivimus."

The doctrine of providence is not inconsistent with the idea of a government of law. The Scriptures affirm that God is the creator of the universe. He is the author of what we call the laws of nature, and can surely change or suspend or overrule them. But he does not govern the world arbitrarily, but according to a fixed plan and for a great end. The laws of nature are the ordinances of God, but a man even may use some powers of nature to control or limit other powers. So, in a far higher sense, and with a method infinitely more perfect, may the Creator control that which he has made. Nor can we deny that he may act directly upon the rational mind, as one finite mind may seek to modify another; or upon both nature and spirit by methods to us now, and perhaps always, incomprehensible.

Some of the proofs of the doctrine are the following: (1) It is inferred from the idea of a personal God, infinite in intelligence, wisdom, goodness, and power; (2) from the evidence of intelligence and design in nature; (3) from the evidences in history of moral order and law. History would otherwise be a tangled skein without beginning or end, without significance, and incapable of harmony or intelligent interpretation. The story of races and nations, the epochs which seem to mark the movements of society and the progress of civilization, would lose their importance, and our hope for the world would vanish, if we destroy the reality and the end of providential control. (4) From the experience of individuals, which may be misinterpreted, but cannot be overlooked altogether. (5) The proofs from the Holy Scriptures: (*a*)

in the passages which indicate or declare the government of God over nature, over irrational animals, over men and nations; (*b*) in the lives of eminent men—*e. g.* Abraham, Moses, Elijah, Saul, David, Daniel, Paul; (*c*) in the Jewish history, conspicuously everywhere; (*d*) in passages which affirm the truth of prophecy; (*e*) and in those which affirm the efficacy of prayer.

New interest, if not importance, has been given to this subject by the tendency of modern speculative thought.

The literature of this subject is voluminous. Some of the most important works which treat of the history of opinion, are—(*a*) in philosophy: Ritter's *History of Philosophy* (12 vols.); *History of Ancient Philosophy* (4 vols.), translated from the first volumes of the general history by A. J. W. Morrison; Ueberweg's *History of Philosophy*, translated by Prof. G. S. Morris (2 vols.). (*b*) In theology: Neander's *General Histories of the Christian Religion and Church*, translated by Prof. Torrey (5 vols.); Hagenbach's *History of Doctrines*, translated by Prof. H. B. Smith (2 vols.); Van Oosterzee, *Christian Dogmatics* (2 vols.), in "Theological and Philosophical Library," edited by Profs. Smith and Schaff; Knapp's *Christian Theology*, translated by Pres. Leonard Woods; and Rev. Dr. Charles Hodge's *Systematic Theology* (3 vols.). S. G. BROWN.

Prov'idence, county of Rhode Island, bounded N. and E. by Massachusetts and W. by Connecticut. Area, 413.3 sq. m. It is uneven, and in part not naturally fertile, but is in general well cultivated and productive. Market-garden products, potatoes, and hay are extensively raised. Limestone is obtained in some places, and a hard, stony anthracite was formerly mined. It has very extensive manufactures of cotton goods, clothing, flour, hardware, iron and castings, jewelry, leather, machinery, metallic wares, woollens, screws, carriages, saddlery, boots, shoes, furniture, worsteds, soap, candles, and many other kinds of goods. Traversed by Boston and Providence and Worcester, Hartford Providence and Fiskhill, Providence and Stonington, Providence Warren and Bristol, and other railroads. Providence, the capital, is also the seat of an extensive coastwise trade. P. 149,190.

Providence, p.-v., Pickens co., Ala. P. 775.

Providence, tp., Hardin co., Ia. P. 1335.

Providence, p.-v. and tp., Saratoga co., N. Y. P. 1155.

Providence, v., Mecklenburg co., N. C. P. 1936.

Providence, v., Pasquotank co., N. C. P. 520.

Providence, v., Rowan co., N. C. P. 1516.

Providence, tp., Lucas co., O. P. 863.

Providence, tp., Lancaster co., Pa. P. 1906.

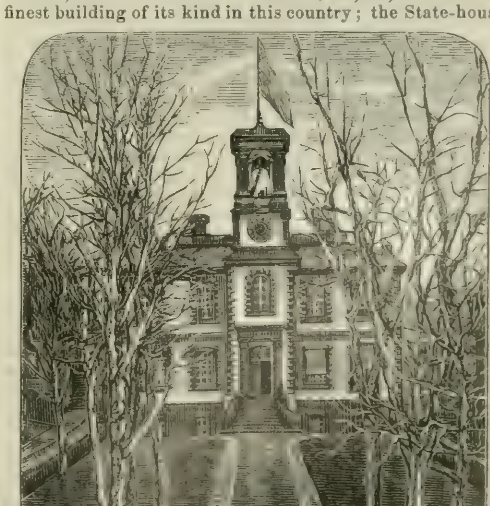
Providence, p.-v., Luzerne co., Pa., on Delaware and Hudson R. R., included in the city of Scranton.

Providence, a port of entry, the second city in New England, the seat of justice of Providence co., and one of the capitals of the State of Rhode Island, is at the head of navigation on Narragansett Bay, 35 miles from the ocean, about 178 miles N. E. from New York, and 44 S. S. W. of Boston, on one of the principal lines of railroad communication between those two cities; lat. 41° 49′ 22″ N., lon. 71° 24′ 48″ W. Two small rivers, uniting in the centre of the city, divide it into three portions—the E. side, the W. side, and the Tenth ward. The W. side and the Tenth ward contain, each, nearly 6 sq. m. of territory, and the E. side more than 3, making 14.76 sq. m. within the limits of the city. The surface of Providence is very uneven; the E. side rises, in some places quite abruptly, to a height of over 200 feet, and is generally considerably above tide-water; the W. side is mostly an extended sandy plain, its highest elevation about 78 feet above the harbor; the Tenth ward contains much farming land, with hills of considerable height and corresponding valleys. In the geographical centre of the city, forming the head-waters of Narragansett Bay, is the Cove, of an elliptical form, 1 mile in circumference, surrounded by a park filled with fine shade trees, and though sadly neglected, it is, in its situation and capabilities, one of the most attractive features of any city in this country.

The city is divided into 10 wards, and its government is vested in a mayor, with 1 alderman and 4 councilmen from each ward. Some of the most important expenses of the government for the year ending Sept. 30, 1875, were as follows: public schools, $217,160; school-houses and lots, $110,959; fire department, $128,665; lighting streets, $144,965; highways, $229,184; police, $228,630; opening streets, $181,892. Several hundred street gaslights in the central portion of the city are lighted simultaneously by electricity. Providence has no large public parks. The two most important are Roger Williams Park, and Field's Point. The former contains 102.6 acres, and came into the possession of the city in Nov., 1871, by the will of Miss Betsy Williams, a descendant of Roger Williams, as a public park and for the erection of a monument to her ancestor. Field's Point contains 37 acres, with salt water on both sides, and delightfully situated for health and recreation in the summer season. There are in Providence 10 lines of horse railroads radiating from Market Square, near the geographical centre, to every portion of the city and to the neighboring towns. They are all owned by one company, and are under excellent management. Providence began a new era of prosperity by the introduction of water from Pawtuxet River, 6 miles distant, in Nov., 1871. The waterworks up to Sept. 30, 1875, had cost $4,513,205, and the receipts to the same date had been $640,834. The water is excellent, and the supply ample for 2,000,000 people. At the present time (Jan., 1876) there are 903 hydrants distributed through the settled portions of the city, each capable of throwing from four to six large streams of water over the highest buildings, and enabling the fire department to dispense almost entirely with the use of steam fire-engines. Under the direction of the water commissioners the city is rapidly constructing

The City Hall.

a comprehensive and scientific system of sewerage. The sewer department has already expended $1,120,294 for this object. The city has long been well known for its elegant and spacious private residences, surrounded by beautiful and extensive grounds, but its public buildings have not been specially noteworthy. Recently, the spirit of progress is fast changing the aspect of the city in this respect. We may name the city hall, built of granite, to be completed in 1878 at an expense of $750,000; the Butler Exchange, a large building of iron for stores and offices; the Arcade, built in 1828 at a cost of $130,000, and still the finest building of its kind in this country; the State-house,



The State-house at Providence, R. I.

built in 1762; several very fine buildings erected by insurance companies; and the Narragansett Hotel, built of brick, seven stories high, and to be completed in 1876 at a

cost of about $800,000. The court-house and the library building of Brown University, now building, will be among the finest architectural ornaments of the city.

There are 79 church organizations in Providence, the four denominations having the largest number being—Baptist and Free Baptist, 18; Episcopalian, 12; Methodist and Roman Catholic, 10 each. Only a few of the church edifices are worthy of notice. The First Baptist, built in 1775, is noted for its beautiful spire; the First Unitarian, St. John's Episcopal, and the Beneficent Congregational are among the older and well-known church edifices, though some more recent are still more expensive. The charitable institutions of Providence are numerous and well supported. The Butler Hospital for the Insane, incorporated in 1844, with invested funds amounting to $90,000, and having about 150 patients at the present time, is delightfully situated, with extensive grounds, both cultivated and native woodland, on the W. bank of Seekonk River. From the beginning this hospital has maintained a high reputation for the treatment of the insane. The Rhode Island Hospital, opened for patients Oct. 1, 1868, at a cost of $450,000, had during the last official year 438 patients, at an expense of $33,298. The Home for Aged Women has a fine brick structure erected on a bluff overlooking the bay at a cost of $30,000. The Colored Orphan Shelter has about 30 inmates; the Children's Friend Society constantly cares for about 100 white orphans; the Providence Nursery and the Home for Aged Men are of more recent origin. The Dexter Asylum, for the use of the city poor, is a large brick edifice in an elevated situation and surrounded by 39 acres of land in the highest state of cultivation. It has about 125 inmates. This estate, with considerable other property, was given to the town of Providence in 1827 for the benefit of the poor by a benevolent citizen, Mr. Ebenezer Knight Dexter. The income from the property is sufficient to pay all the expenses of the Dexter Asylum. The Rhode Island Catholic Orphan Asylum, established in 1860, in charge of the Sisters of Mercy, has 175 orphans in a fine building on Prairie avenue. The incorporated educational institutions of Providence, as well as the public schools, are of a high character. Brown University, a Baptist institution, though under a very liberal charter and management, was established in Warren in 1764 and removed to Providence in 1770. It occupies extensive and highly eligible grounds on the high land E. of the centre of the city, has a valuable library of 45,000 volumes, and a large philosophical and chemical apparatus. An effort is now in progress to increase largely the endowment of the university. There are now 16 professors and 255 students. The Yearly Meeting Boarding School, under the control of the Society of Friends, has a large estate on the high land near the Dexter Asylum, is liberally endowed, and has 180 pupils, equally divided between the two sexes. The female academy of the Sacred Heart of Jesus, established in 1873, occupies a fine estate in the Tenth ward and has 35 boarders. Besides this, the Roman Catholics have 9 academies and free schools in the city, with 2759 pupils (1092 boys, 1667 girls) at this date (Jan., 1876). The public schools of Providence consist of one high school and another in progress, 11 grammar, 31 intermediate, and 36 primary schools. The number of pupils in the public schools in Nov., 1875, was 11,862, and the expense of the schools for the year ending Sept. 30, 1875, was $217,160, besides $110,959 spent during the year for school-houses and lots. The libraries in Providence render efficient aid in the cause of public education. The Athenæum was incorporated in 1836, and now has a capacious stone building with a well-filled reading-room and a valuable library of 35,100 volumes. The Friends' School, Brown University, the Franklin Lyceum, the Franklin Society, the Mechanics' Association, the Young Men's Christian Association, and other societies have each valuable libraries.

Providence has 4 daily, 1 semi-weekly, 6 weekly, and 2 monthly newspapers.

The penal and reformatory institutions of Providence are—the State prison, the Providence county jail, and the Providence Reform School. The prison and jail are in one building and under the same management, and had on Jan. 1, 1876, 56 State prisoners and 191 inmates of the jail. A new State prison is building at the State farm, 6½ miles from the city, to which these prisoners will be removed. The Providence Reform School, established in 1850, is a model institution of its kind. It is beautifully situated at Tockwotten, overlooking the bay, is under the control of a board of trustees elected annually by the city council, and has an average of nearly 200 inmates, of whom about 30 are girls.

There are 12 State banks in Providence, with an aggregate capital stock of $2,861,500; also 25 national banks, with a capital of $15,646,800. There are also 9 savings banks in the city, with deposits on Nov. 27, 1875, amounting to $25,098,684, divided among 46,174 depositors.

Providence is the centre of a large manufacturing district, and therefore has an extensive trade, especially in cloths, chemicals, dyestuffs, coal, etc. During the year 1875 the sales of print cloths alone in the city amounted to 3,324,780 pieces of 40 yards each, equal to 75,563 miles of cloth. This was a slight increase over the year 1874, but was only a little more than one-third the amount in 1869. The commerce of Providence is mostly coastwise. During the year 1875 there were 6464 arrivals at the port of Providence, of which 91 only were foreign. The amount of duties collected during the year was $203,671. Some of the receipts by vessels and by railroad were as follows: cotton, bales, 249,897; flour, barrels, 345,440; grain, bushels, 2,107,000; coal, tons, 691,847. Providence is largely a manufacturing city, and besides those within its own limits it is the head-quarters of a very extensive manufacturing district, particularly of cotton and woollen cloths, yarns, etc. For the year ending July 1, 1875, within the city limits, the value of the products of woollen manufactures was $4,291,573; of the cotton manufactures, $1,874,300; of calico prints, $3,850,828; and of iron manufactures, $8,488,402. The iron manufactures include steam engines and boilers, butt-hinges, screws, locomotives, muskets, iron castings, and others of less importance. Among the other manufactures of Providence there are 137 establishments for making jewelry and silver-ware. During the year ending July 1, 1875, these establishments employed 3068 hands, paying out $2,024,324 in wages; value of the materials used during the same period, $3,253,136, and the total value of the products, $7,177,131.

The registration of births, marriages, and deaths in Providence during the last 25 years has been complete and perfect, and the results show that it is a very healthy city. During the year 1875 the proportion of deaths to population was only 19.02 per 1000, or 1 death in 52.57, and the average for 20 years previous was 19.81 per 1000, or 1 in 50.47. During the same period 1 child was born to each 34.22 of the population, and 1 person was married in 38.33. The population of Providence at different periods has been as follows: in 1830, 16,836; in 1840, 23,172; in 1850, 41,513; in 1860, 50,666; in 1870, 68,904; in 1875, 100,675. Of the population in 1875, 71,438 were born in the U. S. and 29,237 in foreign countries.

Providence, settled by Roger Williams in 1636, was incorporated as a town in 1649, and as a city in 1832. During the first 140 years after its settlement the town increased very slowly, and in 1776 the population was only 4355, or considerably less than that of Newport. Since the close of the Revolution it has steadily increased in population. E. M. Snow.

Providence, v., Orangeburg co., S. C. P. 880.

Providence, v., Sumter co., S. C. P. 1485.

Providence, tp., Fairfax co., Va. P. 3136.

Providence Church, v., Baker co., Ala. P. 1024.

Providence Church, v., Lee co., Ala. P. 382.

Providence, Sisters of, a Roman Catholic sisterhood founded in 1828 at Montreal by Madame Émilie Tavernier; canonically established in 1844.

Prov′ince, in ecclesiastical geography, usually denotes that union of several dioceses which constitutes an archbishopric, and is consequently often conterminous with several states, with an entire country, or even with several countries. In the grand divisions of the Jesuit order North America is considered a province, all the members of the order therein resident being subject to a single superior.

Prov′incetown, p.-v., Barnstable co., Mass., on Old Colony R. R., at the extreme end of Cape Cod, has one of the finest harbors in the U. S. The Pilgrim Fathers first landed here from the Mayflower. Provincetown contains a public library, 5 churches, 2 banks, 4 fire and marine insurance companies, 1 newspaper, 4 hotels, and a paid fire department. The principal occupations are whaling, cod and mackerel fishing. P. 3865.

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Provins′, town of France, department of Seine-et-Marne, has cold mineral springs used for bathing, and manufactures of leather, tiles, and perfumeries from roses which are extensively cultivated in the vicinity. P. 7547.

Provi′so [Lat.], in law, a clause in a deed or contract, or in a statute, containing either a condition that something shall or shall not be done in order that the agreements comprised in the other clauses shall take effect, or a limitation upon the otherwise too general and comprehen-

sive terms of the instrument. It ordinarily commences with the words "Provided that," and when employed in a deed it implies a condition, unless the context clearly shows that it was intended merely to be a covenant. For example, the clause in a mortgage whereby the conveyance is declared to be void upon payment of the debt secured is strictly a proviso, and in the old forms of the instrument it began with the phrase "Provided that," etc. The object of a proviso when inserted in a statute is to limit, in specified contingencies, the otherwise too general and comprehensive terms of the enactment, by declaring that they shall not take effect under certain circumstances, or shall not apply to certain classes of persons or things. In this use it is analogous to, but not identical with, an exception; the latter takes something out of the statute absolutely—the former, if correctly employed, operates conditionally. In many instances, however, from carelessness or ignorance in the drafting of statutes, clauses appear in the form of provisoes which contain no condition, but are to all intents and purposes exceptions in their scope and effect.

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Proviso, p.-v. and tp., Cook co., Ill. P. 2091.

Pro'vo City, p.-v., cap. of Utah co., Ut., on Utah Lake. P. 2384.

Pro'voost (SAMUEL), D. D., b. in New York Mar. 11, 1742, of Huguenot ancestry; graduated at King's College, New York, 1758, and the University of Cambridge, England; entered the Church of England ministry 1766, and in the same year became assistant minister of Trinity church, New York; lived in retirement during the American Revolution; became in 1783 rector of Trinity church, and in 1787 was consecrated bishop of New York at Lambeth by the archbishops of Canterbury (Moore) and York (Markham), assisted by the bishops of Peterborough (Hinchliff) and of Bath and Wells (Moss). Bishop White of Pennsylvania was consecrated at the same time. In 1785, Bishop Provoost was chaplain of Congress, and in 1789 chaplain of the U. S. Senate. He resigned the care of Trinity church in 1800, and in 1801 received a coadjutor. D. in New York Sept. 6, 1815.

Prov'ost-Mar'shal, in the army and navy, an officer who attends to the execution of martial law, the fulfilment of sentences by courts-martial, and the like. He preserves order in towns and districts under military control, and has certain summary powers under the articles of war.

Pruden'tius (AURELIUS CLEMENS), b. in 348 A. D. at Cæsaraugusta, Spain; studied law; practised as an advocate; held several high positions, and was elevated into the patrician order by the emperor Theodosius, but retired afterward from public life and devoted himself exclusively to theological studies and religious poetry. Of his *Liber Cathemerinon* and *Liber Peristephanon*, two collections of hymns, several pieces became very popular, were translated into other languages, and are still in use in our times. Among his other books, all written in Latin verse, are *Hamartigenia*, on the origin of sin; *Psychomachia*, on the contest between good and bad in the human soul; *Contra Symmachum Libri Duo*, etc. There are complete editions of his works by Arevalus (Rome, 1788), by Obbarius (Tübingen, 1845), and by Dressel (Leipsic, 1860).

Prune [Lat. *prunus*, a "plum"], the dried fruit of certain kinds of plums. The finest sorts are called *prunelles*. Table-prunes are prepared by drying choice plums, like the greengage and the St. Catharine. The best prunes are from France, but Germany furnishes large amounts of a coarse kind. Turkey and Spain also export prunes. The greater part of the French prunes are dried St. Julien plums. They are used as a mild laxative for children, and are extensively employed in cookery. They are sometimes dried by artificial heat and sometimes in the sun, or perhaps more commonly are half dried by stoves, the process being finished in the sun.

Prun'ing consists in cutting off parts of a tree or shrub, either for the purpose of producing a certain shape or of increasing the production of fruit or timber. Forest trees are pruned in order to increase the quantity of timber in the trunk by diminishing the side branches, beginning at the lower part of the tree. In fruit trees the branches are thinned out in order to admit the air and light more freely to the leaves and blossoms, and to concentrate and increase the nourishment for the branches which remain. In pruning for the purpose of producing fruit it is necessary to know on what branches and buds the fruit grows. The grape generally appears on shoots of the current year, the peach on those of the preceding year, and the apple and pear on wood of two or three years' growth. The shoots are cut off close to the buds, or at a distance from them not greater than the diameter of the branch to be cut off, in order that the cut may be readily covered with bark the same or next year.

Prun'tytown, p.-v., cap. of Taylor co., West Va.

Pru'nus Virginia'na, the botanical name indicating the genus and species of the wild or choke cherry of the U. S., belongs to the natural order Rosaceæ, sub-order or family Amygdaleæ, is found chiefly on river-banks in the Northern States, is a tall shrub, with grayish bark, flowers in May, bears a reddish fruit which turns to dark crimson, has a smooth stone, and is very austere and astringent until fully ripe. It is the *P. obovata* of Bigelow, the *P. serotina* of several other botanists.

Pruri'go [Lat., "itching"], a skin disease characterized by intense itching and by the presence of small points filled with a watery liquid. It usually occurs in patients who are poor, ill-fed, and filthy. Cleanliness and abundant food should always be provided, but the cure by no means always follows. In fact, the disease may be palliated, but scarcely cured. It is especially bad in winter nights. Rubbing with the solution of calcium sulphide and bathing in alkaline, tarry, and salt washes are to be recommended. Arsenic is sometimes highly beneficial.

Prusa. See BRUSA.

Prus'sia [Ger. *Preussen*], **Kingdom of** (area, 348,337.89 quadrate kilomètres; pop. 24,693,487 in 1871), is divided into the following provinces: Prussia (area, 62,457.86 q. k.; pop. 3,137,545); Brandenburg (area, 39,893 q. k.; pop. 2,863,229); Pomerania (Ger. *Pommern*), (area, 30,119.63 q. k.; pop. 1,431,633); Posen (area, 28,951 q. k.; pop. 1,583,843); Silesia (Ger. *Schlesien*), (area, 40,289.16 q. k.; pop. 3,707,167); Saxony (*Sachsen*), (area, 25,240.89 q. k.; pop. 2,103,174); Sleswick-Holstein (area, 17,522.86 q. k.; pop. 995,873); Hanover (area, 38,478.9 q. k.; pop. 1,963,618); Westphalia (area, 20,199.10 q. k.; pop. 1,775,175); Hesse-Nassau (area, 15,895.48 q. k.; pop. 1,400,570); Rhenish Prussia (Ger. *Rheinland*), (area, 26,974.88 q. k.; pop. 3,579,347). To the Crown belong, furthermore, the estates of Hohenzollern and the duchy of Lauenburg. With respect to nationality, 2,432,000 of the inhabitants of Prussia are Poles, 50,000 Czechs, 83,000 Wends, 145,000 Danes, and the rest Germans. With respect to creed, 16,041,215 are Evangelical, 8,268,309 Roman Catholics, 325,565 Israelites, and about 60,000 belong to other denominations. The Roman Catholics are settled chiefly in Posen, Westphalia, and Rhenish Prussia. The country forms one continuous mass, comprising the whole of Northern Germany to the river Main. The northern part is flat, dotted with lakes, sandy in some places, fertile in others; the southern is traversed by the Riesengebirge, Sudetes, Rhön, Spessart, Taunus, and Weser mountains and the slate mountains of the lower Rhine. The coast has numerous bays, of which Kiel and Jade bays are used as naval stations, and some large inlets, of which the Kurische and the Frische Haffs are the most important. The principal rivers are—to the North Sea, the Elbe, with its affluents, the Havel, Spree, and Saale; the Weser, with its affluents, the Fulda and Werra; the Rhine, with its affluents, the Main, Mosel, Lahn, Sieg, Wupper, Ruhr, and Nahe; and to the Baltic, the Memel, Vistula (Ger. *Weichsel*), and Oder. (See GERMAN EMPIRE.)

The principal occupation of the inhabitants is agriculture; next follow cattle-breeding and mining; finally, manufactures and commerce. The productive soil is estimated at 126,000,000 acres, of which 69,000,000 are arable land and garden, 25,000,000 meadow and pasture-ground, and 31,000,000 forest. Agriculture is chiefly carried on in Sleswick-Holstein, Hanover, Pomerania, Posen, and Prussia. Rye, wheat, beet-root, tobacco, and hops are the principal products. The cultivation of the vine flourishes on the Rhine and its affluents. The forests of the state occupy about 10,000,000 acres. Prussia owns about 2,500,000 horses, most numerous in Holstein, Hanover, and Prussia, the finest studs being established at Trakehnen, Neustadt, and Graditz; about 8,000,000 cattle, 24,000,000 sheep, 5,000,000 swine. The mines and salines yield annually about 800,000,000 cwts., with a value of about 250,000,000 thalers; the most important products are coal, chiefly mined at Leuthen and Waldenburg in Silesia, on the Saar and the Ruhr, iron, zinc, copper, lead, and rock-salt. Much amber is found on the Baltic coast. The principal manufactures are metallic wares, cotton goods, silk, velvet, linen, and cloth. Westphalia, Rhenish Prussia, Silesia, and Saxony are in this respect the most important provinces. The trade is principally carried on in the produce of the country, though the transit-trade with Southern Germany is considerable. (See GERMAN EMPIRE.)

Popular education has reached a comparatively high standard, being maintained by the state and compulsory on the citizens. There are about 30,000 elementary schools, more than 500 middle schools, 195 gymnasiums, with 26 pro-gymnasiums, about 80 normal schools, 9 universities—namely, in Berlin, Bonn, Breslau, Göttingen, Greifswald,

Halle, Kiel, Königsberg, and Marburg; an academy of science at Berlin; academies of art at Berlin, Düsseldorf, Hanover, Kassel, and Königsberg; polytechnic and agricultural schools in several cities; schools of industry and art; and an academy of music at Berlin.

The organization of the army is very comprehensive, and regulated with the greatest care down to the most minute details. It is so closely connected with all the administrative institutions of the country, and plays so conspicuous a part, that the whole country may well be called one immense camp, in which the civil organization has to adjust itself to the military. Every Prussian capable of bearing arms belongs to the standing army for a period of seven years, generally from the twentieth to the twenty-seventh year of his age, serving the first three years in the ranks and the last four in the reserve. Then he belongs for a period of five years to the *Landwehr*, thus making military service for twelve years in all. Besides this, all men capable of bearing arms, but not serving in the army or navy, belong to the *Landsturm*. The number of the recruits annually levied amounts to about 143,000. The organization of the army is based on a territorial principle; that is, the divisions of the army correspond to those of the country into provinces, governments, etc., and in each village throughout the whole country tables are hung up by the government indicating to which regiment and battalion the men of the district belong. There is in this organization a remembrance of the ancient Germanic custom, according to which the army was composed of families and tribes—that is, kinsmen and friends. The number of army corps corresponds to that of provinces; only the guard is composed of picked men from the whole country, and has its head-quarters at Berlin. In consequence of military conventions concluded with the minor states, and the establishment of the German empire, the Prussian army has been combined with that of the rest of Germany, its organization being introduced throughout the army of the German Empire (which see). In peace the Prussian army, including the contingents of the minor states, but exclusive of the armies of Saxony, Bavaria, and Wurtemberg, consists of 212,993 infantry, 51,401 cavalry, 35,550 artillery, 7475 pioneers, and 3490 in the train. In war these figures are increased to 353,848 infantry, 14,364 chasseurs, 46,954 cavalry, 57,647 artillery with 1404 guns, 16,871 pioneers, and 30,031 in the train.

The state of finances is, according to the budget of 1875, as follows: Total receipts, 694,498,919 marks—namely, from direct taxation, 146,659,000; indirect taxes, 46,105,900; mines and salines, 114,346,868; railways, 172,616,210; domains, 71,751,564; expenses the same; public debt, 1,014,227,807 marks; interest, 38,927,635; amortization, 15,599,017 marks.

A Prussian country and a Prussian people first appear in history toward the end of the tenth century. The country comprised the present province of Prussia, and received its name from the Christian missionaries. The people were heathens, and became known to the rest of Europe through the attempts at Christianizing them. It is true that Phœnician and Greek sailors visited the coasts of this country in the remotest ages, attracted thither by the amber-trade, but the notices of the country which may be derived from those sources are fabulous. In the tenth century Bishop Adalbert of Prague endeavored to convert the Prussians, but was killed by them in 997. In the beginning of the eleventh century Duke Boleslaw Chrobry of Poland invaded and subjugated the country, and baptized a number of the inhabitants, but after a long and bloody contest the Prussians once more made themselves independent. In the beginning of the thirteenth century the Bernardine monk Christian arrived among them as a missionary. He understood that without extraordinary military exertions the people could never be converted; he gained the interest of Pope Innocent III. for the cause, was appointed bishop of Prussia in 1215, raised an army of crusaders, and penetrated into the country. Having been defeated by the heathens, he founded in 1225 the order of the Knights of Christ, also called the order of Dobrin, whose aim was the conversion of Prussia; and as this order also was defeated, he sought aid from the German order. This order had been founded in Asia during the Crusades, in 1190, for the double purpose of defending the Holy Land and taking care of sick and suffering pilgrims, and with the consent of the pope it now undertook the task of converting pagan Prussia. In the Orient the state of affairs was very difficult, and offered no prospects to the order of increasing its power, while in Prussia an opportunity of acquiring land presented itself. The German emperor, Frederick II., promised to invest the order with all the land they should conquer here, and to give to the grand master the dignity of a prince of the Roman empire. After a long and difficult contest, the order, supported by several zealous princes, subjugated the whole country, conquering it piece by piece, and covering it with fortified castles, around which it settled Christian and German immigrants. In 1283 the conquest was accomplished; the order ruled Prussia; the fortresses of Marienburg, Brandenburg, and Königsberg were built, and the whole country was divided into districts, which were governed by conventions of knights. In 1309 the grand master moved his residence from Venice to Prussia, and made Marienburg the head-quarters of the order. The national colors of the present kingdom were derived from the official dress of the order—a white cloak with a black cross. For more than 200 years the order ruled the country, and many names of valiant grand masters—such as Hermann von Salza, Winrich von Kniprode, Heinrich von Plauen, and others—became celebrated in the hot contests for the acquirement and maintenance of supremacy; but after that time the order broke down from the enmity of Poland and Lithuania and by its own internal deterioration and discord. The towns, which had grown rich, and the country nobility, would not submit to the egotistical rule of the knights; in 1440 they formed a league against the order, and in 1454 they offered the leadership to the king of Poland. The order carried on the war against united Poland and Lithuania by mercenaries, but by the Peace of Thorn (Oct. 19, 1466) it ceded the whole western half of its possessions, which was incorporated with Poland, and took the oath of allegiance to the Polish king for the rest. The order now endeavored to regain its former importance by electing for grand masters foreign princes, who added an independent power of their own to that of the order; but in this way it lost all, even its existence. In 1511 the margrave of Brandenburg, Albrecht, was elected grand master, and he dissolved the order and transformed the country into a temporal dukedom. His reasons for this extraordinary step were the personal advice of Luther, and, in general, the Reformation, which had spread widely in Prussia, and stood in glaring opposition to the monkish institution of the order. Most of the knights received large fiefs and married, the rest emigrated to Germany. Thus, the connection between Prussia and Brandenburg was introduced. It was not finally accomplished, however, until after the death of Duke Albrecht Frederick (Aug. 28, 1618). In the interval Prussia was held by a lateral branch of the electoral family of Brandenburg, but as this branch became extinct in the above year, it fell as a heritage to the principal line. It was, however, still a fief of the Polish crown, and continued so until 1656, in the time of Frederick William, the great elector—*Der Grosse Kurfürst*—whose long and successful reign (1640–88) denotes one of the most prominent stages in the development of the Prussian state. He was only twenty years old when he assumed the sway; nevertheless, he pursued with unflagging energy the plan of uniting all the loose and broken-up pieces of land which he inherited into a compact and well-ordered whole. His first task was to improve the state of the finances by strict economy, to encourage commerce and industry, art and science, and to form an effective army—not of mercenaries, but of the sons of the country. By the Treaty of Westphalia he obtained Further Pomerania and Kammin and the districts of Halberstadt, Magdeburg, and Minden. Next, he allied himself with the Swedes against Poland, gained the victory at Warsaw (July 20, 1656), and acquired by the convention of Labian the duchy of Prussia as an independent possession, not as a fief of the Polish crown. Immediately after he allied himself with the Poles against Sweden; defeated, in conjunction with Polish and imperial troops, the Swedes at Nyborg in 1657, and obtained Lauenburg and Bütow. He interfered in all affairs in which there was power or reputation to gain; supported the emperor and the Poles against the Turks, and opposed with great energy the intrigues of Louis XIV. by supporting Holland. With France he was compelled to make peace June 16, 1673, because French troops threatened his Westphalian possessions. Next year, however, when the French invaded the German Rhine countries, he advanced toward the upper Rhine with 20,000 men to support the imperial troops. Louis XIV. now caused the Swedes to march from Pomerania into Brandenburg, in order to arrest his march by threatening his own country. Nevertheless, the elector would not leave the imperial army, but asked the emperor to send relief to Brandenburg. As this was not done, he broke up his camp and hastened home with his best troops. June 15, 1675, he fell unexpectedly upon the vanguard of the Swedes at Rathenow, and on June 18 he attacked with 5600 horse the strong Swedish army at Fehrbellin, and drove it in wild flight out of the country. This victory caused a great sensation, and increased the fame of the elector very much. He pursued his victory with great energy; conquered Stettin in 1677, Stralsund in the fol-

lowing year, and occupied the whole of Pomerania at the close of 1678. But the emperor saw this growth of his power with dismay, and he stood alone against France and Sweden, so that he was compelled to conclude peace when a French army of 30,000 men invaded the duchy of Cleves. By this peace, concluded at St. Germain-en-Laye, June 29, 1679, he had to surrender to Sweden what he had conquered of Pomerania, but in indemnification he received from France 300,000 crowns, and he used the momentary good relations with this power to send a fleet to Spain in order to enforce the payment of a large sum due as subsidies. His relations with France became once more hostile when in 1685 he gave refuge to the Protestants who were driven out of France by the Revocation of the Edict of Nantes, and of whom more than 20,000 found a home in his states. Apr. 8, 1686, he entered into an alliance with the emperor and Hôlland, but he died Apr. 29, 1688, leaving to his son an effective army of 30,000 men, a treasure of 800,000 thalers, and a respected position among European powers. His son, Frederick III., made great sacrifices to obtain the royal dignity, and succeeded at last. Jan. 18, 1701, he was crowned at Königsberg as king of Prussia, under the name of Frederick I. (For the subsequent history of Prussia, see the biographies of her kings—FREDERICK WILLIAM I., II., III., and IV., FREDERICK II., WILLIAM I., and the articles on the history of the GERMAN EMPIRE, the SEVEN YEARS' WAR, and the FRANCO-GERMAN WAR.) AUGUST NIEMANN.

Prussian Blue. See BLUE.

Prus'sic Acid, or HYDROCYANIC ACID (which see).

Pruth, a river of Europe, rises in the Carpathian Mountains in Galicia, runs through Bukowina, forms the boundary between Moldavia and Bessarabia, and enters the Danube at Reni, after a course of 350 miles and 75 from the Black Sea. It becomes navigable at Jassy.

Pruyn (JOHN V. L.), b. in Albany, N. Y., in 1806; studied law; was admitted to the bar in 1832; director of the Mohawk and Hudson R. R.; treasurer of the N. Y. Central R. R. Co.; chancellor of the university in 1862; State senator in the same year; elected to Congress in 1863, and re-elected to the Fortieth Congress. D. at Clifton Springs, N. Y., Nov. 22, 1877.

Prynne (WILLIAM), b. at Swanswick, Somersetshire, England, in 1600; graduated at Oriel College, Oxford, 1620; studied law at Lincoln's Inn; was converted to Puritanism by Dr. John Preston, lecturer at that inn; in 1633 issued his celebrated *Histrio-Mastix, the Player's Scourge,* which was construed into a libel upon the queen; was brought before the Star Chamber, fined £5000, expelled from the University of Oxford and from Lincoln's Inn, set on the pillory at Westminster and Cheapside, had both ears cut off, and was sentenced to imprisonment for life. Having issued from his prison a tract entitled *News from Ipswich,* he underwent a repetition of the above punishments, had the letters S. L. ("Seditious Libeller") burned upon his cheek, was imprisoned in close confinement in Caernarvon Castle, and afterward in the castle of Mont Orgueil in the island of Jersey. Great crowds of Puritans witnessed the execution of this atrocious sentence, manifesting their sympathy with Prynne, who in 1640 was released by warrant from the House of Commons. Elected a member of Parliament for Newport, Prynne conducted the proceedings against Laud; became recorder of Bath 1647; took an active part in favor of the Presbyterians in their struggle with the Independents; advocated a reconciliation between Parliament and the king; was arrested for denying the supremacy of Parliament in a pamphlet entitled *A Brief Memento* (1648); was with others ejected from Parliament by the army Dec. 6, 1648; attacked Cromwell and the army in his writings; was again imprisoned in 1650 and 1651; advocated the restoration of Charles II.; was elected to the new Parliament 1660; was made keeper of the records in the Tower; was reprimanded by the House of Commons 1661 for new offences in his writings, and published a vast number of political, legal, and antiquarian treatises, some of considerable value, especially the *Collection of Records* (4 vols. folio) and the *Brief Register, Kalendar, and Survey of Parliamentary Writs* (4 vols. folio, 1659–64). D. in London Oct. 24, 1669.

Pry'or (ROGER A.), b. near Petersburg, Va., July 19, 1828; graduated at Hampden-Sidney College 1845, and at the University of Virginia 1848; studied law; became connected with the press at Petersburg 1851; was an editor of the Washington *Union* 1852 and of the Richmond *Enquirer* 1853; went as special commissioner to Greece 1855; was visitor at the University of Virginia 1856; edited a newspaper entitled *The South* 1856–67; sat in Congress 1857–59; was again elected in 1860, but did not take his seat on account of the secession of Virginia; was chosen to the provisional congress of the Confederate States at Montgomery, and to the first regular Confederate congress; entered the Confederate army as colonel of the 3d Virginia regiment; was made brigadier-general after the battle of Williamsburg; was taken prisoner Nov., 1864, and imprisoned in Fort Lafayette, but was soon released; was for a short time editor of a paper in Tennessee, and in the autumn of 1865 commenced the successful practice of the law in the city of New York, where he has since resided. Author of many published speeches and literary addresses.

Przem'ysl, town of Austria, in Galicia, on the river San, is the seat of the civil and ecclesiastical authorities of the district, and has many educational and benevolent institutions, and manufactures of leather, linens, and wooden articles. P. 15,184.

Przi'bram, town of Austria, in Bohemia, on the Litawka, near its influx in the Moldau, and has important lead and silver mines in its vicinity. P. 7665.

Psalmana'zar (GEORGE), the assumed name of a literary impostor whose real name and early history have remained unknown. He is supposed to have been born in the S. of France in 1679; received a good education under Jesuit instructors; led for some time a vagrant life, roaming through France, Germany, and the Netherlands in the garb of a pilgrim or pretending to some Asiatic nationality; ultimately attracted the attention of Mr. Innes, chaplain of a Scotch regiment at Sluys, Holland, who succeeded (as he supposed) in converting Psalmanazar to Christianity, took him to London, and presented him to Bishop Compton and others as a native of Formosa. It is uncertain whether Innes was a dupe or an accomplice in this affair, but he received promotion for his missionary zeal, and Psalmanazar was encouraged to draw up a *History and Description of the Island of Formosa off the Coast of China* (1704), illustrated with many engravings and with copious specimens of the pretended Formosan language, into which he also translated the Catechism of the Church of England. Psalmanazar was sent to Oxford, but soon repented of and confessed his imposture, applied himself to study, became skilled in Oriental history and literature, and spent nearly half a century in London, chiefly occupied in writing for the booksellers. He completed Palmer's *History of Printing,* wrote several volumes of the *Universal History,* led an exemplary and even pious life, was much visited by Dr. Johnson when young. D. at London May 2, 1763. His *Memoirs* appeared in 1764.

Psal'mody is usually defined to be the act, art, or practice of singing psalms. But it is often employed properly in a wider sense, which includes not only the vocal rendering of the songs used in public worship, but also their origin and history, as well as those of the tunes to which they are sung. Psalmody may be considered as ancient and modern. In the former the songs were all rhythmical and necessarily performed in the chanting or recitative style.

That God was worshipped publicly in song before David's time is clear, not only from the inherent probability of such praise, but also from the readiness and facility with which the responsive hymn of male and female voices was sung after the passage of the Red Sea. No direction, however, was given for such worship in the Law. It was David, the Psalmodist as well as the Psalmist of the Old Testament, who instituted the formal, stated, liturgical services of praise. He had a trained choir of 4000 Levites, who, however, came out in full force only on great occasions. Over these were three leaders—Heman, Asaph, and Ethan or Jeduthun—who directed them by beating time upon cymbals. The treble (*Alamoth,* 1 Chron. xv. 20) was led by the harps ("psalteries" in the English version), and the bass (*Sheminith,* 1 Chron. xv. 21), not in harmony, but simply an octave lower, by lyres or citharas ("harps" in our version). Many, though not nearly all, of the Psalms of David and his followers were composed partly for use in this service, and the superscriptions of a considerable number have reference to this design. In some of these we find allusion to the musical instruments by which they were to be accompanied; in others to the pitch (treble or bass) in which they were to be sung; and in a few to some familiar tune to which they were to be adapted. Some of the Psalms give evidence of adaptation to responsive singing, which was usually done by the two divisions of the choir, though sometimes, as in Ps. xxiv., the service was probably divided between the Levites and the people. The people, however, did not commonly join in the singing, except, apparently, in refrains and familiar formulas of praise, where they were enjoined to come out in full chorus. Some alterations in matters of detail were made in the service of praise in the Second Temple, the system being extended also, so as, for example, to have one psalm appropriated to each day of the week.

As to the musical system of the ancient Jews, nothing definite is known. The primary design of the accents in the Hebrew Psalter is that of musical notation, but these are no longer understood except in their secondary use of interpunction. It is possible that the synagogue-worship of later times and the old Christian chants retain traces of the simple recitative melodies of the ancient temple.

In the New Testament little is said of praise in public worship. The temple-service was of course maintained with gradual modifications until the Dispersion. Hearty and unrestrained singing, being a necessary part of Christian worship, is often enjoined in the Epistles. The services were no doubt a selection from the temple-psalms, with the old tunes, which held a place far into the history of the early Church. To these were gradually added Christian hymns, which were at first modelled after the psalms, and were doubtless set to the same simple music. The Syrian Church, however, had a larger hymnology and more elaborate music than its sister churches.

The development of psalmody in modern times in accordance with the needs of the Church has been due chiefly to two causes—the gradually-increasing and ultimately-predominant use of metrical songs as supplementing the old rhythmical forms, with a corresponding change in the tunes, which improved with the progress of musical science; and the growth of an hymnology in which the manifold experiences of Christians have found full expression. Still, many of the psalms have always been retained in essential substance, and have remained the best source of inspiration and culture for good hymn-writers. Music became a regularly-constituted portion of church-service in the fourth century. Its early development in the Western Church was largely due to Ambrose, bishop of Milan, and its progress during the Middle Ages to the improvements effected by Pope Gregory I. From them the names of the two old standard styles of chanting have been derived. Until the Reformation sacred music was under the control of the clergy. Metrical psalmody with harmony probably arose long before that era in Germany, but had not made much general progress. But the efforts of Luther and many of his helpers, by the adaptation of secular airs and the composition of new tunes, resulted in a widespread enthusiastic interest in sacred music among the Protestants in that country. Ever since then, also, it has been from Germany that the greatest influence and the healthiest tone have been given to the musical department of psalmody. We have but little space in which to speak of other parts of Christendom. In those lands where the influence of Geneva has had chief control, as most conspicuously in Scotland, this part of worship has been largely influenced by a tendency to plainness and severe simplicity in both words and music. In that country also the almost complete exclusion of modern hymns and of instrumental aid has helped to conserve this principle. Yet there congregational singing is hearty and general. In English-speaking countries generally there has always been a failure to attain to a psalmody which should be at once popular, solid, and artistically appropriate. In England there have been several revolutions in the public taste, and parochial singing has long been very degenerate in most of the country. Of late, however, there has been a decided improvement in this respect. In America, where true hymnology has been both appreciated and materially advanced, sacred music has been much influenced by a passion for lively, unsubstantial tunes, subserving a superficial emotion rather than profound edification. Many of the eminent composers who have done much to advance the general interest of psalmody in this country have too often consented to gratify this taste. J. F. McCurdy.

Psalms [Lat. *Psalmus, Psalma;* Gr. Ψαλμός, Ψάλμα, from ψάλλειν, to "play on a stringed instrument"]. This is the title given in the Septuagint version to the inspired songs of the Old Testament, which form one distinct book in the canon. They are sometimes called the Psalms of David, because so many of them were composed by that royal poet. As a collection they are also sometimes designated the Psalter, a term which in English-speaking countries is commonly but not exclusively employed in connection with their use in the act of worship. In the Hebrew Bible we find the whole collection divided into five books—(i.–xli.; xlii.–lxxii.; lxxiii.–lxxxix.; xc.–cvi.; cvii.–cl.)—a division which assumed its final shape before the completion of the Old Testament canon, but was only accomplished after several hands at various periods had helped toward the permanent arrangement. This partition is doubtless a designed correspondence with the five books of the Law. In the places assigned to the several psalms also there is evidence of careful arrangement according to principles more or less obvious, such as a tendency to place in the same group compositions of the same individual, or of the same period, or upon the same general subject, or written in the same style or for a similar liturgical purpose.

For the *authorship* of the several poems the superscriptions attached to many of them are in general our most reliable guide. Seventy-three of the psalms are thus assigned to David, and in nearly every case the correctness of the title is attested by strong evidence in their matter and style. The same criteria enable us to assign with great confidence a certain number of the anonymous psalms to the same author, making his whole contribution to be about eighty. We must remember, however, that much in many subsequent psalms was drawn from his compositions, and that, besides, his spirit greatly influenced all succeeding psalmists; so that we may say, in one sense, that almost the whole Psalter was the work of David. Twelve are ascribed to the singer Asaph, which designation also included certain of his descendants who inherited his poetical and musical gifts. Thirteen or fourteen proceeded from the "sons of Korah." (See Hengstenberg, *Comm. on the Psalms*, Appendix, p. xxi.) Two were written by Solomon (lxxii., cxxvii., in whose superscriptions we should read "of" and not "for," as in the English version). One, Ps. xc., is accredited to Moses. It is difficult or impossible to assign the remaining psalms with certainty to their true authors. Any apportionment which assumes the reliability of the superscriptions would approximate to the above distribution, whether it be assumed that these proceeded from the authors themselves or were inserted by later editors upon reliable tradition. It is probable that most of them are original, and all trustworthy. Classifications attempted by those who distrust their accuracy, resting mainly, as they do, upon subjective grounds, are at variance with each other, and commonly satisfactory only to the critics themselves.

The *dates* of the composition of most of the psalms may be determined by our knowledge of their authors or by their historical allusions. Thus it is easy to follow the course of the development and decline of this part of sacred literature, and its relations to the general religious life of Israel and to the inner experience of the writers themselves. Nearly all the psalms will be found to have been composed when such feelings were deepened and vivified by great national vicissitudes or religious commotions. In David's time these influences met in full measure. Many were indited under Hezekiah and Jehoshaphat, whose pious zeal for national religion and a pure worship naturally fostered such compositions among gifted and devoted men. The spiritual awakenings that followed the Exile also gave rise to many others; and it is to this date that many of the later nameless psalms must be assigned. In Solomon's time, on the other hand, though it was the period of highest literary cultivation, yet attention was given to didactic and reflective rather than to lyric poetry, in accordance with the political quiet and national prosperity that favored a broad culture and religious and philosophic meditation. Yet it must not be forgotten that a special divine direction, as well as national or individual experience, conditioned the appearance of these sacred poems as inspired productions and a permanent part of God's word. We agree with most modern critics in regarding as improbable the theory that some of the psalms were written as late as the Maccabæan period.

As to the *matter* of the Psalms, it must suffice here to say that they were the outflow of the spiritual life of the most highly-endowed natures of a long period of Israel's history. Thus, they contain a record of their adoration, confessions, petitions, and aspirations as these were conditioned, under the Spirit's guidance, on the one hand by their conceptions and knowledge of God and of his dealings with men, and on the other by their own inner history and outward circumstances. We find in the Psalms a vital appreciation of the ideas of God and Providence that had been unfolded in the teachings of the Law, and the most practical illustrations of the duty and privilege of worship and obedience. And so fresh, various, just and profound are their views of the spirituality, holiness, and goodness of God, and their representations of the yearnings, conflicts, and triumphs of the earnest soul, that the Psalter has not only prompted and made valuable all the hymnology of the Church, but has always been the chosen consoler and counsellor of the Christian heart. (See Psalmody.)

Literature.—The most valuable commentaries on the Psalms are those of Calvin and other Reformers, Hengstenberg (4 vols.), Tholuck, De Wette, Hupfeld (4 vols.; new ed. by Riehm), Ewald, J. A. Alexander (3 vols.), Moll (in the Lange series of Commentaries), and Delitzsch. J. F. McCurdy.

Psammet′ichus, the name of three Egyptian kings belonging to the twenty-sixth dynasty, according to Manetho. The name is written *Psemetek* in hieroglyphics,

but was altered by the Greeks, apparently without any reason, to *Psammis*, *Psammetichus*, and *Psammenitus*. Psammetichus I. (664–610 B. C.) subdued, by the aid of Greek mercenaries, the eleven other rulers between whom Egypt was divided at that time, and founded the dynasty. He opened Egypt to Greek commerce, and allowed Greek immigrants to settle on the eastern or Pelusiac mouth of the Nile, the Ionians on the one side and the Carians on the other. At the same time the Milesians settled at Naucratis on the western or Canopic branch of the Nile, and the intercourse which now sprang up between the Egyptians and the Greeks had the greatest influence on the prosperity of both nations. With Psammetichus III. the dynasty ceased to reign. He ascended the throne in 526 B. C., but was defeated, taken prisoner, and put to death in the following year by the Persian king, Cambyses, who now became the ruler of Egypt.

Pseudepig′rapha [Gr. ψευδεπίγραφα, "false additional writings"], in ecclesiastical bibliography, the general name of a vast number of books and fragments, great and small, of spurious works not usually reckoned in the Apocrypha, but like them designed to be foisted into the sacred canon. By some writers, the term Pseudepigrapha is applied to spurious writings claiming a place in the Old Testament canon. The term *Apocrypha* is applied to the spurious New Testament writings; while these writers call those books named APOCRYPHA (which see) by Protestants (but which are received by most other Christians) by the title of deutero-canonical books. While some of the so-called apocryphal and deutero-canonical books are in themselves genuine and valuable, the Pseudepigrapha as a rule are not. They are not even fictions. They are mostly self-evident forgeries—some ancient and others mediæval; some Jewish, others Gnostic, and still others Christian. The following is a partial list of the Pseudepigrapha, some few of which are considered canonical by the Abyssinian and perhaps other churches: The "History of Antiochus," the "History of Asenath," the "Epistle of Baruch," the "Book of Elias," the books called "Jasher" and "Jezirah," the third, fourth, and fifth of "Maccabees," the "Assumption of Moses," the "Preaching of Noah," the "Testament of the Twelve Patriarchs," the "Psalms of Solomon," the "Book of Zohar," of "Enoch," of "Jubilees," the fourth of "Esdras," the "Apocalypse and Vision of Esaias," the "Apocalypse of Zephaniah," a "Book of Lamech," an "Apocalypse of Adam" and one of "Abraham," a "Testament of the Three Patriarchs," a "Testament of Jacob," a "Prayer of Joseph," a "Testament of Moses," one of "Solomon," of "Noah," and of "Abraham," the "Mystic Words of Moses," the "Book of Eldad and Medad," "Jannes and Jambres," "The Repentance of Adam," "The Daughters of Adam," and numerous others. A large part of the mass is now happily forgotten or lost, and many are now known by name only. The number of spurious New Testament books is even greater. We may reckon the following spurious Gospels: the "Protevangel of James" (extant), the "Gospel of (Pseudo-) Matthias" (extant), the "Nativity of Mary" (extant), the "History of Joseph the Carpenter," the "Gospel of Thomas" (fragment), "Gospel of the Infancy" (extant), "Gospel of Nicodemus" (extant), "Gospel according to the Egyptians," "Gospel of Andrew," "of the Twelve Apostles," "of Apelles," "of Barnabas," "of Bartholomew," "of Basilides," "of Cerinthus," "of the Ebionites," "of Eve," the "Gospel according to the Hebrews," "Gospel of James the Greater," "of Judas Iscariot," "of the Manichees," "of Marcion," "of Matthias," "of Perfection," "of Peter," "of Philip," "of the Simonites," "of Valentine," "of Tatian," etc. The spurious books of "Acts," the false "Epistles" and "Apocalypses," are in number very great. A large proportion are not known to exist at present. Of those which are extant not one has any kind of claim to be recognized as a part of the canon.

Pseu′doscope [Gr. ψευδής, "false," and σκοπεῖν, to "see"], an optical contrivance invented by Prof. Wheatstone, which has the effect to cause depressions to appear as reliefs and reliefs as depressions.

Psittac′idæ [from *Psittacus*, or Gr. ψίτταχος, "a parrot"], a family of birds including the parrots and kindred types. The form is that familiar in the ordinary species; the bill is large, strong, and compressed, with the culmen rounded to the tip, which is more or less prolonged downward or hooked; the lower mandible is deep, and much shorter than the upper; at the base of the upper mandible is a cere or naked skin of varying extent; in this are placed the nostrils, which are generally small and oval, and not far from the base of the culmen; the wings are pointed; the tail varies in extent, but is in all more or less elongated; the tarsi are short and robust, and covered with granule-like scales, which extend upon the toes; the claws are arranged in pairs, two anterior and two posterior, the outer in each case being the longest. The species are very numerous, and are familiar under the name of parrots, parrakeets, maccaws, lories, lorikeets, and cockatoos. Finsch in his great work on the family (1867) described 350 species, and Gray in his *Hand-list of Birds* (1870) has enumerated 435. The family has been variously subdivided. On the one hand, by Finsch the family was divided into five sub-families—(1) Stringopinæ, characterized by the owl-like aspect, and represented by two species in New Zealand; (2) Plictolophinæ, including those in which the head is provided with a crest capable of erection; (3) Sittacinæ, comprising those species which have the tail elongated or graduated; (4) Psittacinæ, embracing those in which the tail is short or moderate, and straight or slightly rounded at the end; and (5) Trichoglossinæ, in which the tongue has a split, papillose apex, and the gonys of the mandible obliquely ascending. On the other hand, the latest classification—that of Mr. A. H. Garrod—is based upon the presence or absence of the left carotid arteries, and the presence or absence of an "ambiens" muscle, etc. This classification is very unlike previous arrangements. Two families are recognized, each having several sub-families—viz. (I.) Palæornithidæ (left carotid normal), with the sub-families—(1) Palæornithinæ, (2) Cacatuinæ, and (3) Stringopinæ; and (II.) Psittacidæ (left carotid superficial), with the sub-families (4) Arinæ, (5) Pyrrhurinæ, (6) Platycercinæ, and (7) Chrysotinæ. These combinations are in all respects different from those admitted by Finsch; it is therefore evident that the entire family must be submitted to a still more rigorous study than it has hitherto undergone before its classification can be considered as at all settled. The principal authority for the family is Finsch's great work *Die Papageien, monographisch bearbeitet* (Leyden, E. J. Brill, 1867, 2 vols., 8vo). The paper of Garrod alluded to is *On some Points of the Anatomy of the Parrots which bear on the Classification of the Sub-order*," in *Proc. Zool. Soc. London* (1874, pp. 586–598). (See also COCKATOO, LORIKEET, LORY, PARROT, etc.) THEODORE GILL.

Pskov, government of European Russia, bounded N. by the governments of St. Petersburg and Novgorod, comprises an area of 17,845 sq. m., with 717,816 inhabitants. The surface is mostly flat, abounding in small lakes and rivers; marshes are numerous, forests extensive. Agriculture is almost the only branch of industry, with the exception of cattle-rearing; hemp and flax are staple products.

Pskov, or **Pleskov,** town of European Russia, capital of the government of Pskov, is the see of an archbishop, and has many educational institutions and considerable manufactures and trade. P. 12,981.

Psophi′idæ [from *Psophia;* Gr. ψόφος, "a shrill sound"], a family of birds represented by the trumpeters of South America. The form is heron-like; the neck comparatively short; the bill short, compressed, and curved toward the tip, which is prolonged over the lower mandible; the nostrils inserted in a membranous groove, large and oblique; the wings short, concave, and rounded; the tail very short; the tarsi long and slender, covered with transverse scales; the toes moderate, the three in front united at the base, the hind one small and somewhat elevated; the claws curved and acute. But a single genus is known (*Psophia*), containing five species, found in various parts of the Brazilian empire and the northern portions of South America. THEODORE GILL.

Psori′asis [Gr. ψωρίασις], a skin disease in which there are at first elevated red patches upon which large scales of epidermis appear, the skin between the patches often cracking and bleeding. There are many varieties distinguished by writers, but, except in the case of the syphilitic diseases called psoriasis, the causes are very obscure. Fortunately, syphilitic psoriasis can be readily distinguished from true psoriasis. For the former the appropriate remedies for the specific disease are to be employed. For the latter the best treatment appears to be the use of vapor-baths, followed by strong alkaline applications, and then by tarry ones. Arsenical preparations are also useful. These means will very much mitigate, but will scarcely cure, the disease.

Psy′che [Gr. Ψυχή, the "soul"], in a Greek legend preserved by Apuleius, was a lovely mortal, the daughter of a king. Venus was jealous of her beauty, and ordered Cupid, her son, to inspire Psyche with desire for the basest of men, but the god of love, on beholding her, himself loved her. Thenceforth he visited her every night, requesting her never to see him or inquire who he was. But from curiosity, and the dread lest he should prove to be a monster, as her sisters told her he was, she came to

him with a lighted lamp while he slept. Overcome with joy at his loveliness, she carelessly allowed a drop of hot oil from her lamp to fall upon his arm. Cupid therefore left her with reproaches. After many calamities she became the menial slave of the jealous Venus, who treated her with great cruelty. But her lover invisibly assisted her, and finally, having secured her immortality, made her his wife. The myth is plainly allegorical, and is a figure of the progress of the soul, by the aid of divine love, through the calamities of this life to a happier life hereafter.

Psychol′ogy [from ψυχή, "soul," and λόγος, "reason"], the science of the soul. From a very early date mankind, in speaking and writing, required to draw distinctions between the different exercises of the mind. The Eleatics distinguished between the senses and the reason, and had an intermediate operation, opinion. Plato proceeds on a threefold division of the mental powers—*αἴσθησις*, which makes known the fleeting; λόγος, which reveals the fixed; and *διονδια*, the discursive process which makes known the probable. But the founder of psychology as a science is Aristotle. He has a grand, twofold division of the faculties, which has ever since been acknowledged—the gnoetic or gnostic (in Latin the cognitive), and the orective (in Latin appetent or motive). With him the *psyche* is organic life, and he mentions (1) the nutritive power; (2) sense-perception, with its common percepts by all the senses—viz. motion, rest, number, figure, magnitude—motion by touch and sight, and all the rest by motion; and proper percepts, such as color by the eye and odors by smell; (3) the memory, divided into *μνῆσις*, spontaneous, and *αναμνῆσις*, with an effort: in speaking of this he has his famous classification of the laws of association—viz. contiguity, resemblance, and contrast; (4) the phantasy involved in memory and giving us imagination. Above these—indeed, above the psyche altogether—he places the *νοῦς*, which is represented by him as immortal. Plato had spoken of the *νοῦς* as the place of principles (*τόπος ειδῶν*); Aristotle adds, in capacity merely (*ἔν δυνάμει*). This classification of Aristotle's has been the foundation of every other. Psychology appears in every discussion on mental philosophy since that date, and is found in Augustine, the Schoolmen, Bacon, Descartes, Locke, and Kant. The Scottish school of Reid, Stewart, Brown, and Hamilton has paid great attention to it. It is diligently prosecuted in the modern German schools.

That mind exists, and is different from matter, can be established on two grounds: First, it is made known by a different mental faculty: body is made known by the senses; mind by self-consciousness. Secondly, we know the two as possessing different properties: mind has thought, feeling, will; matter has extension and powers of attraction, and can be weighed and measured. The science of psychology shows that mind follows laws of its own. Psychology is to be prosecuted mainly by self-consciousness looking within and marking what passes. As thus able to look into our own souls, we are able also to understand what takes place in those of others as manifested by their words and deeds and made known in biography, history, and poetry. Attempts are being made in the present day to show how physiology can explain mental phenomena. These have so far been successful, and should be encouraged. But no material forces can explain such phenomena as reason, conscience, will, or break down the distinction between mind and matter.

The common division of the faculties in the present day is a threefold one, adopted by Kant, and taken from him by writers in Germany and Great Britain: (1) the cognitive; (2) feeling; (3) the will. The following may be found a convenient distribution of the faculties:

First, Cognitive.	Second, Motive.
I. Simple cognitive, or presentative.	IV. Conscience, or moral faculty.
II. Reproductive, or representative.	V. Emotions.
III. Comparative, discovering relations.	VI. Will, or optative power.

The cognitive give us knowledge and ideas; the motive stir up feeling and prompt to action.

I. *The Simple Cognitive*, so called because they give us knowledge in the first and simplest form; called also presentative, because the object is now present. It embraces sense-perception and self-consciousness. In sense-perception we have a knowledge (not a mere idea) of things external to the mind—by taste, of a sapid affection of the palate; by smell, of odorous affections of the nostrils; by hearing, of a sound in the ear; and by touch proper or feeling, of the periphery of our bodily frame as subject to various sensations. So far, the infant's knowledge may not extend beyond its body; it knows the objects as extra-mental, but not as extra-organic. But by sight it knows a colored surface as affecting the eye, and by the muscular sense a body as resisting our locomotive energy. From the very beginning and all along we have with our knowledge of body, and indeed as associated with every mental operation, a consciousness of self in its present state—not of a mere phenomenon or appearance of self (as Kant maintains), or of a quality of self (as the Scotch school holds), but of self as acting—say as exercised in thought or feeling. By these two powers we have the knowledge with which the mind starts of things without and within us. Other powers may now work.

II. *The Reproductive or Representative.*—By these the knowledge gained comes up once more in old forms, in ideas of objects, not present, but thus represented. (1) The knowledge is kept; this is retention. The object is not present, the idea is not always present, but there is now a capacity to recall it. The power of retention depends mainly on the amount of energy expended in the original knowledge. (2) The object is actually recalled by an image, say, of a lily or of a state of grief or joy. The faculty which does this we call the phantasy, and the product an idea, a species, or more unambiguously a phantasm. (3) It is recalled according to the laws of association, which are of a twofold nature—primary and secondary. The primary are contiguity and correlation, whereby things which have been together in the mind, or between which there is a discovered relation, tend to recall each other. The secondary determine among a number of objects, any one of which might be called up, why one rather than another presents itself, the main law being that of energy, whereby things on which we have bestowed the greatest amount of mental energy, whether of intellect, feeling, or will, come up more readily and frequently. (4) Things are recognized as having been before the mind in time past; this is the recognitive power (overlooked by Kant and Hamilton), being the main element in memory, and giving us the idea of time, always in the concrete. (5) The compositive power, putting things known in new forms and combinations, and this both by increase and decrease. This is the essential element in imagination, which stretches away into the infinite, our belief in which implies that it is beyond our widest idea, while nothing can be added to it—that is, that it is perfect. (6) The symbolic power, which enables us to think by means of signs, and especially language.

III. *Comparison.*—The mind can discover relations between the objects thus made known and recalled. (1) Identity, whereby the mind perceives that the same is the same, noticed, it may be, in different modes and with different concomitants, as, that I am the same to-day when I am joyful as I was yesterday when I was sorrowing. (2) The faculty of whole and parts, called comprehension and abstraction, whereby we separate a part from the whole, and form abstract ideas. The mind can also discover (3) the relations of space, which gives locality and the science of geometry; (4) of time, which gives arithmetic and chronology; (5) of quantity, from which proceeds mathematics as the science of quantity; (6) resemblance, which enables us to classify, and reach general notions; (7) active property, which notices the correlation of forces; (8) cause and effect, which enable us to rise from effect to cause till we reach a first cause. These constitute the higher intellectual powers of man. Working with them, we have motive powers.

IV. *The Moral Faculty.*—(1) It is partly cognitive; it discovers not a new object, as the senses may do, but a quality in certain objects—that is, in voluntary acts: they may be good or evil—good, such as gratitude, godliness; evil, such as cruelty, deceit. (2) It is also motive. Its exercises are accompanied with emotion, with feelings of approbation and disapprobation. From this power we get such ideas as those of obligation, duty, prompting to good.

V. *The Emotions.*—These imply four elements: (1) an appetence or spring of action, such as the love of pleasure or sympathy with our fellow-men; (2) an idea of an object as appetible or inappetible—say, as about to bring pleasure to ourselves or others; (3) the actual emotion, an excitement of mind, with attraction toward an appetible object and repugnance from an inappetible. In these three processes appetence is the spring, the idea is the channel, and the excitement is the stream flowing out. (4) There is an organic affection of the brain and nerves.

VI. *The Will.*—The essential element here is the power of choice and its opposite, rejection. Two or more objects are presented, and we take the one, and not the other or others; or it is one object pressed on us, and we accept it. This power includes volition, or the final decision to act. But it includes more: it includes wish. It should be noticed that in love considered as a virtue or grace there is wish, there is benevolence, which is well-wishing, a desire of good to the person beloved. It should be resolutely

maintained that the will has an essential freedom of which it can never be deprived.

It should be observed that every one of these groups of powers gives us one or more new ideas. The senses give us the idea of extension and resisting power; self-consciousness, the idea of mind and mental operations; the reproductive, of time and the infinite; the comparative, of connections; the conscience, of moral good and evil; the emotions, of the lovely; and the will, of freedom.

J. McCosh.

Psychrolut′idæ [from *Psychrolutes;* Gr. ψυχρολούτης, a "bather in cold water"], a family of fishes established by Dr. Günther for a species of West American fish. The body is rather elongated; the skin naked and quite loose; the lateral line absent (?); the head large and depressed; the opercular unarmed; the mouth with the cleft oblique and of moderate width; the teeth small and confined to the jaws; branchial apertures of moderate width, the gill-membranes being attached to the isthmus; branchiostegal rays very slender, seven in number; dorsal and anal fins opposite each other, situated far backward on the tail, without spines, and nearly entirely enveloped in the skin; caudal free; pectorals entire; ventrals close together, thoracic, and composed of few (two) rays; there are three and a half gills, and pseudobranchia are well developed. The only known species is *Psychrolutes paradoxus*, Günther, based upon specimens found in the Gulf of Georgia near Vancouver's Island. It is placed by Günther near the Blennidæ and Cyclopteridæ. Theodore Gill.

Ptah, or **Phthah,** an important divinity of ancient Egypt, usually identified with the Greek Hephaistos and Latin Vulcan. His worship was traced to a remote antiquity, and was intimately connected with the adoration of the sun as the author of light and heat. Memphis was the principal seat of his worship, and the beetle (*Scarabæus sacer*) was his peculiar emblem.

Ptar′migan, the vernacular generic name for the species of grouse of the genus *Lagopus* which are distinguished by the legs being densely feathered to the claws, the nasal grooves closed over with feathers, and the development of sixteen or eighteen tail-feathers. The species are characteristic of the high northern regions of the globe, and, with the exception of one species, assume a white coat during winter; in summer they are of a more or less reddish or buff color. In winter they seek the shelter of thickets of willows, birches, etc., but in summer they frequent plains. When pursued in winter they frequently dive in the loose snow, in which they work their way with great ease. The female begins to lay her eggs about May or June, and deposits about eight or ten eggs in the nest. Six species have been recognized by recent authors, of which *Lagopus albus* inhabits both hemispheres, *L. rupestris* and *L. leucurus* North America, and *L. mutus*, *L. hemileucurus*, and *L. scoticus* the Old World. *L. scoticus* is extremely closely related to *L. albus*, and has been even regarded as the permanently dark insular form of that species. Theodore Gill.

Pteraclid′idæ [from Gr. πτερόν, "wing," and κλείς, "lock"—*i. e.* "fin-locked," on account of the extent of the fins], a family of mackerel-like fishes. The body is oblong or elongated and compressed; the scales of moderate size, and spinigerous or emarginated; the lateral line continuous; the head compressed, and with the snout obtuse and convex; the opercular unarmed; the mouth with the cleft wide and oblique; teeth on the jaws as well as palate; branchial apertures continuous below; branchiostegal rays seven; dorsal fin elongated, extending from the forehead to near the caudal, and composed chiefly of filiform spines; anal fin also enlarged, and extending from the breast nearly to the caudal; caudal distinct; pectorals with branched rays; ventrals jugular, with four to six slender rays; pyloric appendages developed in small number (about six in *P. Carolinus*). The family is based especially upon the genus *Pteraclis*, species of which are found in the Indian seas, the ocean about the island of Madeira, and along the coast of Carolina. To the family perhaps also belongs the genus *Pterycombus*. Theodore Gill.

Pterich′thys [Gr. πτερόν, "wing," and ἰχθύς, "fish"], the most remarkable member of the strange group of placoderm fishes, of which the remains are found in the Devonian rocks of Europe. It was of small size—the largest one foot in length—the body almost enclosed in a case or trunk of enamelled bone. From this projected a tail covered with angular scales and provided with a dorsal and a caudal fin. (See Fossil Fishes.) J. S. Newberry.

Pteri′idæ, a family of the Monomyria (which see), to which belongs the pearl oyster. (See Comparative Anatomy and Precious Stones.)

Pterocarpus. See Kino.

Pteroc′lidæ [from *Pterocles;* Gr. πτερόν, "wing," and κλείς, "hook"], a small family of birds peculiar to the Old World, containing the so-called sand grouse. The form is as much that of the pigeon as the grouse; the bill is short, compressed, and the culmen curved to the tip; the wings and tail are elongated and pointed; the tarsi moderately robust and covered with feathers; the toes rather stout, the three in front more or less united, the hinder rudimentary or wanting. In its anatomy this type is intermediate between the true gallinaceous birds and the pigeons; in some respects, however, they are much more nearly related to the latter than the former. Two genera are recognized by authorities—(1) *Pterocles*, with fourteen species, and *Syrrhaptes*, with two. They are found in Southern Europe, as well as in Africa and Asia, in dry sandy places or deserts, rocky plains, and wooded grounds. They feed chiefly upon hard seeds, bulbs, and insects. The females lay from two to four eggs on the bare ground. *Pterocles arenarius* and *P. alchata* are found in Southern Europe. *Syrrhaptes paradoxus*, although strictly an Asiatic species, sometimes makes incursions into Europe as far westward as the British islands. One of these visitations was made in 1863, in which year it made its appearance at 148 European localities, as recorded by Newton—"from Galicia to Donegal, and from Gascony to the Faröe Islands." The earliest date given is 6th of May in Moravia; by the end of that month the farthest point throughout the N. W. had been reached. The species is said to have appeared in Europe in 1853; in 1859 it reappeared; and in 1863 the unprecedented visitation recorded took place. Its subsequent incursions have been inconsiderable. Theodore Gill.

Pterodac′tyls [Gr. πτερόν, "wing," and δάκτυλος, "digit"], an extinct group of flying animals, confined to the Mesozoic or Reptilian age, and usually regarded as an order of reptiles. The anterior limbs were adapted for flight by the elongation of the fore arm and fifth or outer digit, corresponding to the little finger of the human hand. By this means an expanse of membrane was supported as in the bats, which these animals in some respects resembled. The head was large, the jaws long, and armed with teeth. In many other points the skull approaches that of birds. Nearly all the bones were pneumatic, with very thin walls, as in most birds. The skin seems to have been destitute of scales or feathers, as no traces of either have been discovered. Prof. Seeley, who has recently studied the pterodactyl remains of the English Upper Greensand, considers them a sub-class of vertebrates equal in value to the birds, and closely related to them. The earliest pterodactyl yet known is *Dimorphodon macronyx* from the Lower Lias of England. Many species occur in the Oolitic lithographic slates in Bavaria. A few fragments only are known from the Wealden, while the English Greensand has furnished many large species. Others from the Upper Cretaceous were the latest forms of this group known from the Old World, and were perhaps contemporaneous with the gigantic species lately made known from the Upper Cretaceous shales of Kansas. The largest of these (*Pterodactylus ingens*, Marsh) probably measured between the tips of the fully-expanded wings nearly twenty-five feet. Two smaller species occur in the same formation, but all are large in comparison with the common European forms. O. C. Marsh.

Pteroglossus. See Rhamphastidæ and Araçari.

Pterop′oda [Gr. πτερόν, "wing," and πούς, ποδός, "foot"], a group of mollusks formerly considered a separate class, but now generally regarded as of a sub-class of the class Gasteropoda. All living species are marine; all are characterized by a pair of swimming fins attached to the head. The right whales feed largely on shelless species. The shells of some are brought up by deep-sea dredges. They are comparatively little studied by scientists, because they are not often found alive near the shore.

Ptolemaic System. See Ptolemy.

Ptolemais. See Acre.

Ptol′emy, the name of thirteen kings of Egypt belonging to the Greek or Macedonian dynasty, of which the most remarkable were—Ptolemy I., Soter (323–283), the founder of the dynasty. His father's name was Lagus, and the dynasty is often called the Lagides, but his mother, Arsinoë, had been the mistress of Philip II. of Macedon, and he was generally supposed to be a son of the latter. He was one of the most prominent generals of Alexander the Great, after whose death (in 323) he was appointed governor of Egypt. The reigns of Alexander's half-brother, Philip Arrhidæus (322–317), and his posthumous son, Alexander II. (317–311), were merely nominal, however, and Ptolemy was in reality the ruler of Egypt, though he did not assume the title of king until 305. The surname *Soter*, "the preserver," was given to him by the Rhodians, whom he saved

when they were attacked by Demetrius Poliorcetes. The first part of his reign was occupied by wars with Perdiccas and Antigonus, in which he suffered a terrible defeat in the naval battle off Salamis in 306, but succeeded in baffling and defeating first Perdiccas, and subsequently Antigonus, when they invaded Egypt, and conquered Syria, Palestina, Cœlesyria, and Cyprus, which were added to his realm. After the death of Antigonus (in 301) he reigned in peace. Memphis was his capital, but Alexandria increased rapidly, and was even now the principal mart of the Mediterranean. Jews and Greeks gathered here in great numbers, and not only for the sake of commerce. A library was founded, and a school whose teachers were maintained at the public expense; and both institutions soon attracted the most renowned philosophers and scientists to the city.—PTOLEMY II., PHILADELPHUS (283–247), b. in 309; continued successfully the work which his father had commenced. He founded Arsinoë at the head of the Red Sea, and Berenice farther to the S. The former he connected with the Nile by restoring and completing the canal of Necho; the latter by constructing an excellent road to Coptos. He built the celebrated lighthouse on the island of Pharos; founded colonies and mercantile stations, such as Ptolemais on the confines of Ethiopia for the trade in elephants; concluded commercial treaties even with India; and brought the material prosperity of his country to its culmination. When he died he left 740,000 talents in his treasury, an army of 200,000 foot and 40,000 horse, besides chariots and elephants, and a fleet of 1500 vessels. The annual revenue of Egypt proper amounted to 14,800 talents. No less successful were his exertions for the establishment of the literary and scientific supremacy of Egypt. The number of rolls in the library increased to 400,000; its librarian was Callimachus. To the school were added botanical and zoological gardens. Among its teachers were Euclides, Aristarchus of Samos, and Aratus, Hegesias, and Theodorus. At the court lived Theocritus, Manetho, Apelles, etc., and a widespread tradition says that the Septuagint was undertaken at the command of the king.—PTOLEMY III., EUERGETES (247–222), was a brilliant warrior; made a victorious campaign from the Nile to the Indus, and brought back to Memphis the old Egyptian gods which Cambyses had carried to Babylon, whence he received the surname *Euergetes*, "the benefactor."—With PTOLEMY IV., PHILOPATOR (222–205), PTOLEMY V., EPIPHANES (205–181), and PTOLEMY VI., PHILOMETOR (181–146), begin the degeneration of the dynasty and the influence of the Romans—the two causes which soon brought about the downfall of the Egyptian empire. Ptolemy IV. sent large supplies of corn to Rome during the Second Punic war, and as a reward for his good offices the Romans interfered in the war between Antiochus of Syria and Ptolemy V. in favor of the latter. Under Ptolemy VI. the Roman commissioners played the part of mediators between him and his brother, Euergetes II., and under PTOLEMY VII. (146–117) they proved themselves a domineering power in the realm, in accordance with whose interests the polity of the state had to be directed. In the family of the Ptolemies it became common for the brothers to marry their sisters—a connection which was permitted by the Egyptian laws, but which was a horror to the Greeks. Ptolemy VII. married not only his own sister, but also the daughter of this sister by an elder brother. The later members of the family, although the men retained their eminent gifts for science and art, and the women their wonderful beauty, were seized with a sort of madness which burst forth in the most unnatural freaks of sensuality and cruelty. With Cleopatra the family lost its royal dominion; her son by Cæsar was sometimes called Ptolemy XIV., but died in childhood. CLEMENS PETERSEN.

Ptolemy (CLAUDIUS PTOLEMÆUS), b. at Pelusium in Egypt; flourished at Alexandria in the middle of the second century after Christ. Of his personal life nothing more is known. Of his works are still extant the *Syntaxis Mathematica* and the *Geographia*. The former is a representation of the science of astronomy at the time of the author, based partly on his own researches, partly on those of Hipparchus. As it is the only authority we have for the views of astronomy entertained by the ancients, and as it formed the foundation of all astronomical science down to the time of Copernicus, the book is consequently of the greatest interest. Having disappeared during the Dark Ages, it again became known to the Europeans through the Arabs. About 827 it was translated into Arabic, and of this Arabic translation, the *Almagest*, a Latin translation was published in 1230 under the auspices of the emperor Frederick II. The best edition of the Greek text, accompanied by a French translation and notes, is by Halma (4 vols., Paris, 1813–28). The fundamental ideas of this system, the "Ptolemaic system," are the position of the earth in the centre of the universe and the revolution of the planets around the earth. Of the *Geographia* a Latin translation with maps was frequently reprinted at Rome in the latter part of the fifteenth century, and it was almost the only source of geographical knowledge until the voyages of discovery by the Portuguese made its information antiquated. Edition by Wilberg and Grashof (Essen, 1838–42).

Pto'sis [Gr. πτῶσις, a "fall"], a dropping of one or rarely both upper eyelids; an inability to open the eye. It may come from a degenerate or undeveloped condition of the muscle-tissue, or from palsy of the third nerve. It has been successfully treated by tacking the orbicular muscle to the occipito-frontal. It often passes away without surgical treatment, and there are cases which are not benefited by any treatment whatever.

Pu'berty [Lat. *pubertas*, "youth," from *pubes*, "hair"], the period of life at which the exercise of the reproductive function becomes possible. In males it usually takes place between the ages of thirteen and sixteen, and in females somewhat earlier; and it appears that in very warm and very cold climates puberty is reached somewhat earlier than elsewhere. There are also cases of *prœotia*, or precocious development in this respect. The period of puberty is attended in males by a more complete development of the larynx, a deepening of the voice, the first appearance of the beard, etc. In the female the contour becomes rounded and more graceful, the catamenia appear, and the mammary glands are developed. There is no doubt that to those who are inclined toward constitutional disease this is a period of some danger, and especially to the female. At this time, too, the mind and tastes are often rapidly developed, and the impressible nature of youth may now become, on the one hand, inspired by noble and generous sentiments, or may receive, on the other, a fatal bent toward that which is base.

Pub'licans [Lat. *publicani*], farmers of the public revenues of the Roman state. The various revenues which Rome derived from her subject provinces were let out or sold by the censors to the highest bidder. The immediate lessees or purchasers were of the wealthiest Romans, principally of the equestrian order, who often formed themselves into societies or stock companies to give the securities required by the government. The provinces were sublet by districts, and the actual collection of taxes was made by lower classes, sometimes even slaves. Oppression and extortion characterized the whole system, and in the provinces the publicans directly concerned in gathering the taxes were hated and despised, as we read in the New Testament. A. L. CHAPIN.

Public Health. See SANITARY SCIENCE.

Public Houses, Laws as to. See HOTEL, by C. G. LELAND, A. M., and INNKEEPERS, by J. N. POMEROY.

Pub'lius Sy'rus, a Syrian slave who attracted great attention in Rome in Cæsar's time as a writer of mimes. St. Jerome mentions that a collection of moral sentences extracted from the writings of Publius Syrus was used at his time as a school-book in Rome. There exists a compilation of this description, *Publii Syri Sententiæ*, edited by Orellius as an appendix to his edition of Phædrus (1832), but that collection has been compiled from various sources, though the most of the 1000 apothegms may belong to Syrus.

Puccoon', a general name applied in the U. S. to several dissimilar plants which yield a yellow or reddish juice, often utilized for dyestuffs. The best-known representative is the *Sanguinaria Canadensis* or BLOOD-ROOT (which see). Other puccoons are of the borage and crowfoot families (see RANUNCULACEÆ), the latter being medicinally used as a substitute for quinine, and being popularly regarded as a specific for cancer.

Pück'ler-Mus'kau (HERMANN LUDWIG HEINRICH), PRINCE OF, b. on the family estate of Muskau in Saxony Oct. 30, 1785; studied law at Leipsic; served in the army during the wars against Napoleon; travelled much, and became widely known both for his enthusiasm for landscape gardening and through his spirited travelling sketches. D. at Branitz Feb. 4, 1871. Under his direction celebrated gardens were laid out at Muskau and at his usual residence, Branitz, in the Prussian province of Brandenburg; he also wrote *Andeutungen über Landschaftsgärtnerei* (1834). Of his travelling sketches several have been translated into English—*The Travels of a German Prince in England*, by Mrs. Sarah Austin (3 vols., 1832), *Tutti Frutti*, by Edmund Spencer (5 vols., 1834), *Mehemet Ali and Egypt* (3 vols., 1848).

Puddling. See IRON MANUFACTURE, by JOHN B. PEARSE.

Pueb'la, state of the Mexican confederation, between lat. 16° 20' and 20° 15' N., and between lon. 97° and 99° 15'

W., and bounded by the states of Mexico, Vera Cruz, and Oaxaca. Area, 11,761 sq. m. Pop. 830,560. The surface is an elevated plateau from 5000 to 7000 feet high, which to the W. rises into a lofty mountain-range, comprising the famous volcano Popocatapetl. Agriculture is the principal occupation of the inhabitants, and excellent wheat is produced. Some manufactures of cotton fabrics and earthenware are carried on.

Puebla, or **La Puebla de los Angeles,** town of the Mexican confederation, capital of the state of the same name, in a fertile plain at the foot of Mount Popocatapetl. It was founded in 1531, and has broad and regular streets, lined with gayly-colored, substantially-built, and richly-ornamented houses, and many fine public squares provided with fountains. Its cathedral is a magnificent building of noble and imposing exterior, while its interior is most gorgeously decorated with paintings, statues, carvings, and ornaments of gold and silver. The educational and benevolent institutions are numerous and good; there are 3 hospitals, an ecclesiastical seminary with 9 professorial chairs, a theatre, museum, public library, and 15 elementary schools. Soap, pottery, and a peculiar kind of cotton shawl used all over Mexico, are extensively manufactured. P. 75,000.

Pueb'lo, county of Central Colorado. Area, 3000 sq. m. Traversed by Arkansas River and by Denver and Rio Grande R. R.; is in part composed of mountains and valleys, and in part of grassy plains. Products, live-stock and wool. Corn and wheat are extensively raised by irrigation. Cap. Pueblo. P. 2265.

Pueblo, p.-v., cap. of Pueblo co., Col., on Arkansas River and on Denver and Rio Grande R. R., 126 miles S. of Denver, has 4 newspapers, is rapidly growing, and is considered the metropolis of Southern Colorado, being situated in the midst of an agricultural and stock-raising region. P. 666.

Pueblos [Sp. *pueblo*, "village"], a class of semi-civilized Indians of New Mexico and Arizona, so named from their remarkable communal houses, sometimes of several stories in height, which serve as the habitations of entire clans. (See ARCHITECTURE OF THE AMERICAN INDIANS.) They now number about 7000, inhabiting 19 villages, have about 450,000 acres of land, and own property to the amount of $535,750. They have considerable skill in agriculture, raising grain, cotton, vegetables, and fruits by means of irrigation, manufacture pottery and cotton stuffs, and preserve the same grade of civilization which they had three centuries ago. Many are Roman Catholics, but the majority retain their original religious beliefs and practices, prominent among which is the maintenance of the sacred fire and the worship of Montezuma, a divinity who must not be confounded with his namesake, the Mexican emperor. The Pueblos constitute several tribes and speak different languages. There is little warrant for the widespread belief that they are closely connected by race with the Aztecs. By the treaty of Guadalupe Hidalgo, as interpreted by Chief-Justice Slough in 1857, the Pueblo Indians are citizens of the U. S., but that status has never been recognized by either the Federal or Territorial government. Their internal administration is carried on by themselves in accordance with their ancestral customs, each village having a governor and a court or council of three elders. The U. S. agency maintains 8 schools with about 300 pupils. Their religious supervision has been assigned by the Indian bureau to the Presbyterians, who as yet (1876) have done little for their improvement, while the virtual exclusion of the Roman Catholics, who have had missions among them nearly 200 years, led to dissatisfaction, which culminated in a protest from the governors of fifteen of the nineteen villages.

Puen'te de Genil', town of Spain, province of Cordova, on the Genil, manufactures earthenware and trades in oil. P. 7853.

Puer'peral Fe'ver, a fever occurring only to women, following childbirth, and characterized by acute metroperitonitis, or inflammation of the uterus and peritoneum. It may occur in isolated cases in private practice, but more commonly develops in hospitals and lying-in asylums, where numerous patients are aggregated, the air vitiated, and especially if unfavorable surgical cases—erysipelas, gangrene, suppurating wounds, pyæmia, or septicæmia—are present. Under such circumstances many cases coexist or occur consecutively, and often spread to individuals in the surrounding community. Such epidemics, and its spread by seeming contagion, have led some to regard it as a specific and contagious disease. But a counter-opinion has greater weight of authority, that it is indeed only a condition of blood-poisoning by the absorption of septic or purulent matter on the recently-exposed and often lacerated interior of the uterus, or the inflammation of that organ and the peritoneum by the presence of septic matter in the blood. Thus, sudden suppression of the lochia or discharge following labor, sewer-gas, the emanations from decomposing animal or vegetable matter are causes of puerperal fever in the best localities and in households where no surgical source exists. The modern discovery and use of disinfectants, the adoption of the plan of isolated or pavilion hospitals, the entire separation of lying-in wards from surgical wards, the use of free antiseptic injections during the period of convalescence from confinement, have all proved efficacious in lessening the frequency of puerperal fever. Puerperal fever is chiefly characterized by the symptoms of peritonitis—swelling, tympanitis, tenderness and pain in the abdomen, constipation, nausea and vomiting, marked elevation of temperature, and rapid, feeble pulse; the exhaustion varies with the case; the patient may die early of collapse or following typhoid symptoms of several days' duration. The treatment comprises veratrum viride to control the circulation, opium as a specific in peritonitis, and antiphlogistic local applications to the abdomen. Cold cloths or ice, sedulously employed at the outset, may abort the inflammation or lessen its severity, but when the disease is established warm anodyne fomentations are preferable. Nutritious liquid food, quinine, and alcoholic stimulus must be administered at regular intervals and in doses determined by the degree of prostration.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Puerperal Mania, perversion of the mind in women immediately after childbirth and during the first week thereafter, exceptionally occurring before delivery, or developed weeks or months after labor by excessive and exhaustive nursing. It may therefore be considered as a derangement of the mind due to the influences of the childbirth upon the sympathetic nervous system and emotional nature of the mother. Puerperal mania may be characterized by mental agitation or excitability, or, reversely, the patient may sink into a state of mental apathy, moodiness, reticence, or despondency. There will be restlessness, inability to sleep, headache, impaired appetite, coated tongue—in some cases an increase of temperature. The bowels are usually constipated, the urine diminished in quantity. The secretion of milk is often lessened or suspended. Although the delirium in some cases is violent, no evidence of inflammation or other organic disease of the brain or its membranes has been detected as the lesions to which the symptoms would lead on post-mortem examination. In the delirious form and in the melancholic form there is equally an aversion to the father or the child. Suicide and murder of the child are occasional occurrences. Puerperal mania may be expected to occur in women of nervous temperament or those predisposed to insanity; in such also as are greatly reduced by previous ill-health, by hæmorrhage during or following delivery, or whose blood has been impoverished by absorption of malaria and putrescent effluvia. The prognosis is favorable; the mind in most cases is, in time, restored to a normal condition. The patient of puerperal mania may wholly escape it at subsequent childbirths if the system be fortified in advance by iron to correct anæmia, and care be taken to prevent unusual loss of blood during parturition. Where insanity or emotional excitability are family traits, mania may recur with successive labors despite all precautionary efforts. The treatment varies with the form of mania and severity of symptoms. The infant in most cases is to be removed, as it is unsupplied by the mother's breast-milk, and its influence is often pernicious; when left, it should have a constant attendant to guard it against injury at the hands of its mother. Firm but gentle control of the patient is essential, and often removal from husband, family, and familiar friends is essential to the quiescence of mind and body. Rest and sleep must be ensured by cerebral sedatives and soporifics, as bromide of potash, bromide of ammonium, hydrate of chloral, stramonium, hyoscyamus, or the preparations of opium when borne without excitement, as codeine and the deodorated tincture of opium. Even the hypodermic injection of morphine may be required in obstinate insomnia and delirium. The constipation is to be corrected, the diet must be nutritious, and the appetite, if deficient, stimulated by use of tonic elixirs and wine. The strength must be sustained and the blood enriched by cod-liver oil, quinine, and iron.

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Puerto de la Mar. See COBIJA.

Puer'to Cabel'lo, town of Venezuela, South America, province of Caraccas, on an island in the Gulf of Triste, has a most excellent harbor, large, commodious, and perfectly safe. It carries on a considerable trade, but its climate is unhealthy. P. about 8000.

Puer′to de San′ta Mari′a, or, simply, **El Puerto,** town of Spain, province of Cadiz, at the mouth of the Guadalete in the Bay of Cadiz. It is a handsome and well-built town, surrounded with fine promenades, and in communication with the great commercial centres, as it is the principal place for the exportation of the famous Xeres wine; over 1,500,000 gallons are annually exported from this place. Leather, soap, hats, brandy, and liqueurs are manufactured, and in May of each year one of the most famous bull-fights of Spain takes place here. P. 21,714.

Puer′to Prin′cipe, town of the island of Cuba, West Indies, was founded in 1514 by Velasquez on the site of the old Camaguei, close by the sea, but has since been moved twice farther inland, and is now situated 10 miles distant from its harbor, Nuevitas, on the northern coast of the island, with which it is connected by railway. P. 30,000.

Puff Ad′der, the *Clotho arietans,* a deadly serpent of South Africa, so called from its habit of puffing up the neck when irritated. It is very large and thick, and is ordinarily slow, but can move very quickly upon occasion. It is of most frightful appearance, and is frequently seen half buried in the sand. There is no known remedy for its bite.

Puff-Balls. These peculiar plants are placed in the order Trichogastres of the gasteromycetous group of Fungi, and are characterized by a single or double covering (*peridium*), with the spore-bearing interior (*hymenium*) at first spongy, but soon ripening into a dry, dusty mass of threads and spores. (For classification and definition of terms see Fungi.) Like other fungi, the puff-balls are parasitic, living usually on decaying vegetable matter, and pass rapidly through their stages of growth. Among the most common of our puff-balls are some of the species of the genus *Lycoperdon,* recognized by the thin membranaceous peridium, easily breaking away when ripe, allowing the escape of the spores from within. *L. pyriforme* is the pear-shaped species seen growing almost everywhere, single or in clusters, on decaying logs and stumps. The peridium in this species is quite tough, and the greenish-yellow spores escape through a small opening at the top. Fig. 1 represents a member of this species, with the rotten wood removed from the base and *mycelium. L. giganteum,* the "giant puff-ball," is the largest species, often attaining the size of a large foot-ball, with a few of extraordinary dimensions, measuring two feet in diameter. When young its white fleshy substance is esteemed for food, but soon the interior in ripening is reduced to a brown powder, which is sometimes employed as an anæsthetic. Another quite large species, and much more common than the last mentioned, is *L. cœlatum.* The peridium is flaccid and collapses at maturity, forming the shape of a cup, with the spores escaping by a rupture at the side. While young the species is eaten to some extent. *L. saccatum* is an elongated species growing in woods, and is easily recognized by the plaited folds on the under side of the peridium. The spores are of an amber color and covered with minute spines. A small species of the size of a marble is *L. pusillum,* often found on old pasture-land. The peridium also becomes flaccid, while the spores are very small and olive-colored. A common, small, and warty species often seen on rich soil has received the name of *L. gemmatum.* In the genus *Scleroderma* the peridium is firm, with distinct veins throughout the interior, spores large and granulated, arranged in masses. The most common species is *S. vulgare,* with its outer covering thick and early breaking away, leaving the bluish-black mass of the interior. They grow on gravelly banks under shrubs and trees, the largest and most mature more or less covered with warts on the upper surface. A thin-coated species, called *S. Bovista,* is sometimes found. *S. verrucosam* is characterized by its warty exterior and thin stem. Like the last, it grows on sandy soil. The genus *Bovista* is known by having a persistent peridium, usually very thin, and a continuous outer covering, which breaks away. *B. nigrescens* is of a blackish color, with the spores brown, one or two inches in diameter, often growing in pastures. Because of its lead color a small species has taken the name of *B. plumbea.* In *B. cyathiformis* we have a large species, often four to six inches in diameter, with a papery peridium and brown spores. In the genus *Geaster* the peridium is distinct and double, the outer one bursting and dividing into several stellate lobes, which often become much reflexed, giving a star-like appearance, warranting the common name of "starry puff-balls" which these species have received. In *G. hygrometricus*—so named because of the influence moisture has upon this plant, closing the outer covering in wet weather to open again on becoming dry—the spores, which are within the inner coat, and make up the interior of the sphere in the centre of the star, find their way out through an opening at the top. Figs. 2 and 3 show the closed and open states of this interesting and somewhat peculiar species of puff-ball. Much like this species, though having the mouth for the escape of the spores furnished with teeth and the whole covering of a red color, is the species *G. rufescens. G. fimbriatus, G. Curtisii,* and *G. saccata* are other rare species, agreeing with those just mentioned in their general shape and appearance. In some species of this genus the outer wall is divided into two parts, and a peculiar appearance is produced by the inner portion becoming separated and reflexed, raising the puff-ball into the air while it rests itself by its tips upon the upturned laciniæ of the outer wall. *G. fornicatus,* or "vaulting geaster" (Fig. 4), has this peculiarity, as has also the smaller species, *G. minimum,* and a somewhat larger member, *G. limbatus.* These pedicillate species are not very common. In the genus *Polysaccon* the peridium is simple, with the interior divided by masses of threads into many cavities or chambers. The genus is not a large one, and the species is rare. A yellow dye is obtained from a species growing in Italy. The remaining genera, *Batarrea* and *Tulostoma,* are characterized by having a stem of considerable length, and their species serve to connect the puff-balls with the neighboring group of Phalloidei.

Fig. 1.

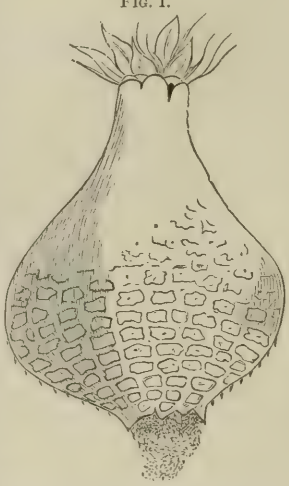


Fig. 2.

Fig. 3.

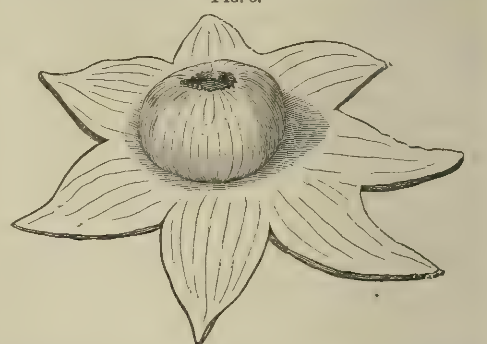


Fig. 4.

The tropics are much the richest regions in puff-balls, furnishing many large and beautiful specimens. As furnishing plants of economic value the puff-balls are of little value, but to the curious and scientific they are full of interest. (For works treating upon this subject see Fungi.) B. D. Halsted.

Puf′fendorf, von (Samuel), Baron, b. at Chemnitz, Saxony, Jan. 8, 1632; studied theology at Leipsic and mathematics at Jena; went as tutor to the son of the

Swedish ambassador to Copenhagen, where he wrote *Elementa Jurisprudentiæ Universalis* (published in Holland in 1660); was appointed professor of natural law at the University of Heidelberg in 1661; published in 1667, anonymously at Geneva, his *De Statu Imperii Germanici*, which contained a very severe criticism on the constitution and legislation of the German empire, and was burnt by the hangman in Austria; went in 1670 to Sweden, first as professor of law at Lund, afterward as royal historiographer at Stockholm; published in 1672 his celebrated work, *De Jure Naturæ et Gentium*, translated into English by Basil Kennet (London, 1749); returned in 1688 to Germany as historiographer to Frederick William of Brandenburg. D. at Berlin Oct. 26, 1694. As historiographer he wrote on Swedish and Prussian affairs, but his fame rests exclusively on his juridical works.

Puffin. See AUK.

Pugatcheff' (YEMELYAN), b. in 1726 at Simoweisk, a village on the Don, in the territory of the Cossacks; grew up as a member of a band of robbers; served in the Seven Years' war, first in the Russian, then in the Prussian, and at last in the Austrian army, and was imprisoned for some time after his return to Russia for attempts at sedition. A resemblance between him and the murdered emperor, Peter III., gave him an opportunity for one more adventure. A rumor was spread that Peter was not dead, but had escaped in disguise and was about to appear among his true Cossacks. In Aug., 1773, a proclamation from the emperor was issued. Shortly after Pugatcheff presented himself as the monarch, and was joined by a few other adventurers. The religious sect of the Raskolniks acknowledged him, and his party began to grow; the peasantry rose in his favor; he occupied several forts on the Ural and Don; some Tartar and Finnish tribes joined him, and he was on his march to Moscow with a considerable army when he was sold by his comrades for 100,000 rubles to Suwarow, and executed at Moscow Jan. 21, 1775.

Pu'get Sound, a large irregular bay in Washington Territory, forms one of the safest and best harbors on the Pacific coast. From it coal, lumber, fish, and fruit are exported. It is surrounded by a broken but fertile region, covered with dense and lofty forests.

Pugh (GEORGE ELLIS), b. at Cincinnati, O., Nov. 28, 1822: graduated in 1840 at Miami University; served in the Mexican war as captain 4th Ohio Vols.; city solicitor of Cincinnati 1850; attorney-general of Ohio 1851; U. S. Senator 1855–61. D. at Cincinnati, O., July 19, 1876.

Pughe (WILLIAM OWEN), b. at Tyn y Bryn, Merionethshire, Wales, Aug. 7, 1759; was originally named OWEN, but added the name of Pughe on receiving an inheritance; went to London in youth; engaged in the study of Welsh literature under the patronage of a tradesman named Owen Jones, with whom he published in 1789 the poems of the old bard Dafydd ap Gwilym, and with the assistance of Edward Williams issued the important work known as the *Myvyrian Archæology* (3 vols., 1801–07); edited various ancient Welsh books; published a Welsh and English dictionary (1793–1803), the *Cambrian Biography* (1803), and translated into Welsh Milton's *Paradise Lost*, Heber's *Palestine*, and other poems. D. in London June 4, 1835.

Pu'gilism [Lat. *pugil*, "a boxer"], the art of fighting with the fists in accordance with certain rules, usually practised as a public spectacle, and often for the interest of a wager or an honorary belt to be gained by the victor. Pugilism was practised on a vast scale in ancient Greece in connection with the Olympic and other national games, but was never popular under the Roman empire. It was revived in England in the middle of the eighteenth century, and soon became popular, many persons of the higher classes frequenting the exhibitions, and even taking part in them. In comparatively recent times prize-fighting has been sometimes practised in the U. S., but with all possible secrecy, it being prohibited by law. There is a considerable English and American literature of the subject.

Pugin' (AUGUSTUS), b. in Normandy in 1769; is known as a draughtsman by works illustrating mediæval architecture—*Architectural Antiquities of Normandy*, *Specimens of Gothic Architecture in England*, *Architectural Illustrations of the Buildings of London*, *Gothic Ornaments from Buildings in England and France*. The works were elaborate and costly; letter-press by competent hands, Wilson and Britton the antiquary. D. in England Dec. 19, 1832. O. B. FROTHINGHAM.

Pugin (AUGUSTUS NORTHMORE WELBY), son of Augustus, b. in London, England, Mar. 1, 1812; inherited his father's tastes and talents, adding to them literary ability. Having been converted to Romanism, he devoted himself with zeal to the revival of ecclesiastical architecture in England, designing churches and religious houses, seldom building secular edifices, and never erecting sacred ones for Protestants. In his later years he wrote pamphlets in defence and commendation of his faith, his enthusiasm for which made him for months an inmate of an insane asylum. His influence was great in fostering a taste for Gothic forms in architecture and ornament. His principal works are—*Examples of Gothic Architecture*, *Principles of Pointed or Christian Architecture*, *An Apology for the Revival of Gothic Architecture*, *Glossary of Ecclesiastical Ornament*. (See *Blackwood's Magazine* for Dec., 1861.) D. at Ramsgate Sept. 14, 1852. O. B. FROTHINGHAM.

Pugin (EDWARD WELBY), son of the preceding, b. Mar. 11, 1834; at the age of seventeen undertook the completion of his father's designs and contracts; a devoted Catholic, designed the cathedral at Queenstown; built churches in Liverpool, Kensington, Peckham, Barton, Sheerness, Stratford, Leeds, Cork, Dublin; also in Belgium—more than 100 churches in all—besides orphanages, colleges, priories, etc.; restored the archiepiscopal palace at Mayfield; finished a superb Gothic structure begun by his father at Scarisbrook Hall; claimed for his father the merit of designing the New Houses of Parliament, supporting the claim in a volume. D. Feb. —, 1876. O. B. FROTHINGHAM.

Pugwash, a seaport in Cumberland co., N. S., on Northumberland Strait, 50 miles W. of Pictou. It has quarries of gypsum, limestone, and sandstone. Deals are largely shipped to Great Britain. P. about 700.

Pujet' (PIERRE), b. at Marseilles Oct. 31, 1622; was apprenticed as a wood-carver in a shipbuilding establishment; visited Italy twice, studying art; practised painting for some time, but devoted himself subsequently to sculpture and architecture; resided for several years in Genoa, but was recalled to France in 1664 by Colbert as director of ship-decoration at the docks of Toulon; retired after a few years' service into private life. D. at Marseilles Dec. 2, 1694. His most celebrated works are *St. Sebastian*, in the church of St. Maria da Carignano in Genoa; *Milo devoured by a Lion* and *Perseus and Andromeda*, at Versailles. He belongs wholly to the school of Bernini.

Pujol', de (ALEXANDRE DENIS **Abel**), b. at Valenciennes, France, Jan. 30, 1785; studied painting under David, and obtained distinction by historical and religious pictures. D. at Paris Sept. 28, 1861.

Pulas'ki, county of Central Arkansas. Area, 700 sq. m. Traversed by the Arkansas River and by Cairo and Fulton and Memphis and Little Rock R. Rs. It is undulating, fertile, well timbered, and produces live-stock, corn, cotton, and lumber. Iron, lead, and silver ores, kaolin, and some coal are found. Cap. Little Rock. P. 32,066.

Pulaski, county of Central Georgia. Area, 550 sq. m. It is somewhat uneven, but fertile. Cotton, corn, and live-stock are leading products. Traversed by Brunswick and Macon R. R. and Ocmulgee River. Cap. Hawkinsville. P. 11,940.

Pulaski, county of S. Illinois. Area, 190 sq. m. It is uneven, very fertile, and well timbered. On the S. E. Ohio River separates it from Kentucky. Tobacco, wheat, corn, and lumber are leading products. Traversed by Illinois Central and Cairo and Vincennes R. Rs. Cap. Mound City. P. 8752.

Pulaski, county of N. W. Indiana. Area, 434 sq. m. It consists partly of prairie and partly of oak-openings. Grain, wool, and hay are leading products. Traversed by Pittsburg Cincinnati and Chicago and Louisville New Albany and Chicago R. Rs. Cap. Winamac. P. 7801.

Pulaski, county of Central Kentucky. Area, 640 sq. m. It is hilly and very fertile. Tobacco, grain, wool, and live-stock are leading products. Coal is found, with other valuable minerals. Traversed by Cumberland River and its forks. Cap. Somerset. P. 17,670.

Pulaski, county of Central Missouri. Area, 500 sq. m. It is very hilly, with fertile valleys and great mineral wealth. Corn and live-stock are leading products. Traversed by Gasconade River and Atlantic and Pacific R. R. Cap. Waynesville. P. 4714.

Pulaski, county of S. W. Virginia. Area, 325 sq. m. It is mountainous, and contains coal and other minerals. Grain and tobacco are important products. Traversed by New River and by Atlantic Mississippi and Ohio R. R. Cap. Newbern. P. 6538.

Pulaski, p.-v., Indian Creek tp., Pulaski co., Ind., on Tippecanoe River. P. 123.

Pulaski, p.-v. and tp., Jackson co., Mich. P. 1165.

Pulaski, p.-v., cap. of Oswego co., N. Y., at the intersection of Oswego and Rome and Syracuse Northern R. Rs., has an academy, 4 churches, a custom-house, jail, paper and straw-board mills, 2 banks, 1 newspaper, 2 door, sash, and blind factories, 1 foundry, a carbon-pipe factory, a

butter-tub factory, 2 tanneries, 4 grist-mills, and a chair-factory. P. 1560. L. READE MUZZY, ED. "DEMOCRAT."

Pulaski, p.-v. and tp., Williams co., O., includes Bryan, the county-seat. P. 3547.

Pulaski, tp., Beaver co., Pa. P. 943.

Pulaski, p.-v. and tp., Lawrence co., Pa., on Erie and Beaver Canal and Erie and Pittsburg R. R. P. 1563.

Pulaski, tp., Oconee co., S. C. P. 653.

Pulaski, p.-v., cap. of Giles co., Tenn., on Nashville and Decatur division of Louisville Nashville and Great Southern R. R., has 1 newspaper and is the trade-centre for a large agricultural district. P. 2070.

Pulaski, tp., Iowa co., Wis. P. 1082.

Pulaski (CASIMIR), COUNT, called in Polish KAZIMIERZ PULAWSKI, b. in Lithuania Mar. 4, 1747, son of Count Joseph Pulaski, who in 1768 formed the Confederation of Bar for the preservation of the liberties of Poland; was educated for the law; saw some military service under Charles, duke of Courland, and in 1769 joined his father and two brothers in the national struggle against the despotism of King Stanislaus Augustus. His father and brothers having perished in the war, Casimir was for some time commander of the insurgents, and made a bold attempt to seize the king in Warsaw. Being outlawed on the failure of this attempt, he escaped to Turkey 1772; participated in a war against Russia; proceeded to France, where he made the acquaintance of Franklin, and offered his services to the cause of American independence. Arriving at Philadelphia in the summer of 1777, he joined the army as a volunteer; distinguished himself at the battle of Brandywine, and two days later was appointed by Congress brigadier-general (Sept. 13), and given command of the cavalry. He took part in the battle of Germantown, and in Mar., 1778, having resigned his command, he formed at Valley Forge an independent corps of lighthorse and infantry called "Pulaski's Legion," officered chiefly by foreigners. By a surprise at Little Egg Harbor, N. J., a large part of his infantry was bayonetted, but the legion was again recruited to 330 men. In Feb., 1779, he set out for the South; reached Charleston May 8; made a vigorous but unsuccessful attack upon the British advance-guard May 11; accompanied Count d'Estaing to the siege of Savannah, where he was given the command of the French and American cavalry; was mortally wounded in the assault of Oct. 9; was carried on board the U. S. brig Wasp in Savannah, where he d. Oct. 11, 1780, and was buried on St. Helen's Island. A monument to his memory was erected by the citizens of Savannah, and the cornerstone laid by La Fayette in 1825. (See his *Life* in Sparks's *American Biography*, 2d series, vol. iv.)

Pul'ci (LUIGI), b. at Florence in 1431; belonged to the circle of Lorenzo de' Medici and Poliziano, and d. in 1487. Of his epic, *Il Morgante Maggiore*, Lord Byron has translated one song.

Pulgas, tp., San Mateo co., Cal. P. 1438.

Pulley. See MECHANICAL POWERS, by PROF. W. P. TROWBRIDGE, A. M., M. N. A. S.

Pullman (JAMES MINTON), b. Aug. 21, 1836, at Portland, Chautauqua co., N. Y.; graduated at St. Lawrence Divinity School in 1860; pastor of the First Universalist parish of Troy, N. Y., same year; ordained in 1862; accepted the pastorate of the church of Our Saviour, New York City, in 1867; organized the Young Men's Universalist Association of the city of New York in 1869; has been secretary of the General Convention of Universalists since 1868, and chairman of the publication board of the New York State convention of Universalists, having in charge the *Christian Leader* since 1869.

Pulmonaria. See LUNGWORT.

Pulmona'ta, an order of gasteropodous breathing mollusks, deriving the name from the fact that the blood is exposed to the air while circulating though a vascular network lining the internal surface of the bronchial cavity. There are two genera, *P. terrestris* and *P. aquatica*, the former comprehending five and the latter six genera.

Pulmon'ifers [Lat. *pulmo*, "lung," and *fero*, to "bear"], the name of a sub-class of gasteropods adapted for aërial respiration by a peculiar lung-like modification of the walls of the pallial cavity. It includes the common inoperculate land and fresh-water shells and slugs. (See GASTEROPODS.) THEODORE GILL.

Pul'que [Mexican], the fermented juice of various species of AGAVE (which see). It is obtained by scooping out a cavity in the crown of the plant just as the flower-stalk is about to form. In this cavity the sap collects for many weeks, one plant furnishing a large amount of juice. At first the taste is pleasant and the liquor harmless, but after fermentation it acquires peculiarly intoxicating properties, and is very injurious in its constitutional effects. It is used in Mexico and other parts of Spanish America.

Pulsatilla. See ANEMONE.

Pulse [Lat. *puls, pultis*], a general name for such seeds of leguminous plants as are used for human food. All kinds of pulse abound in vegetable caseine, and all are highly nutritious, but as a rule they are not easy of digestion, and are best suited for hard-working men. Beans, pease, and lentils are the most important kinds of pulse.

Pulse [Lat. *pulsus*, from *pellere*, to "beat"], the result of the blood-wave sent through the arteries of the body by the ventricles of the heart. Each contraction of these ventricles sends into the arteries two to four ounces of blood, which, entering vessels already full but contracted, expands, elongates, and uplifts them, and produces a sudden lifting and impulse on the finger applied to them. This impulse is equal in all the arteries of equal size throughout the body, but the physician usually examines it on the thumb-side of the wrist (in the radial artery), because there the vessel is near the surface, resting on bone, and its varying movements can be best appreciated. These movements indicate, first, the particular action of the heart, and second, the state of contraction or relaxation of the artery-walls. The frequency of the pulse in a healthy adult, at rest, is 72 to 75 beats in a minute—in women a little more frequent than in men; more frequent while standing than while sitting, least frequent in the recumbent position. But a slow pulse is sometimes found in healthy, strong persons; 40 or 45 beats are not very uncommon; Heberden and Fordyce have found it as low as 30 and 26, the latter in one instance no more than 20. Muscular exertion increases the number of heart-beats in a given time, and consequently the frequency of the pulse, in proportion to its amount and duration. Certain mental states, as surprise, anger, or a sudden sense of danger, will produce great increase in its frequency.

The pulse in disease sometimes becomes very frequent, and sometimes very slow. In inflammation of the membranes of the brain in children it has been often found, toward the termination, beating at the rate of 180 for a day or more; it has sometimes reached 200. The latter number cannot be easily counted at the wrist; 160 is often with difficulty made out; but the heart-beats can be appreciated by the ear at almost any rate of possible frequency, except in the mere flutter of some conditions of heart disease. In some states of disease of the brain and liver the pulsations are no more than 40, or even 30, in the minute.

Dr. Guy, after numerous observations at different ages, gives the following as his results in regard to normal frequency: At birth, 140 per minute; in infancy, 120; in childhood, 100; youth, 90; adult age, 75; old age, 70. Dr. Guy and others have noted that it is more frequent in the morning than in the evening.

There is nothing more wonderful in physical life than the lively sympathy of the heart, expressed by the varying pulse, in the various diseases that afflict the body. It "speaks a various language" which the educated alone can properly interpret. It is small or full, rapid or slow, hard or soft, quick or prolonged, irregular in various ways, giving a varying number of beats in the different fractions of a minute, the beats tumultuous, frequent, and slow alternately, or is double (*dicrotic* or *bisferiens*). It is often intermittent; that is, a single beat is lost. This occurs both with and without disease of the heart; it is often caused by the use of tobacco. In some states of imperfect innervation of the heart its pulsations cease entirely, to be resumed after the lapse of a considerable fraction of a minute. In two such cases the writer found the period of absolute inaction of the heart to be fifteen seconds. It was attended by extreme paleness, complete loss of consciousness, suspension of the breathing; indeed, temporary death. An instrument has been invented by which many conditions of the pulse can be inscribed on paper attached to a revolving cylinder. It is called a "sphygmograph."

Venous Pulse.—The arterial pulsation reaches the very small arteries, but is lost in the smallest or capillary arteries and capillary veins, so that the blood returns to the heart in a continuous, steady stream; but when the tricuspid valve is insufficient, a wave of venous blood may be sent back into the venous trunks and produces a visible pulsation, mostly in the veins of the neck. Such pulsations will correspond, as those in the arteries do, with the contractions of the ventricles (systole). Hypertrophy of the right auricle of the heart may also produce venous pulsations. So may aneurism of the aorta when it obstructs the current of blood descending through the vena cava, the enlarged artery communicating its pulsation to the blood in the vein. In some instances of difficult breathing the veins of the neck are seen to become distended in a sort of wave, apparently from below, but really from above, be-

cause the outlet is obstructed at the heart. This filling occurs in expiration, and the veins are emptied in inspiration. Though this action has been called pulse or pulsation, it is very different from the movement to which the term is commonly applied.

Nysten (*Dictionnaire*, etc.) states that the arterial pulsations in the horse are from 32 to 38 in the minute; in the ass, from 45 to 48; in oxen and cows, 35 to 42; in sheep, 70 to 77; in the dog, 90 to 100. These countings were made when the animals were at rest. ALONZO CLARK.

Pul'te (JOSEPH HIPPOLYTE), M. D., b. at Meschede, Westphalia, Germany, Oct. 6, 1811; took his medical degree at Marburg, having studied also at the gymnasia of Berlin and Söst; settled in Allentown, Pa., 1834, and was one of the founders of a homœopathic college at Allentown; removed in 1840 to Cincinnati, O.; professor of clinical medicine in the homœopathic college at Cleveland 1852; of obstetrics 1853–55; afterward professor of the science of clinical medicine in Pulte Medical College, Cincinnati, O.; served as editor to various professional and other journals; author of various works in English and German, of which the best known is the *Homœopathic Domestic Physician* (1850), which has had an extensive sale.

Pult'eney (WILLIAM), earl of Bath, b. in England in 1682; educated at Westminster School and at Christ Church, Oxford; entered Parliament as a Whig 1705; took part in the prosecution of Dr. Sacheverell; defended Walpole in the prosecution made in 1712; became on the accession of George I. privy councillor and secretary at war 1714–17; became cofferer of the household under Walpole 1720, but went over to the opposition 1725, becoming the bitterest political enemy of his former friend, against whom he wrote several pamphlets; fought a duel with Lord Hervey, in which both combatants were wounded, 1731; became extremely popular as the leader of the general crusade against Walpole; associated with Pope and the "wits" of the day, who paid him extravagant compliments for his literary ability; was the real framer of the cabinet of 1742 on the downfall of Walpole, though the earl of Wilmington was the ostensible head; was created at this time earl of Bath; lost much political influence by his transference to the Upper House of Parliament, and was premier for two days in Feb., 1746, on the resignation of the Pelham ministry, but was unable to form a cabinet. D. in London July 8, 1764, his title expiring with him, as he left no male issúe. Author of many political pamphlets, and chief assistant of Bolingbroke in writing the celebrated journal *The Craftsman.*

Pult'ney, p.-v. and tp., Steuben co., N. Y., near Crooked Lake. P. 1393.

Pultney, tp., Belmont co., O., on Ohio River, Central Ohio division of Baltimore and Ohio, and River division of Cleveland and Pittsburg R. Rs., includes the v. of Bellaire. P. 6319.

Pultneyville, p.-v., Williamson tp., Wayne co., N. Y., on Lake Ontario.

Pu'lu, or **Vegetable Silk,** a richly-beautiful fibre produced by a tree-fern of the genus *Cibotium*, growing in the Malay and other Pacific islands. The attempt to manufacture it has not proved successful, but it is a very useful styptic, and is considerably used as such by Dutch surgeons.

Pu'ma, or **Cougar** [*Felis concolor*, Linn.], a carnivorous animal found throughout South America and a great part of North America, known in Spanish American countries as the American lion, and in the U. S. as the catamount or wild-cat, and vulgarly as "painter" (a corruption of "panther"). The adult male is from four to five feet long, has a thick fur, brown above and grayish-white beneath, with the ears and tail nearly black, and sometimes partially striped along the sides. It climbs trees, lives chiefly upon deer, and has a shrill scream; is cowardly, and does not voluntarily attack man, but makes a desperate resistance to the hunter. It is easily tamed, and becomes quite docile.

Pum'ice [Lat. *pumex*], a light, porous mineral, a sort of soft trachyte, found near active or extinct volcanoes, and formed by steam in blast furnaces when water is poured over melted cinder. It is not unlikely that the admixture of gases in the lava from which it is formed is the cause of its porous nature. It is considerably used in the arts, in polishing hard materials, and in dressing parchment and fine leather. In the toilet it serves to remove stains and patches of thickened cuticle. It is chiefly exported from the Lipari Islands.

Pump. A pump is a machine for elevating water or other liquid. The height to which the water is raised is called the "lift." Pumps sometimes act not by raising water, but by forcing it into a vessel against a pressure, as in the case of the feed-pumps of steam-boilers. Such pressure may, however, be always represented by a head of water. The necessities of industry and the rivalry of inventors and manufacturers have given rise to innumerable varieties of this machine. The accompanying figures are examples of the types in most common use.

FIG. 1.

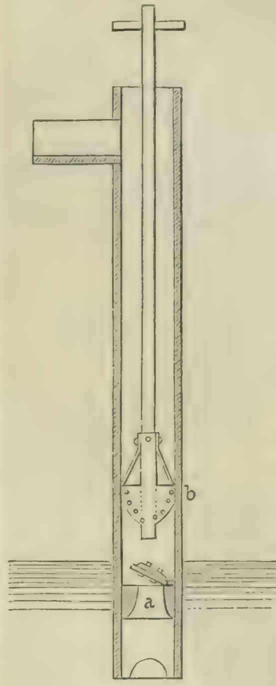


Fig. 1 shows the simplest form of this machine. It is used for lifts of but a few feet, for draining shallow pits and bailing flat-bottomed-boats. As it can be made by a carpenter in a few hours, it is frequently applied where there is but temporary need of a pump. It consists of a square wooden barrel, a foot-valve *a*, and a piston *b*. The foot-valve is a leather flap on a wooden seat; the flap has a leaden back to give it due stiffness and weight. The piston *b* is a leather cup attached to a wooden rod. On its downward stroke the water folds it together, and allows it to pass freely. In its upward movement the water distends or bags it out, causing it to press against the interior of the barrel, and making it tight. The water above the piston is simply lifted, while the water follows the piston and flows through the valve *a* in virtue of the atmospheric pressure. Pumps of this kind are sometimes arranged as at Fig. 2. The workman procures a tough sapling, and, fixing one end securely, attaches the other to the pump-rod. This acts as a spring to raise the piston. With this arrangement the workman throws his weight upon the spring at each stroke, pressing down the piston, which rises with but slight effort. He works in this manner with much less fatigue than in raising the water by a dead lift. Water is always poured into such a pump before starting it.

FIG. 2.

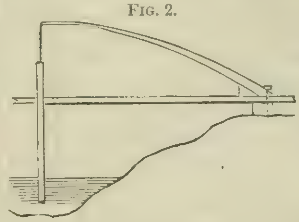


Fig. 3 is a section of a force-pump much used for domestic purposes. Fig. 6 is a general view of the same. The valves, the most important organs of the pump, are fully shown here and at Figs. 4 and 5. Fig. 4 is the valve *m* or *k*, which serves at the same time as a joint-packing. The outer ring serves as the joint-packing. The inner circle is the valve or flap. The neck between the two is the hinge. A backing of lead gives

FIG. 3.

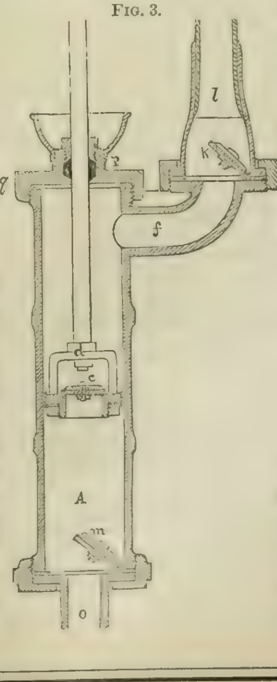
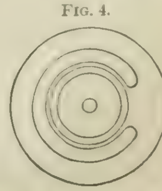


FIG. 4.



weight and stiffness to the flap. The piston-rod passes through a stuffing-box P in the cover q, and is moved by a handle, as shown at Fig. 6. The action of the pump is readily understood. During the downward movement of the piston the valves m and k close, preventing the backward movement of the water. The pressure of the water raises the valve c in the piston, and allows the water to pass through the piston as it descends. During the upward movement of the piston the valve c is closed. The water above the piston is forced through the branch f, raising the valve k and passing into the ascending pipe l. The atmospheric pressure forces the water through the supply-pipe o into the pump-barrel A, raising the valve m. This pump differs from the ordinary domestic pump only in delivering the water above the pump. If the cover q and the branch f were removed, it would be the ordinary suction-pump discharging at f. The piston of the ordinary suction-pump is more commonly made as shown at Fig. 5. It has a joint at c, as the piston-rod does not move in a straight line. The leather packing is also differently applied from that shown at d, Fig. 3.

Fig. 5.

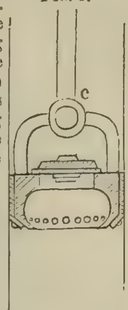
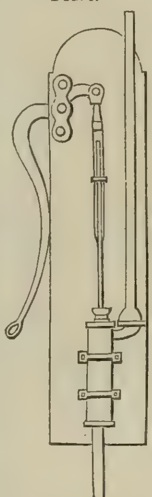


Fig. 6.



It will be noticed that the pumps shown at Figs. 1 and 3 are *single-acting*. They furnish a stream only during the ascent of the piston. Fig. 7 represents a double-acting pump driven by a powerful steam-engine. It is one of a pair of pumps constructed by Mr. Worthington of New York for the town of Brookline, Mass., intended to raise 2,000,000 gallons of water per day to a height of about 180 feet. The plunger a moves horizontally through water-tight packing. It is supposed, in the drawing, to be moving as indicated by the arrow. In so doing it diminishes the water-space in the chamber b, forcing the water through the valves $l\ l\ l$ into the chamber e communicating with the force-main f. At the same time it tends to create a vacuum in the chamber c, which tendency causes the water to rise from the pump-well through the pipe g and chamber d, lifting the valves $o\ o\ o$ and entering the chamber c. During the return stroke the water enters the chamber b through the valves $n\ n\ n$, and passes from c to e through the valves $m\ m\ m$, the valves $l\ l\ l$, $o\ o\ o$ remaining closed. This is called a *double-acting* pump, because it discharges an unintermittent stream. h is an air-chamber communicating with the force-main. Its use is explained under the head of PUMPING-ENGINES. Figs. 8 and 9 show the valves of this pump: g is the valve-seat, of iron with a brass face. It is leaded into a recess in the plate; a is the valve, of rubber; f, a spindle on which the valve slides in rising and falling; b, a plate forming a socket for the valve and a bearing for the spring; d, a spiral spring of brass wire; c, cap; $h\ h$, nuts. Each pump has twenty-four valves, there being two rows, only one of which appears in the drawing.

Fig. 7.

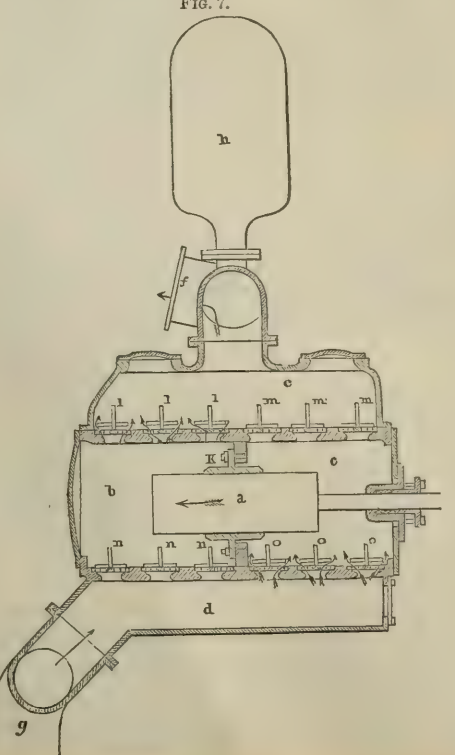


Fig. 8.

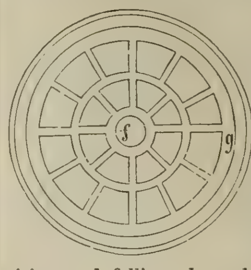


Fig. 9.

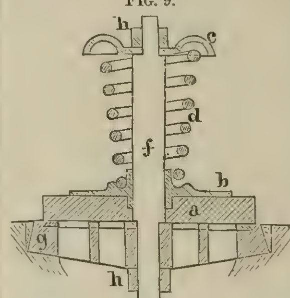


Fig. 10 is an outline sketch of a double pump for supplying the city of Brooklyn, N. Y. It is driven by an enormous steam-engine, and is capable of raising 10,000,000 gallons 170 feet in 16 hours. $a\ a$ are the pump-barrels; $b\ b$, the pistons, each having a valve; $d\ d$ are the piston-rods, each passing through a stuffing-box and attached to the opposite ends of the balance-beam of the steam-engine, so that one piston descends while the other rises; $c\ c$, $e\ e$ are valves in the annular spaces around the pump-barrels. The operation of this pump is as follows: The upper piston while rising draws the water through the valve of the lower piston and the valves $e\ e$. The lower piston while rising forces the water through the valve of the upper piston and the valves $c\ c$. The traverse or stroke of each piston is 10 feet, and each stroke advances the column of water in the force-main by this distance. No attempt is made to show the construction of these valves; examples of such will be found under the head of VALVES.

Fig. 10.

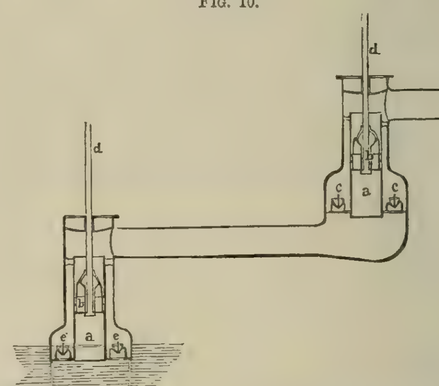
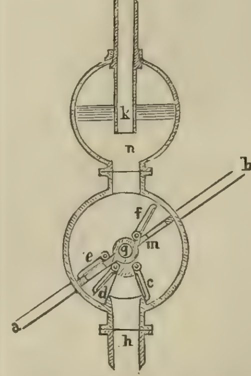


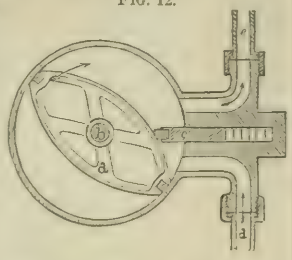
Fig. 11 is a pump devised by Bramah, and much used in the old-fashioned hand fire-engine. It is operated by giving a rocking movement to the shaft g by means of brakes on the ends of the arms $a\ b$. The shaft g carries a diaphragm m closely fitting the cylindrical pump-chamber. Upon pressing down the end b of the arm, the diaphragm revolves from m toward c. The valves c and e close, d and f open. The water is drawn through the pipe h and forced into the chamber n. When the diaphragm revolves in the oppo-

Fig. 11.



site direction, c and e open, d and f close, and the same movement of the water takes place. The chamber n is partly filled with air in a high state of compression, whose elasticity helps to maintain an uninterrupted stream through the pipe k. Fig. 12 is a pump also said to be invented by Bramah, to be operated by a continuous rotary movement. An elliptical diaphragm a fits the cylindrical pump-chamber tightly by means of suitable packing at the circumference and ends.

FIG. 12.



A sliding partition c is pressed by springs against this diaphragm, forming a tight connection in every position of the latter. The shaft b passes through a stuffing-box in the end of the pump-chamber, and is turned by a crank in the case of a hand-pump and by a belt and pulley in a power-pump. The diaphragm revolving in the direction of the arrow, the space communicating with the supply-pipe d enlarges, and draws the water through d, and the space communicating with the discharging pipe e diminishes, and forces the water through e.

We come now to the centrifugal pump, a machine much used in hydraulic constructions requiring the temporary removal of large volumes of water. The water is caused to revolve with great velocity in a circular chamber. The tendency which water, in common with all heavy bodies, has to move in a straight line causes a pressure upon the circumference of the chamber sufficient to make the water rise to a greater or less height, depending on the velocity. The simplest, most efficient, and most reliable form of the centrifugal pump is the one indicated by Figs. 16 and 17. It is placed at the lowest point of the pit to be drained, and being once put in position, cannot be readily changed. The water receives a rotary movement from arms attached to a vertical shaft. It enters the pump at the centre and rises through a pipe at the circumference. The shaft is driven by a steam-engine by means of a belt and pulley at the top. This form of pump requires no valves and is not readily deranged. The height to which the water will rise is the height due the velocity of rotation at the circumference—that is, the height from which a heavy body must fall to acquire this velocity. It is not always convenient to place the pump at the lowest point of the pit. Some excavations require pumping before reaching the lowest point. Some also require frequent changes of the position of the pump. For such cases a pump has been devised which can be placed at the top of the lift, raising the water by suction. Figs. 13, 14, and 15 show such a pump in detail, as constructed by Messrs. White, Clarke & Co. of Baldwinsville, N. Y. The cylindrical shell is made in two halves. Fig. 13 shows one-half with the arms. Fig. 14 is a vertical section showing the valves. a is the driving shaft passing through a stuffing-box b, and carrying the arms, which are not shown in the section. The shaft carries a pulley through which it receives motion from a portable steam-engine; $c\ d$ are the valves. They are made of thick rubber, cut out as shown at Fig. 4, serving as joint-packing as well as valves. Fig. 15 is an auxiliary hand-pump attached outside the suction-pipe, between the valves, for the purpose of filling the latter and the pump before starting. It is a single-acting plunger-pump. When the plunger rises, the valve d is lifted, admitting air or water into the space between the valves. When the plunger falls, c rises, etc. While the pump is in operation the water flows continuously through the valves. These are not essential to the action of the pump while running, but only necessary in filling it and preventing it from emptying when it stops. The length of the suction-pipe is increased as the excavation progresses. This pump is of course subject to the same restriction as all suction-pumps. Its lift cannot exceed the height due to the pressure of the atmosphere. In fact, it cannot work efficiently with more than three-fourths of that lift. J. P. FRIZELL.

FIG. 13.

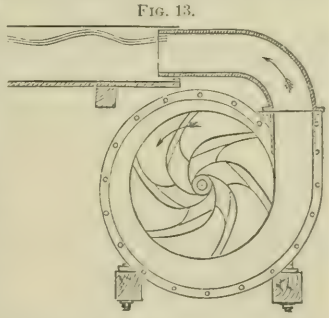


FIG. 14.

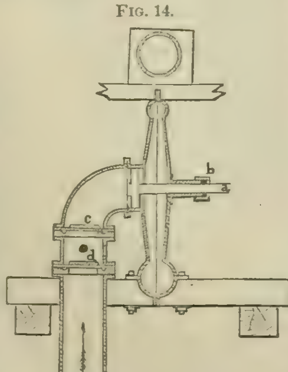


FIG. 15.

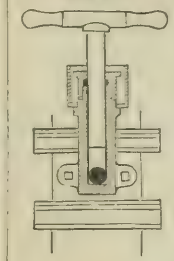


FIG. 16.

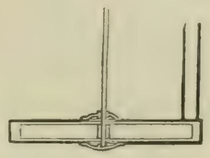


FIG. 17.

Pumps, Air. See PNEUMATICS.

Pumpelly (RAPHAEL), b. at Owego, Tioga co., N. Y., Sept. 8, 1837; educated at Paris, Hanover, and Freiberg, Saxony, 1854–60; was engaged in mining operations in Arizona 1860–61; was employed by the government of Japan to explore the island of Yezo 1861–63; by the government of China to report upon the coal-supply of that empire 1863–64; returned to the U. S. over land through Mongolia, Siberia, and Russia; became professor of mining engineering at Harvard 1866; made a survey of the copper-region of the upper peninsula of Michigan 1870–71, and was State geologist of Missouri 1871–73. Author of articles in scientific journals in French, German, and English, of *Geological Researches in China, Mongolia, and Japan* (1867); *Across America and Asia* (1870), and of volumes of the *Geological Survey* of Michigan (1873) and of Missouri (1873), each accompanied by an atlas.

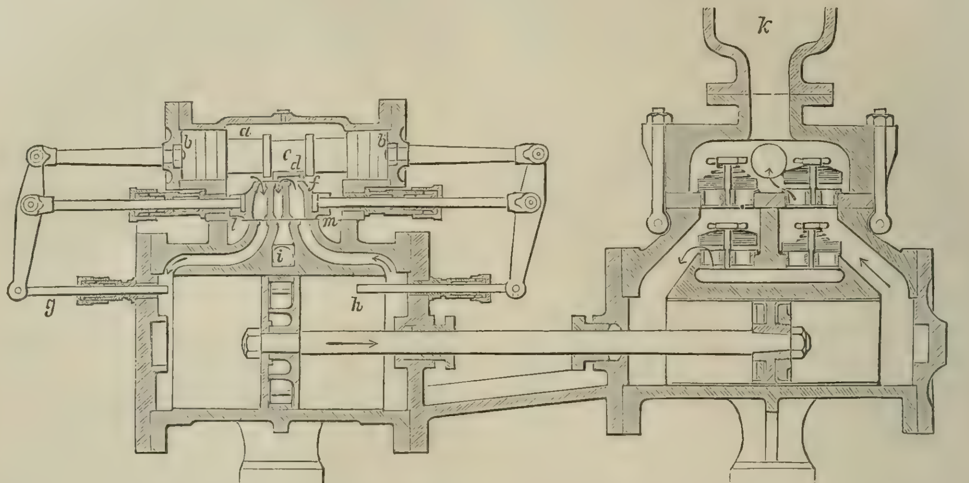
Pump'ing-En'gine. This term is applied to a steam-engine constructed specially for driving a pump, the engine and pump being inseparable from each other, and constituting together one machine. The general principles of the construction of the steam-engine will be found under the appropriate headings. Nothing more can be attempted here than a brief exposition of the distinctive principles applied in adapting the engine to pumping.

Pumping is almost always performed by the reciprocating rectilinear movement of a piston or plunger. Rotary pumps, properly so called, are but very little used. The centrifugal pump is used for temporary purposes, and is driven by an ordinary engine. Inasmuch as steam is almost universally applied by giving a reciprocating rectilinear movement to a piston and rod, the most simple and natural idea of a pumping-engine consists of a steam-cylinder in the same line with the pump-cylinder, the pistons being connected by the same rod. This is a common form of engine for dealing with small quantities of water. Such machines are called direct-acting engines. They have the advantage of great compactness and moderate cost. They are also free from an inconvenience belonging to crank-engines; viz. in certain positions of the crank called "dead points" the engine cannot be started. On the other hand, they have very serious disadvantages. The steam must be maintained at full pressure during the stroke, losing all the benefit of expansion. Moreover, to reverse the motion of the piston at the proper point without too much clearance requires valves and valve-gear of more complicated construction than the crank-engine. A clear understanding of the first disadvantage requires a few words as to the nature of expansion.

In unexpansive engines the "port" or orifice for the admission of steam from the boiler is kept open during the entire "stroke" or traverse of the piston. At the end of the stroke the cylinder is filled with steam of the same pressure substantially as that in the boiler. This is rejected through the exhaust-port on the return stroke of the piston. In an expansive engine the admission-port is closed when the piston has performed a part of its stroke, the remainder being performed by the expansion of the steam in the cylinder. The portion of the stroke performed with the admission-port open is called the "admission." The

point at which the admission-port is closed is called the "cut-off." If the cut-off occurs when the piston has performed one-fourth of its stroke, the engine is said to have a cut-off of one-fourth and a fourfold expansion. Steam used with twofold expansion gives 67 per cent. more power than when used without expansion, with threefold expansion more than twice as much, with fivefold expansion two and a half times as much, with tenfold expansion more than three times as much, and with twenty-fold nearly three and three-fourths times as much. It is at once apparent from these facts that no efficient pumping-engine can be constructed which does not avail itself of the expansive force of the steam, and its efficiency usually depends upon the extent to which it can use this agency. We accordingly recognize four general types of the pumping-engine, distinguished by the means employed for using expansion: (1) Simple direct-acting or non-expansive engines. It will readily be perceived that a simple direct-acting engine, as shown at Fig. 1, cannot use steam expansively. As soon as the steam is cut off, the pressure upon

Fig. 1.



the steam-piston commences to diminish, and if the degree of expansion is great, the pressure becomes very small toward the end of the stroke. On the other hand, the resistance to the movement of the water-piston is the same at all parts of its stroke, so that as soon as the steam-pressure falls below this latter the movement must stop. In this machine the advantage of expansion is sacrificed to compactness and simplicity. (2) Direct-acting engines with more than one cylinder of different capacities, the exhaust-port of the smaller cylinder communicating with the admission or "steam" port of the larger. No cut-off is used in such engines, but a limited degree of expansion is secured, combined with a nearly uniform pressure on the pump-piston or plunger. (3) The Cornish engine (so called from its having formerly been the leading type of engine employed for draining the mines of Cornwall, Eng.). In this type of engine the steam only acts upon one side of the piston. Its immediate effect is to lift, or rather to toss, an enormous weight, which in its descent acts upon the plunger of the pump. How such a movement can exert the expansive force of the steam will appear upon a little reflection. Let Fig. 12 represent a cylinder and piston, the piston being attached by means of its rod to a heavy weight. Suppose steam admitted through the port *a*, of pressure barely sufficient to raise the weight. It will rise as long as the steam enters the cylinder, and stops as soon as it ceases. No expansion can take place in this case. The steam must be discharged from the cylinder at the same pressure that it had when it came from the boiler. Let us now vary the supposition by assuming the steam to exert a pressure on the piston equal to two or three times the weight. The latter rises suddenly with a jump. Suppose the steam to be cut off when the bottom of the piston has reached the position *b c*, the piston continues to rise under the action of the expanding steam. When it reaches the position *k l*, where we may suppose the pressure of the steam, by reason of the expansion, to be equal to the weight, it has a velocity sufficient to carry it much higher. Now, above *k l* the pressure of the steam is not sufficient to lift the piston were it at rest, but being in motion the pressure exerts its full effect in prolonging its movement. The piston passes the line *k l* with a velocity sufficient to carry it to *d e*; the expansive force of the steam extends its movement to *f g*. It is evident that, supposing the steam to be always cut off at the same point, the greater its pressure the higher the weight will ascend. In this way any desired degree of expansion may be secured, and the pressure of the steam may be utilized after it has become far too attenuated to operate the pump directly. (4) Pumping-engines with fly-wheels. These expand their steam upon the same general principle of mechanics as the Cornish engine; that is, they employ the superfluous pressure of the early part of the stroke in imparting momentum to an immense weight, which makes good the deficiency of pressure in the latter part of the stroke. The weight consists of the rim of a wheel to which motion is communicated by the piston through its rod and a connecting-rod. The introduction of this member between the steam-cylinder and pump, with the requisite connections and appendages, makes this type the most elaborate and expensive of all the forms of the pumping-engine, while at the same time it has been found in this country the most efficient.

Fig. 2.

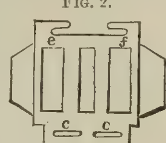
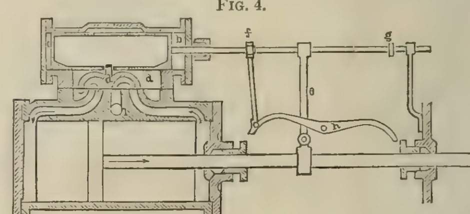


Fig. 3.

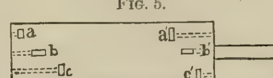
Figs. 1 to 6 are illustrations of the first type of engine. The most important feature of these engines is the mechanism for moving the valves. Let us first consider Fig. 4,

Fig. 4.



which represents in principle the pump invented and manufactured by Mr. L. J. Knowles of Warren, Mass. Here *d* is the main valve, which, when moved to the left, uncovers the passages for causing the piston to move to the right, and *vice versâ*. At first view, it would appear sufficient to attach to this valve a rod with tappets *f* and *g*, to be operated by the arm *e* on the piston-rod. A little reflection will show the unfitness of such an arrangement. The movement of the valve in that case would be barely sufficient to reverse the movement of the piston, but not sufficient for the proper working of the engine. With a heavy load the ports would be open less than with a light one, since less force would be required to arrest the movement of the piston. For this reason makers of these engines have recognized the necessity of introducing an arrangement for continuing the movement of the valve after the motion of the piston is reversed. This arrangement consists of an auxiliary cylinder and piston. The auxiliary cylinder (Fig. 4) is truly cylindrical at its ends *b c*. The central part is enlarged, forming the steam-chest *a*. The auxiliary piston reaches

Fig. 5.



nearly the whole length of its cylinder, fitting steam-tight at the ends. It is attached to the valve *d*, and carries the latter with it in its movement. At each end of the piston on its lower side are three minute openings or ports, each communicating with a passage which leads to the space at the end of the piston. A rod attached to the piston passes through a stuffing-box in the cylinder. It is called the valve-rod or valve-stem. An arm *e* is attached to the rod of the main piston. Its upper end has a hole through which the valve-rod passes freely. A tappet on this arm strikes the curved rocking-lever *h*, and gives it a tilt at each stroke of the main piston. The rocking-lever is connected with the valve-rod by an arm, as shown at Fig. 6, and the tilt has the effect of communicating a slight movement of rotation to the auxiliary piston. Near each end of the auxiliary cylinder, in the bottom, are two minute ports—one communicating with the steam-chest, the other with the exhaust-passage. The consequence of this arrangement is that when one of the openings in the piston (as *b′*, Fig. 5) coincides with the exhaust-port in the cylinder, the steam escapes from the space *b*, Fig. 4. When it coincides with the steam-port the steam is admitted to *b*, etc. The operation of this mechanism is as follows: The main piston is moving toward the right in Fig. 4; the steam is entering the left end of the main cylinder, and escaping from the right end through the exhaust-passage *i*; when the main piston approaches the end of the cylinder the tappet on the arm *e* strikes the right end of the lever *h*, causing a slight rotation of the auxiliary piston. This rotation brings the port *b*, Fig. 5, opposite its steam-port, and the port *c′* opposite its exhaust-port. The auxiliary piston then moves to the right, carrying the valve *d* with it, admitting steam to the right, and allowing it to escape from the left of the main cylinder. The forward movement of the auxiliary piston closes the exhaust at *c′*, and brings *a′* in communication with its steam-port, bringing the auxiliary piston to rest. When the main piston reaches the left end of the cylinder the reverse action takes place. In such small engines it often happens that the water in the well or cistern falls till the pump sucks air. In that case the piston starts forward with great velocity. To prevent it from striking the cylinder-head, in such a case, before the auxiliary piston has time to act, the tappets *f g* on the valve-rod enable the piston and valve to be moved by the direct action of the tappet-arm *e*.

Fig. 6.

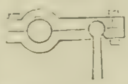


Fig. 1, taken from London *Engineering*, July, 1875, is a section of a steam-pump made by George F. Blake & Co. of Boston. It has an auxiliary piston *c* moving the main valve *d*, shown in section at Fig. 3. The distinctive feature of this engine is the auxiliary valve *f*. This is in fact a movable valve-seat. It slides upon the main valve-seat *l m*, but not far enough to close any of the ports. It also forms a seat on which the valve *d* slides. Fig. 2 shows the bottom of the auxiliary valve, and Fig. 13 its seat; *c c′* (Fig. 2) are recesses in the valve. On the seat (Fig. 13) five minute ports appear, in addition to the three large ports leading to the main cylinder and exhaust. The ports *d* and *f* lead to the space *b′* (Fig. 1), *a* and *e* lead to *b* (Fig. 1), and *b* leads to the exhaust. When the valve (Fig. 2) resting on the seat (Fig. 13) is moved to the right, the recess *c* covers the two ports *a b*, putting the space *b* (Fig. 1) in communication with the exhaust. The port *f* is uncovered, admitting steam to the space *b′*, Fig. 1, causing the auxiliary piston to move to the left. The action of the engine will now be apparent. The main piston, moving to the right as indicated, strikes the tappet-rod *h*, carrying it outward, moving the auxiliary valve, and bringing *g* into a position proper for the return stroke. The auxiliary piston moves to the left, as explained, carrying the main valve *d* into the position necessary for reversing the movement of the main piston. Should the main piston "run away"—that is, move so fast that the auxiliary piston cannot act, which occurs when the pump sucks air—the auxiliary valve is carried beyond the main valve, and takes steam for reversing the movement of the main piston. An improvement recently made in these pumps consists in using a single tappet-rod passing through the water cylinder-head, instead of the two shown here. The reverse movement is made by the water-piston.

Fig. 7.

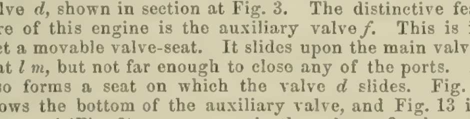
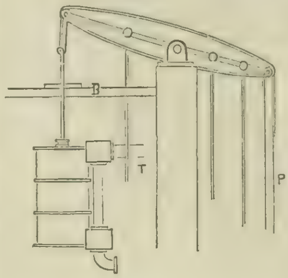


Fig. 7 indicates the construction of a pumping-engine of the second type, expanding the steam by means of two cylinders without cut-off. *c* is the small or high-pressure cylinder, *a* its steam-chest, *g* its exhaust-passage; *d* is the large or low-pressure cylinder, *b* its steam-chest, *h* its exhaust-passage. The steam passes from the exhaust-passage of the high-pressure to the steam-chest of the low-pressure cylinder through the pipe *f*. From the latter it passes to the condenser. In the figure a movement of the valve-rod to the right will put both valves in a position to admit steam to the left of each piston and release it from the right. The pistons may be fixed to the same rod, but the more usual arrangement is to provide the large piston with two rods passing outside the small cylinder. The rod of the small cylinder drives the pump, and the two rods of the large one are attached to it by a cross-head. These engines are often arranged in pairs, each actuating a pump delivering into the same main. Each engine in this case serves as an auxiliary cylinder to work the valves of the other.

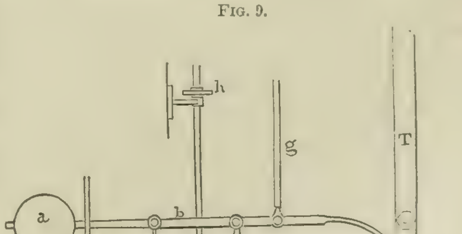
It may be observed that the Cornish and fly-wheel pumping-engines may have more than one cylinder, but they use the cut-off in addition. A combination of cylinders without cut-off is the only means of working steam expansively used in direct-acting engines.

Fig. 8.



The general arrangement of the Cornish engine, as applied to mine-pumping, is indicated at Fig. 8. The weight to be lifted consists of the pump-rod and its attachments, called the "pit-work." The rod is composed of timbers placed end to end and fastened together by iron fish-plates and bolts. In its descent it actuates the pump-plungers. The total weight is often much greater than could be lifted by the engine; it is sustained, in part, by counterweights called "balance-bobs." The steam is admitted above the piston, lifting the weight by means of a balance or working-beam. In the figure P is the pump-rod, T is the "plug-rod" for working the valves. Two other rods are shown, one of which works the air-pump of the condenser, the other the feed-pump for supplying the boiler. B is one of a pair of heavy timbers called the spring-beams, to prevent the piston from overreaching its stroke and striking the bottom of the cylinder in case the pump-rod should break or the valves should not work as intended. In such case a projection on the end of the working-beam strikes these timbers. The same necessity exists in the Cornish as in direct-acting engines for an independent mechanism to control the movement of the valves. This mechanism is called the cataract, and is shown at Fig. 9. It consists of

Fig. 9.



a cistern in which works a small plunger-pump. A tappet on the plug-rod T when the latter is near the lower part of its stroke presses down the handle *e* and raises the plunger, together with the heavy weight *a*. The plunger rises readily, drawing water into the cylinder *f* through the valve *d*. When it descends the valve *d* closes, leaving no escape for the water except through an opening which may be regulated at pleasure by raising the rod *c* by a thumb-screw *h*. The lower end of the rod *c*, it will be noticed, is a conical plug, fitting a corresponding aperture. The descent of the weight *a*, acting through the rod *g* and other suitable mechanism, operates such of the valves as cannot be moved directly by tappets on the plug-rod. By

means of the thumb-screw *h* the speed of the engine is regulated according to the quantity of water to be drawn from the mine. Fig. 10 shows a valve much used in Cornish engines: *c* is the cylinder, *b* the steam-port, *a a* the steam-chest, *d* the valve-rod. This is called a balanced valve. The pressure of the steam offers but slight resistance to its being opened. A slight movement of the valve-rod causes a large opening for the passage of the steam. It is never raised so much as appears in the figure.

FIG. 10.

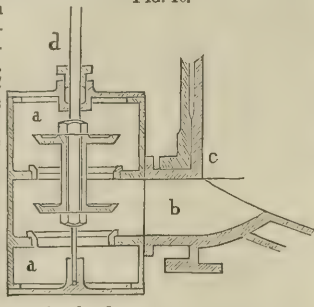
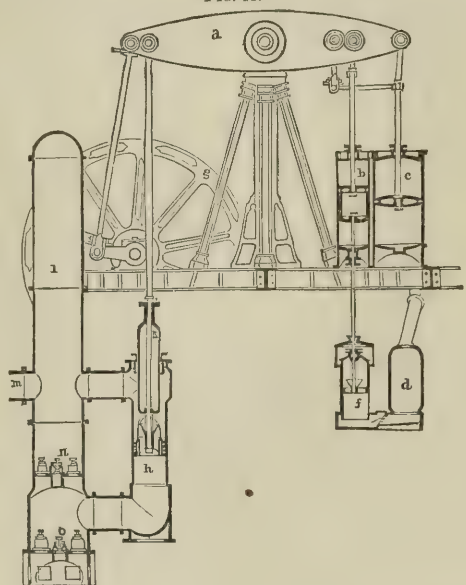


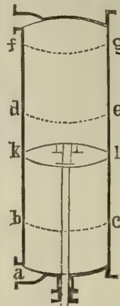
Fig. 11 is an engine of the fourth type, being one of a pair recently constructed for the Milwaukee waterworks. (The cut is taken from the report of the water commis-

FIG. 11.



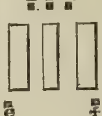
sioners of that city.) *a* is the beam, *b* the high-pressure cylinder, *c* the low-pressure cylinder, *d* the condenser, *f* the air-pump, *g* the fly-wheel, *h* the pump-barrel, *k* the plunger, *l* the air-chamber, *m* the force-main, *n*, *o* the valves. From a defect in the drawing it appears as if the pump-rod were rigidly attached to the plunger, which would be impracticable, as the upper end of the rod must have a slight lateral movement corresponding to the oscillations of the beam. The more usual construction is the one shown in the small plunger, Fig. 9. The steam from the boiler enters the high-pressure cylinder *b* on which the cut-off mechanism operates. The exhaust-passage of *b* communicates with the low-pressure cylinder *c*, where it acts at diminished pressure, but on a larger area of piston. From *c* it exhausts into the condenser, and is condensed by a shower of cold water. The piston of *b* is elongated, as from its connection with the fly-wheel its stroke cannot be equal to that of *c*. A second rod passes through a stuffing-box in the bottom of the cylinder *b*, and works the air-pump for extracting from the condenser the water used to condense the steam and the air disengaged from it under the influence of heat. The pump consists of the plunger and a bucket or piston with valves. All the valves allow the water to pass upward, but not downward. Upon the downward stroke of the pump the water is forced through the main *m* by the displacement of the plunger, which is forced into the water-space. Upon the upward stroke a column of water of the diameter of the pump-barrel is lifted, but this is diminished by the volume of the plunger, which is withdrawn from the water-space. The upper part of the chamber *l* is filled with air highly compressed. The purpose of this is as follows: At the commencement of the stroke, when steam is admitted to the cylinder, the fly-wheel is hurried forward. Toward the end of the stroke, when the pressure of the steam on the pistons is greatly diminished by expansion, the movement of the fly-wheel slackens. Now, without the air-chamber the acceleration of movement would take effect upon the whole force-main, often a mile or more in length. The air-chamber serves as a sort of reservoir to equalize the flow through the main.

FIG. 12.



Duty of Pumping Engines.—This is a conventional phrase, usually understood to mean the number of pounds of water raised 1 foot by the combustion of 100 pounds of coal. The first type of engine is expected to yield a low duty. It is only employed when simplicity and compactness are more desirable than economical working. Well-constructed engines of the second type give a duty of 50,000,000 or 60,000,000. The Cornish engine is capable of a high duty. In 1827 the average duty of eleven engines in Cornwall was reported as 64,000,000, one of which reached 87,000,000. In 1834 a maximum duty of 90,000,000 was obtained, and instances are more recently reported of 100,000,000, and even 120,000,000. These results for the Cornish engine refer to the combustion of 1 bushel of coal (84 pounds), instead of 100 pounds. At the present day, however, the average duty of Cornish engines is much less than the above, being not over 50,000,000 for 100 pounds of coal; they work with less expansion than formerly. It must be observed that in this engine the higher the degree of expansion the more violent must be the initial strain upon the pump-rods or "pit-work." In the course of time, as shafts have become deeper and pit-work more cumbrous, the frequency of breakage has made it advisable to diminish the strain upon the pit-work at the expense of a diminished economy in the use of coal. The engine shown at Fig. 11 yielded a trial duty of 75,000,000; a similar engine, tested at Lynn, Mass., gave something over 100,000,000 with 100 pounds of coal.

FIG. 13.



J. P. FRIZELL.

Pump'kin, or **Pompion** [Lat. *pepo*; Fr. *pompon*], the fruit of *Cucurbita Pepo*, a coarse annual vine of the gourd family. It is much cultivated in the U. S. as food for cattle, and is often employed in making pies. Many varieties are known.

Pumpkinton, tp., Pickens co., S. C. P. 716.

Pun [perhaps from the local English *pun*, to "pound," and the Anglo-Saxon *punian*, to "bruise"], a kind of play upon words, in which a word is capable of being understood in two or more quite different senses, the combination of which, or the mental change from one to the other, presenting an odd idea, generally a ludicrous one. Punning is usually considered the lowest species of wit, bearing about the same relation to words which wit bears to things; that is, presenting an idea in some new and unexpected form. But not unfrequently a pun involves wit or humor of the highest order. Thus, when the poet Gay received a large sum of money from Rich, the manager, for his *Beggar's Opera*, from which the manager also gained a large profit, it was said by some one that "*The Beggar's Opera* made Gay rich, and Rich gay." Not unfrequently the point of a pun lies in the juxtaposition of two or more words similar or identical in sound, but different in spelling and signification; as when it is said that "It is not right to write rite wright." One of the best examples of this kind, in which the pun rises to the dignity of pathetic humor, is that of Hood, who speaking of a poor sempstress who was tearfully embroidering a costly veil, said, "The sewing-woman was sewing, *in formâ pauperis*, upon a veil, which to her was literally a vale of tears." A pun often gives point to an epigram; as when some one said that the famous utterance of Napoleon III., *L'Empire c'est la paix* ("The Empire is peace"), should have been *L'Empire c'est l'epée* ("The Empire is the sword"), the sound of the two phrases, when uttered, being hardly distinguishable. The wit in a pun is not unfrequently polyglot; that is, a phrase of one language is used which in sound or spelling closely resembles a phrase in another language, but which has a wholly different meaning; as, when a wealthy tobacconist was about to set up a carriage with a coat-of-arms on the panel, some one suggested that an appropriate motto would be *Quid rides*, which means in Latin "What are you laughing at?" but might be read in English "Quid rides." The figure of speech called *paronomasia* by writers on rhetoric, and defined by them as "the use of words in the same connection which are similar in sound, but dissimilar in sense," is simply punning. This was a favorite form of expression among the Hebrews, and the books of the Old Testament, in the original, abound in examples of it, although it is of course usually lost in

translating, and thus the precise point of many passages is necessarily missed in our version, unless the paronomasia is pointed out in a note. Among the best puns in the English language are the following: A man who had a very tall wife named Experience, said, "Long experience has taught me the advantages of the married state." In *The Merchant of Venice,* when Shylock is whetting his knife on his shoes, Gratiano exclaims, "Not on thy sole, but on thy soul, false Jew!" Some one was boasting that he had shot a hundred hares before breakfast. "Then you must have been firing at a wig," rejoined a listener—the pun lying in the identity of sound between "hares" and "hairs." "My dress is too short," said a lady. "Never mind that," replied her husband: "it will be long enough before you get another." Capt. Back was sent to the Arctic regions in search of Capt. Ross, who in the mean time returned. Some one said, "Back did not get Ross, but Ross got back."

Punch, tools for cutting hard materials. Most hand-punches are of hardened steel, and fitted to receive blows on the head with the hammer. Machine punches are much used for making holes in soft iron. The punch is of tough steel, and is thrust through the iron by means of a cam. Many kinds of punching-machines have been invented.

Punch [Hindoo, *pantsch,* "five," because once made of five substances—arrack, water, lemon-juice, sugar, and tea], a name applied at present to a great variety of mixed drinks having some alcoholic liquor as the basis.

Punch. See PRINTING, by W. S. PATERSON.

Punch, Punchinello, or **Punch and Judy** [It. *pulcinella* or *policinella;* Fr. *polichinelle*], a kind of puppet-show frequently exhibited in the streets of European cities, especially of Italy. Its origin has been traced to the Atellan farces of ancient Rome, but in its present popular form the drama is ascribed to Silvio Fiorillo, an Italian playwright who flourished about 1600. The actors in the performance are wooden puppets, of whom the principal are Punchinello (in English Mr. Punch), his wife (called in English Mrs. Judy), and their dog Toby. The puppets are moved by the exhibitor by means of concealed wires, and he also supplies a comic dialogue, varying his voice to suit the different characters. As usually represented, Mr. Punch is a stout personage with protruding paunch, thin legs, hooked nose, and a chin which turns up so as almost to meet the point of the nose; Mrs. Judy is a thin, shrewish dame, grotesquely attired; and the dog Toby, who is the embodiment of cunning, and usually wears a hat, plays an important part in the action. The play is a domestic tragi-comedy, in which Mr. Punch is greatly berated by his wife, and finally comes to grief. Various explanations have been given of the origin of the name. Some suppose it to be a diminutive of the Italian *pulcino,* Latin, *pullicenus,* a "chicken;" others, that it comes from the Latin *pollice,* the "thumb," a common appellation of dwarfs, as in our "Tom Thumb;" but perhaps the most probable supposition is that the name comes from Puccio d'Aniello, a famous buffoon of Acerra, near Naples, whose humorous eccentricities were in the seventeenth century transferred to the Neapolitan stage, and made the vehicle of social and even of political satire, in which the vices and follies of the great could be lashed with comparative impunity in the persons of the grotesque puppets, and unpalatable truths enunciated in the squeaking voice appropriate to the senile Pulcinello. This character of public censor is that assumed by the famous Mr. Punch of the well-known English satirical and humorous journal. In some of its aspects the show of Punchinello reminds one of the so-called "moralities" of the Middle Ages and of the clown of the more recent comic drama; and the grotesque faces of the performers have their prototypes in the masks worn by the actors in the ancient Greek and Latin comedies. Puppet-shows of an essentially similar character, but often much more elaborate, are common in China and Japan.

Punctua'tion [Lat. *punctum,* "point"], the art of dividing literary composition by points or stops to show more clearly the sense and relation of the words (grammatical punctuation), and of noting the different pauses and inflections required in reading (rhetorical punctuation). Ancient inscriptions show that words were grouped together without break or pause-mark, the structure of the sentence being the only indication of the meaning, as shown in the Assyrian and the Egyptian; but names were often enclosed in rings or squares to distinguish them from ordinary words; and in the Behistun inscription an oblique wedge separates the words. The Chinese sometimes has a straight line at the right side of the column to indicate proper names; the names of places are in rectangles, authors or works cited in hexagonal or other surrounding lines, and sentences are divided by a small circle or comma and ended by a large circle. The Japanese also uses the circle as a period. Nearly all the Eastern languages, having a peculiar chirography, use a heavy colon and a double colon, or a line and a double line, for the comma and the period. The Ethiopian uses the colon to separate words, and the double colon to separate sentences. The early Hebrew Scriptures had no variation of the size of letters for capitals and small letters, and the words, verses, and chapters were not marked off in any way. Between 180 B. C. and 500 A. D. the words were separated by spaces, even the precise quantity of space ordained, and the verse-mark, or colon, introduced. The Masorah includes an elaborate system of accents, which correspond roughly to modern stops, and like them indicate the breaks or divisions in the sentences required by the meaning. The ancient Greek did not separate words or sentences, and probably about 370 B. C. the period was introduced and placed at the end of words in three positions, representing our comma, colon, and period. Greek codices up to the eighth century, although beautifully written and illuminated, show no spaces between the words, and the punctuation is merely a period placed at the end of a sentence and above the line. (See illustrations under CODEX.) Aristophanes is credited with first using points. Early Latin inscriptions are usually without spaces between the words, but different marks were introduced at various times, a colon or a period being latterly used to separate the words. In the ninth century small letters were adopted, and the comma, the colon, and the Greek note of interrogation (;) came into use. Caxton (about 1474) used only an oblique stroke for commas and periods in his early works. The modern system of punctuation is due to Manutius, a Venetian printer of the beginning of the sixteenth century. The principal points indicating the grammatical construction are—the period (.), the colon (:), the semicolon (;), the comma (,), the dash (—), the curves, or marks of parenthesis ( ), the eroteme, or note of interrogation (?), and the ecphoneme, or note of exclamation (!). These are used in the European languages with the same meaning generally. In Greek the colon is represented by a period above the line, and the note of interrogation is our semicolon. The first four points suggest the parts of the sentence distinguished by them; as, the period is a complete round of words; the colon, the greatest division or limb of the period; the semicolon, the half limb or greatest division of the colon; the comma, a segment of the sentence. The dash is employed where the subject breaks off abruptly, where a series of clauses leads to an important conclusion, and before a word or clause repeated, termed the echo. The curves, or marks of parenthesis, enclose an explanatory remark or matter not directly connected with the sentence. The note of interrogation is placed after a question, and in Spanish is also placed, inverted, before the question. The note of exclamation follows a direct address or exclamation, whether of joy, sorrow, or invocation. This point is also inverted before an exclamatory sentence in Spanish. It may be interesting to note that Benjamin Franklin recommended the introduction into English literature of this Spanish practice of inverting the interrogation and exclamation points. There are other marks usually treated under punctuation, but serving merely to point out some particular fact; as, the apostrophe ('), to indicate the elision of a letter or letters and for the sign of the possessive case; the hyphen (-), placed between compound words and at the end of a line when a word is divided; the quotation-marks (" "), which enclose quotations from other books or a speaker's words; the brackets [ ], which enclose a remark made by an author within the remarks of another; and the reference-marks—star or asterisk (*), dagger (†), double dagger (‡), section (§), parallel (‖), paragraph (¶), which refer to foot-notes in connection with the reading; and also the index (☞), used to point out a remarkable statement. WILLIAM S. PATERSON.

Pun'go, tp., Princess Anne co., Va. P. 2120.

Pungoteague', p.-v. and tp., Accomack co., Va., on Pungoteague Creek. P. 4513.

Pu'nic Wars, the three great wars between the Carthaginians (*Punici*) and the Romans. The First Punic war lasted 23 years (264–241 B. C.). It was a contest for the possession of Sicily, which was finally won by the Romans. The finances of Carthage were crippled and the state involved in a bloody civil war, while Rome was strengthened and her naval supremacy established. The Second war lasted 16 years (218–202 B. C.). It was initiated by the capture of Saguntum by Hannibal, who thereupon made his great invasion of Italy. The war was closed by the Roman victory at Zama. The Third war was evidently undertaken by the Romans with the express intention of finally destroying Carthage, her long-humiliated and now scarcely-dangerous rival. The war lasted 3 years (149–146 B. C.). Carthage made a most heroic and persistent defence, but was at last utterly destroyed.

Pun'ishment [Lat. *pœna*, "penalty"]. In its most general sense, punishment is the suffering or deprivation of rights which the state inflicts upon the violator of the penal law. Publicists and legislators have differed radically and widely in respect to the nature and design of all punishment. Three principal theories have been maintained, and three corresponding systems of legislation have been constructed in accordance therewith. The first regards retribution, or the vindication of the law upon the offender, as the essential feature and object, and all other effects as accessory. According to the second, prevention is the only design of punishment, and the only motive which justifies its use by society—the prevention of the criminal from further wrongdoing, and the deterring of others by the example from similar infractions of the law. The third asserts that the only legitimate purpose of punishment is the amendment of the offender. The ancient methods of administering the penal law were chiefly based upon the first of these theories; the modern legislation of enlightened nations is mainly constructed upon the second, although the last enters largely into many systems as a modifying element. The various punishments now recognized by the penal codes of Christendom may be reduced to the following classes: death, perpetual imprisonment with or without labor, imprisonment for determinate periods, enforced labor in mines, galleys, and the like, banishment to penal settlements, pecuniary fines, and in certain special cases the infliction of the lash. As an accessory to these penalties the criminal is often deprived of political or civil rights belonging to citizenship, such as the electoral franchise, the ability to testify in courts of justice or to hold office. Whether the death-penalty should be retained, and whether confinement should or should not be solitary, are questions which engage the attention of the ablest publicists and the most experienced statesmen. JOHN NORTON POMEROY.

Punjaub' (the land of the "five rivers;" by the Greeks called *Pentapotamia*), a territory of North-western Hindostan, bounded N. by Cashmere, E. and S. by the Sutlej, and W. by the Suliman Mountains, and since 1849 belonging to British India. Area, 102,001 sq. m. P. 17,596,752. The northern part of the country is mountainous, covered with spurs of the Himalaya from 17,000 to 20,000 feet high, and enclosing deep valleys. The southern and western part is a great plain around the Indus and its five powerful affluents, the Jhylum, Chenaub, Ravee, Beas, and Sutlej, hot, dry, and treeless, consisting of a hard clay or loam which in many places becomes sandy and arid. The average heat of the summer is 112°; the winter is cool, with frequent frosts. Rain is rare, but the large and numerous streams can easily be used for irrigation; and wherever the soil is well cultivated its productiveness is very great. Sugar, rice, cotton, wheat, and indigo are raised in large crops and of superior quality. The manufacturing industry of the country is highly developed in the large cities of Amritsir, Lahore, Multan, etc. The population is very much mixed, consisting of Afghans, Thibetan Mongolians, and different Hindoo races, such as Jats, Sikhs, etc. Two-thirds are Mohammedans.

Pu'no, town of Peru, South America, capital of department of the same name, on the shore of the Lake of Titicaca, at an elevation of 13,832 feet. The silver-mines of the vicinity are now filled with water, and the 6000 inhabitants of the town are mostly employed in agriculture.

Punshon (WILLIAM MORLEY), D. D., b. at Doncaster, England, in 1824; became a local Wesleyan preacher in 1840; studied at the Wesleyan College, Richmond; became one of the most popular preachers in England; preached in London 1858–68; removed in the latter year to Canada for the purpose of marrying a sister of his deceased wife, which he could not legally do in England; has since the death of his second wife returned to England, and been president of the British Conference; author of sermons and discourses, *Life Thoughts* (1863), *Sabbath Chimes*, in verse (1867), the *Prodigal Son* (1868), etc.

Pun'ta Are'nas, p.-v. and tp., Mendocino co., Cal., on Pacific Ocean. P. of v. 956; of tp. 1406.

Punxataw'ney, p.-b., Young tp., Jefferson co., Pa., on Big Mahoning Creek. P. 553.

Pu'pa [Lat., a "doll"], a stage of transformation in insect life which follows the larva state, and precedes the *imago* or perfect insect. Many or most insects enter this stage through a semi-pupa state, and some leave it through a state called semi-imago. The pupæ of Lepidoptera are called chrysalides. These and many other pupæ are enveloped in a pupa-case, and exhibit few signs of vitality, but many pupæ are active and voracious, and considerably resemble the perfect insect; also a genus of land-snails.

Puppets. See MARIONETTES.

Puranas. See SANSKRIT LANGUAGE AND LITERATURE, by PORTER C. BLISS, A. M.

Pur'beck Beds [from the isle of Purbeck, Dorset, England], in British geology, a group of three beds, upper, middle, and lower Purbecks, together constituting the uppermost member of the Oolite. The lower Purbeck rests on the Portland Oolite, and above the upper Purbeck comes the Wealden. The upper bed affords the Purbeck marble, and the whole group is singularly rich in organic remains.

Pur'cell (HENRY), b. in London, England, in 1658; became in childhood a singer in the choir of the king's chapel; composed several anthems before reaching the age of eighteen, when he became organist of Westminster Abbey; was very successful as a composer of music for operettas and of dramatic music in general, to which he devoted himself for many years, composing also a great number of anthems, sonatas, choruses, odes, glees, comprising a complete service of church music. D. Nov. 21, 1695. His chief productions were published in 1697.

Purcell (JOHN BAPTIST), D. D., b. at Mallow, Ireland, Feb. 26, 1800; was educated at Emmittsburg, Md., and the Sulpitian seminary, Paris; entered the Roman Catholic priesthood at Paris 1826; became a professor in Mount St. Mary's College, Emmittsburg, Md., and was its president 1829–33; was consecrated bishop of Cincinnati 1833, and in 1850 made archbishop of the same see, the first of the title. His public discussions with Alexander Campbell (1838), Thomas Vickers (1868), and others have been published, also a volume of *Lectures and Pastoral Letters*, a series of school-books, a *Life* of X. D. McLeod, etc.

Pur'chas (SAMUEL), b. at Thaxted, Essex, in 1577; educated at St. John's College, Cambridge; took orders in the Church of England; was presented by James I. to the vicarage of Eastwood, Essex, Aug., 1604; subsequently obtained the rectory of St. Martin's, Ludgate, London, and became chaplain to Archbishop Abbot. D. at London in Sept., 1626. Compiler of *Purchas his Pilgrimage, or Relations of the World*, etc. (folio, 1613), and *Purchas his Pilgrimmes* (4 vols., folio, 1625), a celebrated collection from the works of many hundreds of travelers, and author of *Microcosmos, or the History of Man* (1619), and *The King's Tower and Triumphant Arch of London* (1623).

Pur'chase (law). In its popular sense, this term describes the mode of acquiring property either in lands or chattels by a sale for money or other valuable consideration. In its technical and legal signification, it denotes the acquisition of property in lands alone by any mode known to the law except that of descent. The common law divided the means of acquiring real property into two general classes—descent or inheritance from an intestate ancestor, and purchase. The latter embraces the particular cases of obtaining ownership by escheat, prescription, adverse possession, forfeiture, devise, and conveyance by deed; the last including all modes of forced transfer in bankruptcy, insolvency, or by judicial sale. The popular meaning is given to the term by those rules and doctrines of equity which protect the *bonâ fide* purchaser of lands against many prior, outstanding, but to him unknown titles and claims. In the equitable doctrine referred to, purchase necessarily implies a transfer by way of actual sale for a pecuniary consideration, and is directly opposed to all acquisitions by gift, devise, or other voluntary methods not accompanied by a payment of value on the part of the one who receives the title and seeks the aid of equity in its support. JOHN NORTON POMEROY.

Purchas Judgment, The, a judgment of the judicial committee of the privy council in the case of *Herbert* v. *Purchas* on appeal from the arches court of Canterbury, A. D. 1871. Briefly stated the charges before the committee were that the respondent had offended—(1) by the use of the mixed chalice; (2) by standing with his back to the people, between the people and the holy table, whilst reading the prayer of consecration; (3) by the use of wafer-bread; (4) by providing holy water for the use of the congregation; (5) by the use of certain unauthorized vestments; (6) by wearing or carrying in his hand a cap called a *biretta*. The dean of arches decided—(1) that to mix water with the wine at the time of the service is "an additional ceremony," and so forbidden; but that, provided that the mingling be not made at the time of the celebration, it is not unlawful. This decision was overruled, and all mixture, wherever made, was declared to be illegal. (2) The judge of the lower court believed that this charge had been settled by the privy council in the case of *Martin* v. *Mackonochie*. He also ruled that the words of the rubric, "before the people," "do not require that the people should see the breaking of the bread or the taking of the cup into the priest's hands." Their lordships reached a different conclusion on both points, and decided that "the prayer of consecration is to be used at the N.

side of the table, so that the minister looks S., whether a broader or narrower side of the table be toward the N." (3) The law has directed the use of pure wheat bread, and therefore wafer-bread is illegal. (4) The facts were not proved, and the appeal on this point was disallowed. (5) The dean of arches said: "The plain words of the statute, according to the ordinary principles of interpretation, and the construction they have received in two judgments of the privy council, oblige me to pronounce that the ornaments of the minister mentioned in the prayer-book of Edward VI. are those to which the present rubric referred. They are, for the minister . . . officiating at the communion service, the cope, vestment or chasuble, surplice, alb, and tunicle; in all other services the surplice only." Their lordships were of opinion that the question of vestments had never been before the court, and adjudged that the chasuble, alb, and tunicle are illegal. (6) With respect to the biretta, which the respondent was said to have carried in his hand, not worn, they did not feel justified in pronouncing that he did an unlawful act. It was directed that the respondent pay the costs in both courts. The case was heard *ex parte* by reason of the respondent's want of means to procure counsel. But before the judgment had been made final, being then enabled to take upon himself the expense of counsel, the respondent prayed for a rehearing of the case. His petition was refused. The judgment was followed by protests in every form, many who had little sympathy with the course of Mr. Purchas uniting with his supporters. Those whose practices were condemned, many of whom, it is said, had submitted to previous judgments touching ritual, considered themselves justified by what they denounced as "an outrage upon law, logic, and history" in counting as no ways binding on conscience the decisions of the highest court of appeal for ecclesiastical causes. The Purchas judgment settled definitely no disputed point. Underlying the matters adjudged and all like ritualistic questions there are others of a deeper nature which alone give them dignity—namely, Is the Church of England one and the same Church before and since her Reformation? Is the minister whom her formularies style priest a true priest? Is the table of the Lord, like to that so called by Malachi, an altar? Is the service thereat rendered a true commemorative sacrifice? Is the presence of the Lord in his sacrament a real presence, such as to constrain special outward marks of reverence? W. F. Brand.

Pur'dy, p.-v., cap. of McNairy co., Tenn.

Purdy's Station, p.-v., N. Salem tp., Westchester co., on New York and Harlem R. R.

Pur'gatives, in medicine, substances that produce more or less fluid discharges from the bowels. Very many drugs are purgative in sufficient dose, but those available in medicine as cathartics, and in common use at the present time, are castor oil, rhubarb, aloes, and calomel, forming a group of comparatively mild agents, causing only fluid feculent stools; certain salts, producing watery discharges, of which the most prominent are magnesium citrate and sulphate, sodium phosphate, acid potassium, tartrate and potassium and sodium tartrate; and, finally, a group of vegetable nature, producing again watery stools, but also being more or less irritant to the intestines. These are senna, jalap, podophyllum, scammony, colocynth, gamboge, croton oil, and elaterium. Setting aside senna, the others last mentioned are commonly spoken of as the *drastic* cathartics, from their highly irritant properties. Besides the foregoing, there are many substances which have a very mild effect upon the bowels, and are called *laxatives*. The more prominent of these are magnesia and magnesium carbonate and sulphur among inorganic substances, and manna, purging cassia, tamarinds, prunes, figs, and other fruits among vegetable. Purgatives operate partly by quickening the muscular contractions of the intestines, whereby the contents of the latter are hurried down to the rectum, and partly, especially with those causing watery stools, by determining an abundant secretion of fluid into the intestinal canal. Purgatives are used for the primary object of emptying the bowels, and also to relieve congestion of distant organs and to induce the absorption of dropsical collections of fluid. The properties of the individual purgatives mentioned above will be found described under the several headings. Edward Curtis.

Pur'gatory, a Roman Catholic doctrine, first clearly taught by Gregory the Great, who d. 604 A. D. (See Eschatology.)

Purifica'tion of the Virgin, Feast of, called also **Candlemas Day,** and the **Presentation of the Child Jesus,** is the celebration of the visit of the Virgin and her Child to the temple at Jerusalem, in accordance with the Levitical law for the ceremonial purification of puerperal women. It was introduced into the calendar in 494 by Pope Gelasius I. It occurs on Feb. 2.

Pu'rim [Hebrew-Persian, *pûr*, plural *pûrim*, a "lot," because Haman cast lots for the destruction of the Jews, Esth. iii. 7], a Jewish feast which falls on the 14th or 15th of the month Adar (February and March), in commemoration of the deliverance described in the book of Esther. The festival was in former times, as still in many places, celebrated in a noisy and tumultuous manner, with loud expressions of hatred at the reading of Haman's name in the synagogue.

Pur'itans. The Reformation in England under Henry VIII. was unsatisfactory to many, because, in their view, it accomplished only a partial elimination of the corruptions and abuses of the Church of Rome. Through the ecclesiastical alternations of the reigns of Edward VI. and Queen Mary these recusants grew in numbers and influence. They gave Queen Elizabeth no little trouble, and were in turn greatly harassed by the efforts made, through the high commission court, to force them to conformity. It was during her reign in 1564 that they were called in derision *Puritans*, because they were ever calling for a simpler, *purer* form of worship and insisting on a stricter, *purer* life. They were, however, staunch in their loyalty to the queen, supporting her most heartily in the part she took in sustaining the general interests of Protestants in Europe. They stood forth as a distinct party, leading the opposition to the despotic claims for the royal prerogative asserted by the first two Stuarts, and their influence culminated in a triumph when royalty was overthrown and the Commonwealth was established. The genuine Puritans were mostly of the commoners of England, men of strong minds, good judgment, and sterling character. They adopted the Calvinistic creed, and rigidly conformed their lives to its principles. This gave an aspect of precision to their manners and stern severity to their lives, but it made them strong in their integrity and persistent in the struggle for liberty and right. Much as they have been ridiculed and maligned, England owes to the Puritans some of the best features of her free constitution: and never before had her power in Europe been felt as it was under the Commonwealth, when, through Cromwell, they controlled the government. During the struggle with the Stuarts many of them emigrated to New England, and there embodied their principles in a framework of government on which, as a stable foundation, the great republic of the U. S. has been built up.

The term Puritans is applied loosely to embrace all who objected to the ceremonies of the Established Church, and advocated holy living, and resisted the royal prerogative. But, especially with reference to the early history of this country, a distinction of two classes should be recognized. The Puritans proper adhered to the Church, striving to mould it to their own views. The Independents, despairing of the needed reform in that way, insisted on an absolute separation from the Church for a new organization. The Pilgrims who established the first colony in New England at Plymouth were Independents. Those who subsequently established themselves on Massachusetts Bay were Puritans. (See Independents, by Leonard Bacon, D. D.) A. L. Chapin.

Purneah, town of British India, presidency of Bengal, on both sides of the river Kosi, in lat. 25° 45′ N. and lon. 88° 23′ E. It occupies an area of 9 sq. m., mostly single houses surrounded with gardens, orchards, and indigo-plantations. P. 50,000.

Purple, Aniline. See Aniline Colors, by Prof. C. F. Chandler, Ph. D., M. D., LL.D.

Pur'ple of Cas'sius, a substance precipitated, generally of a brown color, but sometimes purple, by adding solutions of stannous chloride to those of gold-salts. Its composition is yet uncertain. When dry and powdered it is dull blue. It is soluble in ammonia when fresh to a magnificent purple-colored liquid. It has been used in enamel-painting. H. Wurtz.

Purple, Tyrian. See Tyrian Purple.

Purple Wood, a beautiful plum-colored wood from Guiana, of very great strength and smoothness of finish. It is the product of *Copaifera bracteata* and *C. pubiflora*. It is adapted to a wide range of uses. The trees are of the order Leguminosæ, and produce a part of the balsam copaiba of commerce.

Pur'pura [Lat. "purple"], a disease in which spots of deep purple color appear in the skin, produced by the escape of blood from the vessels. Some cases are caused, apparently, by plethora; others by a degenerative change in the walls of the blood-vessels. Purpura spots often appear in typhus, scurvy, the plague, and the eruptive fevers. The approved treatment is by tonics, mineral

acids, rest, and attention to any untoward constitutional peculiarities.

Purpura, a genus of gasteropods of the whelk family. This genus furnished a part of the Tyrian purple dye of antiquity, hence the name. There are numerous living and extinct species. Some kinds are found on the U. S. coasts.

Purpurine ($C_{14}H_8O_5 = C_{14}H_5(OH)_3(O_2)''$; (*madder-purple* of Runge; *matière colorante rose* of Gaultier de Claubry and Persoz; *oxilizaric acid* of Debus; *oxyalizarine, trioxy-anthraquinone*), discovered by Robiquet and Colin in 1828. It exists in madder in the form of a glucoside, which is included in the *rubian* of Schunck, which is an amorphous mixture of several glucosides (see RUBIAN and ALIZARINE), but is distinct from the crystalline RUBERYTHRIC ACID of Rochleder (which see), which is the alizarine glucoside. The purpurine glucoside has not yet been isolated, being very unstable. It occurs also in MUNJEET (which see), associated with munjistine.

Preparation.—Purpurine is extracted from madder by the same processes as alizarine, and is usually separated from it by its greater solubility in a solution of alum. Robiquet and Colin clear the madder with strong sulphuric acid, extract the purpurine with a boiling 12-per cent. solution of alum, and precipitate it with dilute sulphuric acid. Runge allows the alum solution to stand and deposit a little alizarine present, and afterward purifies the purpurine by recrystallization from alcohol. Debus first prepares a lead lake from the madder, decomposes this with dilute sulphuric acid, dissolves the coloring-matters in alcohol, converts them into a zinc lake, decomposes this with acid, dissolves the product in ether, again forms a zinc lake, decomposes this, and separates the purpurine from the alizarine by alum. Kopp extracts the madder with aqueous sulphurous acid, and precipitates the purpurine free from the alizarine by adding 3 to 5 per cent. of sulphuric acid, and heating to 86° to 104° F.; this decomposes the glucoside of purpurine, but does not affect the ruberythric acid, which requires a much higher temperature. This process is carried out on a manufacturing scale by Schaaff and Lauth at Strasburg. Schützenberger and Schiffert examined this purpurine, and announced the discovery in it of three other coloring-matters. By treating the crude purpurine with lukewarm alcohol the orange body (hydrate of purpurine) and the yellow purpuro-xanthin are extracted, and may be separated by benzol, which dissolves the purpuro-xanthin. The portion insoluble in tepid alcohol is treated with boiling alcohol, which dissolves out the purpurine, leaving the pseudo-purpurine, which is insoluble. They find the crude purpurine to contain about 75 per cent. of pseudo-purpurine, 12½ purpurine, 12½ orange matter, one-fifth of 1 per cent. purpuro-xanthin. Schunck considers the existence of these three bodies more than doubtful, believing them to be mixtures of bodies previously known, especially the yellow substance, which resembles rubiacine. Rosenstiehl and others confirm their existence. (See *Am. Chemist*, vi. 53.) Stenhouse recommends munjeet as an excellent source for pure purpurine. He boils munjeet with alum solution, filters hot, precipitates coloring-matters with hydrochloric acid, dries, extracts with carbon disulphide, dries, washes out the munjistine with boiling water, and obtains the purpurine as the final residue, free from alizarine. F. de Lalande (*Compt. Rend.*, lxxix. 669) converts alizarine into purpurine by treating it with sulphuric acid and arsenic acid or manganese dioxide; pours into water, and purifies precipitate by alum, etc. He claims to have thus proved that the atom of oxygen by which it differs from alizarine does not belong to a hydroxyl group, and consequently that purpurine is oxyalizarine, and not trioxy-anthraquinone. The artificial formation of purpurine from alizarine sulphonic acid ($C_{14}H_5(SO_3H)(OH)_2O_2$) by fusion with potassic hydrate is not successful, as H not OH takes the place of (SO_3H), regenerating alizarine.

Properties.—Purpurine appears as a red powder in red feathery crystals (by sublimation), in orange-red needles (from boiling alcohol). It is slightly soluble in boiling water, giving a rose-colored solution. It dissolves in alcohol, ether, benzol, glycerine, concentrated sulphuric acid, and acetic acid. Its solution in sulphuric acid may be heated to 400° F. without decomposition, the purpurine being thrown down unchanged on pouring the solution into water. It dissolves in a boiling alum solution to a pink fluorescent liquid, and does not separate on cooling, even from concentrated solutions. It dissolves in alkaline hydrates and carbonates, forming cherry-red or poppy-red solutions, from which acids reprecipitate it in orange-yellow flocks. The solutions in alkaline hydrates lose color on standing in the air, the purpurine being oxidized and destroyed. Purpurine dissolves in ammonia, but on standing or on the application of heat, *purpuramide* or *purpureine* ($C_{14}H_5NH_2(OH)_2O_2$) is formed, which is precipitated by acids in deep-violet flocks. Boiling nitric acid converts purpurine into phthalic and oxalic acids. Heated with zinc-dust, it yields anthracene ($C_{14}H_{10}$). With bases it forms compounds; those with the alkalies are soluble in water. Sodic purpurate may be obtained in crystals by adding an alcoholic solution of caustic soda to one of purpurine, and then adding some ether. The basic, calcic, and aluminic lakes are soluble in boiling solutions of carbonate of soda. Bolley claims to have converted purpurine into alizarine by heating it in closed tubes to 410° F. (*Jahresb.*, 1866, 644.) Rosenstiehl (*Compt. Rend.*) failed to obtain alizarine, although he tried various reducing agents. He always produced purpuro-xanthin, a yellow body, isomeric with alizarine. Martin of Avignon says, however, that purpurine, pseudo-purpurine, the orange hydrate of purpurine, and even the purpuro-xanthin, are easily converted into alizarine by dissolving in sulphuric acid, adding zinc-powder and throwing into water when the alizarine separates. (See Calvert's *Dyeing and Calico-Printing*, London, 1876, p. 38.)

Optical Properties.—Stokes (*J. Chem. Soc.*, xii. 219) has shown that purpurine can be recognized by the peculiar absorption-bands which some of its solutions give when examined before the spectroscope. Solutions in alkaline carbonates give two dark bands in the green, as do also the solutions in ether and alum; the latter is also beautifully fluorescent. A square inch of dyed cloth furnishes sufficient purpurine for the solution in carbonate of soda for this optical reaction. Alizarine is easily distinguished from purpurine by forming violet solutions with the alkalies and alkaline carbonates, the former undergoing no change in the air (purpurine is destroyed), by its insolubility in alum solutions, by the solubility of its calcic, baric, and aluminic lakes in carbonate of soda, and by its optical properties, alizarine solutions giving different absorption-bands before the spectroscope.

Application to Dyeing and Calico-Printing.—Purpurine produces with alumina mordants bright reds; with iron, grayish violet. These tints resist cleaning with soap and nitro-muriate of tin tolerably well, but are not so permanent as those produced by alizarine, nor do they resist light as well. There is a difference of opinion as to the part played by purpurine when madder, garancine, etc. are used in dyeing calico. Some think the purpurine of little importance; others consider it essential to certain pinks and reds. (See Schützenberger, *Dingl. Pol. J.*, cxcvii. 438; Rosenstiehl, *Am. Chemist*, vi. 53.) According to Robiquet and Schunck, the finest and most perfect madder-colors are produced by alizarine, whereas Runge and Strecker are of opinion that the liveliest tints are produced by purpurine, and that this substance likewise plays the principal part in the manufacture of Turkey-red. According to E. Kopp, on the other hand, the real basis of Turkey-red is alizarine; and he further states that purpurine, though it dyes mordanted fabrics perfectly, does not yield colors of so great a degree of stability and has not so great a degree of affinity for oiled cloth as alizarine. Schunck says that the final result of dyeing with madder is simply the combination of alizarine with the mordants. Perkin confirms this, and finds no purpurine in finished prints.

Consult Robiquet and Colin, *Ann. Chim. Phys.*, xxxiv. 244; Gaultier de Claubry and I. Persoz, *Ann. Chim. Phys.*, xlviii. 69; Persoz, *Ann. Chim. Phys.*, li. 110; Runge, *Ann. Chim. Phys.*, lxiii. 282; Debus, *Ann. Chim. Phys.*, xxxviii. 490; Wolff and Strecker, *Ann. Pharm.*, lxxvi. 1, or *Q. J. Chem. Soc.*, iii. 243; Rochleder, *J. pr. Chem.*, lv. 385, and lxvi. 85; Schützenberger and Schiffert, *Bull. Soc. ind. Mulhouse*, 1864, 70; Schützenberger, *Bull. Chim. Soc.*, 1865, ii. 12. C. F. CHANDLER.

Purpurine, Anthra ($C_{14}H_8O_5$), a coloring-matter isomeric with purpurine, found by Perkin in artificial alizarine. It is separated from the alizarine by the solubility of its alumina lake in sodic carbonate. As a dye it resembles alizarine more than purpurine. The reds are much purer and less blue, while the purples are bluer and the blacks more intense than those of alizarine. In fastness against soap and light Perkin finds them equal to alizarine tints. (See Perkin, *J. Chem. Soc.* [2], viii. 143; x. 659; xi. 425; *Am. Chemist*, iv. 53.) C. F. CHANDLER.

Purpurine, Hydrate of ($C_{14}H_8O_5 + H_2O(?)$), or **Orange Matter,** discovered in Kopp's purpurine of Schützenberger and Schiffert. (See PURPURINE for mode of preparation.) It is obtained by the evaporation of its alcoholic solution as a crystalline conglomerated mass; is decomposed by dry heat, yielding purpurine; is insoluble in benzol, very soluble in alcohol. According to Rosenstiehl, the final result of dyeing is the same as with purpurine. (Consult authorities mentioned under PURPURINE, especially Rosenstiehl, *Am. Chemist*, vi. 53.) C. F. CHANDLER.

Purpurine, Pseudo ($C_{14}H_8O_6 = C_{14}H_4(OH)_4O_2$), discovered by Schützenberger and Schiffert in Kopp's purpurine (see PURPURINE for mode of preparation), of which it constitutes three-fourths. It is almost insoluble in boiling alcohol, crystallizes in fine brick-red acicular crystals from hot benzol. By sublimation or treatment with alcohol at 200° C. in sealed tubes it yields purpurine. According to Rosenstiehl (*Am. Chemist*, vi. 53), it does not dye mordanted cotton except in distilled water, when it gives shades approaching those of alizarine. In practice, the pseudo-purpurine is found in the refuse of the dye-beck as a calcic lake. (Consult authorities mentioned under PURPURINE.) C. F. CHANDLER.

Purpuro-Xanthine ($C_{14}H_8O_4$), a yellow compound isomeric with alizarine, found by Schützenberger and Schiffert to the extent of one-fifth of 1 per cent. in the purpurine of Kopp. It is readily soluble in alcohol and benzol, sublimes without decomposition, dyes alumina mordants a dull and fugitive yellow, is readily produced by the reduction of purpurine or pseudo-purpurine by heating to 180° C. with aqueous PI_3, or by dissolving in sodic hydrate, adding stannous chloride till the red color changes to yellow, and precipitating with an acid. (See PURPURINE.)
C. F. CHANDLER.

Pur'ree, or Indian Yellow, a yellow coloring-matter brought from India and China in lumps weighing three or four ounces, brown on the outside and deep orange-yellow within. Most writers consider it to be of animal origin, deposited from the urine of camels, elephants, and buffaloes, especially after they have eaten certain plants; others consider it an intestinal or biliary concretion of some animals; Stenhouse considers it to be a vegetable juice, evaporated down with the addition of magnesia. It is used for the preparation of Indian yellow, a fine, rich, durable yellow color, much used by artists, and often adulterated with chrome yellow. It consists mainly of euxanthate of magnesium. C. F. CHANDLER.

Pursh (FREDERICK), originally FRIEDRICH PURSCH, b. at Tobolsk, Siberia, in 1774, of German parentage; was educated in Dresden; resided as a botanist in the U. S. 1799–1811; published *Flora Americæ Septentrionalis* (London, 1814); went to Canada. D. at Montreal June 11, 1820. His MS. *Journal* still exists.

Purs'lane [a corruption of the word *porcelain*, from its appearance], a common garden-weed, *Portulaca oleracea*, found wild on sea-shores, etc. It is sometimes used as a potherb, and its shoots are pickled. To the same genus belong the showy flowering *Portulaca grandiflora* and *P. Gilliesii*.

Pur'suivant of Arms [Fr. *poursuivant*, a "follower"], the lowest order of officers in heraldry. Pursuivants are novices for the full rank of herald. They are maintained in the three British heraldic establishments, and from their number the heralds are usually appointed. In mediæval times nobles and other gentlemen might maintain pursuivants, or even full heralds. (For the present titles of the several British pursuivants see HERALD.)

Pu'rus, a river of South America, rises in Peru, in the mountains E. of Cuzco, about lat. 14° S., and traverses Bolivia and Brazil in a north-eastern direction, joining the Amazon in lat. 4° S., lon. 61° W. The regions it flows through are the least known in South America, covered with the most magnificent primeval forests.

Purva-Mímánsá. See HINDU PHILOSOPHY, by PROF. JOHN DOWSON.

Pus. See SUPPURATION.

Pu'sey (EDWARD BOUVERIE), D. D., b. in 1800, a nephew of the first earl of Radnor; was educated at Eton and Christ Church, Oxford; graduated with high honors 1822; became a fellow of Oriel College 1823; studied in Germany, and in 1828 became regius professor of Hebrew at Oxford and one of the canons of Christ Church cathedral. His contributions to the *Tracts for the Times* (1835 *seq.*), of which series he wrote Nos. 18, 66, 67, and 69, gave to the Tractarian movement the name of Puseyism. Newman's celebrated tract, No. 90, was in 1841 defended by Dr. Pusey in a published letter which excited much controversy. (See TRACTARIANISM.) He was (1843–46) suspended from preaching in the university for three years in consequence of the supposed utterance of heretical doctrine in a sermon on the real presence. Among the most important of his numerous works are—*On the Benefits of Cathedral Institutions* (1833), *On the Royal Supremacy* (1850), *On the Real Presence* (1855, 1857), *History of the Councils of the Church* (1857), *Commentary on the Minor Prophets* (1860 *seq.*), *Daniel, the Prophet* (1864), *Eirenicon*, etc.

Pusheta, tp., Auglaize co., O. P. 1290.

Push'kin (ALEXANDER SERGEIVITCH), b. at Pskov, Russia, June 6, 1799; studied at Tzarskoge Selo; entered in 1817 as clerk in the government office of foreign affairs, but was discharged in 1820 for an *Ode to Liberty*, and banished to his estates; was recalled in 1825 by the emperor Nicholas, and killed in a duel at St. Petersburg Feb. 10, 1837. By his countrymen he is considered the greatest poet Russia ever produced, and those of his works which have been translated into German, French, or English have attracted great attention outside of Russia. He wrote romantic epics—*Ruslan and Liudmila* (1820), *Plennik Karkaskoi* (1822), etc.; one drama—*Boris Godunow*; several novels, under the pseudonym of "Belkin," of which some were translated into English in 1875 by Mrs. J. Buchan Telfer in *Russian Romance*. Collected works, 12 vols. (St. Petersburg, 1839).

Pustule, Malignant. See MALIGNANT PUSTULE.

Pu'tah, tp., Yolo co., Cal. P. 1412.

Puteaux', town of France, department of Seine, on the Seine, opposite the Bois de Bologne, has some manufactures and contains villas and summer residences. P. 9375.

Puteoli. See POZZUOLI.

Putiglia'no (*Putignano*), town of Italy, province of Bari di Puglia, on the summit of a long hill and surrounded by a wall. The church of San Pietro Apostolo is very ancient, and there is a tradition that St. Peter preached in this town in the year 44. The inhabitants of Putigliano are very industrious, occupying themselves not only in agriculture, but in the manufacture of nails, of cotton cloths, of coarse woollen stuffs, etc. P. in 1874, 10,044.

Put-in-Bay, p.-v. and tp., Ottawa co., O., on South Bass Island in Lake Erie, 20 miles from Sandusky, is a noted place of summer resort. P. 1148.

Put'nam, county of N. E. Florida. Area, 610 sq. m. St. John's River traverses the S. E. part of the county, and then forms for some distance its E. boundary. The soil is varied; much of it is very fertile, while a large part is sandy and covered with dense pine forests. The hummock-lands are well adapted to sugar and cotton culture. Cap. Palatka. P. 3821.

Putnam, county of Central Georgia. Area, 350 sq. m. It is bounded E. by Oconee River and traversed by a branch of Macon and Augusta R. R. It is uneven and fertile. Cotton and corn are important products. Cap. Eatonton. P. 10,461.

Putnam, county of Central Illinois. Area, 180 sq. m. It is traversed and partly bounded on the N. by Illinois River. It is level and very fertile. Corn and wheat are leading products. Traversed by various railroads. Cap. Hennepin. P. 6280.

Putnam, county of Central Indiana. Area, 490 sq. m. It is hilly except in the N. E., and fertile. Cattle, grain, and wool are important products. Lumber, carriages, etc. are manufactured. Traversed by several railroads, centring at Greencastle, the capital. P. 21,514.

Putnam, county of Missouri, bounded N. by Iowa and on the E. by Chariton River. Area, 475 sq. m. It is somewhat uneven, and has coal and abundant timber. Cattle, grain, tobacco, and wool are important products. The soil is almost uniformly fertile. Cap. Unionville. P. 11,217.

Putnam, county of New York, bounded W. by Hudson River and E. by the Connecticut State line. Area, 234 sq. m. It is very mountainous and rocky, with fertile valleys. Dairying is one of the principal industries. Iron ore, granite, limestone, and other minerals abound. Iron castings, pig iron, paper, and brick are leading articles of manufacture. The county is a popular region for summer resort, and abounds in wild scenery. Traversed by Harlem and Hudson River R. Rs. and by several minor railroads. Cap. Carmel. P. 15,420.

Putnam, county of N. W. Ohio. Area, 594 sq. m. It is level and very fertile, though in part marshy. Cattle, grain, wool, and lumber are leading products. Traversed by Dayton and Michigan R. R. Cap. Ottawa. P. 17,081.

Putnam, county of Central Tennessee, chiefly on the N. W. slope of the Cumberland Mountains. Area, 500 sq. m. It is hilly, but generally fertile. Beds of coal are found. Cattle, corn, tobacco, and wool are leading products. Cap. Cookville. P. 8698.

Putnam, county in the western portion of West Virginia. Area, 450 sq. m. Traversed by Great Kanawha River and Chesapeake and Ohio R. R. It is hilly and has a variety of soils, mostly fertile. Grain and tobacco are leading products. Cap. Winfield. P. 7794.

Putnam, p.-v., Windham co., Conn., on Norwich and Worcester division of New York and New England R. R., about midway between Norwich and Worcester, has 7

cotton and woollen mills, 6 shoe-factories, 5 churches, 2 banks, 2 weekly newspapers, and mechanical shops. P. 4192. E. C. STONE, ED. "PUTNAM PATRIOT."

Putnam, tp., Fulton co., Ill. P. 1654.

Putnam, p.-v. and tp., Fayette co., Ia. P. 766.

Putnam, tp., Linn co., Ia. P. 760.

Putnam, tp., Livingston co., Mich. P. 1361.

Putnam, p.-v. and tp., Washington co., N. Y. P. 603.

Putnam, p.-v., Springfield tp., Muskingum co., O., on Muskingum River, opposite Zanesville, of which it is a suburb, and on Cincinnati and Muskingum Valley R. R. P. 2050.

Putnam (FREDERICK WARD), b. at Salem, Mass., Apr. 16, 1839; was educated at home by his father, Eben Putnam (Harvard, 1815), until 1856, when he entered the Lawrence Scientific School under Prof. Agassiz, with whom he remained until 1864, when he returned to Salem; took an active part in the Essex Institute as superintendent of its museum; originated and conducted the *Naturalist's Directory.* On the foundation of the Peabody Academy of Science in 1867 he was elected director of the museum, which position he held until Oct., 1875, when he succeeded the late Prof. Wyman as curator of the Peabody Museum of Archæology and Ethnology at Cambridge. In 1867 he, with others, commenced the publication of the *American Naturalist*, of which he was editor and proprietor until 1875; was elected permanent secretary of the American Association for the Advancement of Science; was appointed in Dec., 1875, civilian assistant on the U. S. surveys W. of the 100th meridian (in charge of Lieut. Wheeler), being entrusted with the special duty of reporting on the archæological and ethnological material that had been collected; and in 1876 took charge of the Agassiz collection of fishes at the Museum of Comparative Zoology.

Putnam (GEORGE PALMER), A. M., great-nephew of Gen. Israel, b. at Brunswick, Me., Feb. 21, 1814; became a bookseller's clerk at Boston 1826, and at New York 1828; prepared in early youth his useful book, *Chronology, or an Introduction and Index to Universal History, Biography, and Useful Knowledge* (New York, 1833), republished in 1850 and in later editions as *The World's Progress, a Dictionary of Dates*; edited *The Bookseller's Advertiser* (1834); visited Europe in the employ of Mr. John Wiley 1836–38, with whom he became a partner 1840; resided in London 1840–47, conducting the foreign business of the firm of Wiley & Putnam, which became increasingly important; wrote *The Tourist in Europe* (1838) and *American Facts* (1845); edited the *American Book-Circular* (1843), and prepared a *Pocket Memorandum-Book in France, Italy, and Germany* (1848). Returning to New York in 1847, he commenced business on his own account 1848, and soon became one of the most enterprising of American publishers; was noted for the high average excellence of his publications (which, among many others, included the works of Irving, Cooper, Bryant, Hawthorne, Lowell, Bayard Taylor, Asa Gray, and Tuckerman); edited the *Popular Library*, consisting of 24 vols. of choice English literature, the *Home Cyclopædia* (5 vols., 1850–53), and founded *Putnam's Magazine*, a first-class monthly which enjoyed great repute from its beginning in 1853 until its transfer to another publisher in 1856. Mr. Putnam was for some time forced to suspend business, but subsequently resumed, and the magazine was re-established in Jan., 1868, but in 1870 was merged into its younger rival, *Scribner's Monthly.* More than 300 volumes were issued by Mr. Putnam during his career as a publisher. His great services to American literature at home and abroad were doubly meritorious from the courtesy, kindliness, and generosity of his dealings with authors, who found in him a true friend. His business relations with IRVING were especially honorable and satisfactory to both parties, as mentioned in the article under that title. Mr. Putnam held the position of collector of internal revenue in New York 1863–66; was a distinguished art-critic; became one of the founders and honorary superintendent of the Metropolitan Museum of Art, was chairman of the committee on art in connection with the universal exposition at Vienna, and was for many years a leader in the social literary circles of New York. D. in New York Dec. 20, 1872.

PORTER C. BLISS.

Putnam (HALDIMAND S.), b. at Cornish, N. H., 1836; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant topographical engineers July, 1857, captain 1863; served principally in the West in explorations and surveys prior to 1861. In the civil war he served on the staff of Gen. McDowell at the battle of Bull Run and gained the brevet of major for gallantry. In October he proceeded to his native State and organized the 7th New Hampshire Vols., of which regiment he became colonel Dec., 1861. In command of his regiment he served in Florida and South Carolina, and in Apr., 1863, commanded a brigade in the Stono Inlet expedition, also in the capture of Morris Island, and in the assault on Fort Wagner, July 18, 1863, where he led the second assaulting column, and was killed on the parapet of the work while rallying his men. Brevet lieutenant-colonel and colonel for Morris Island and Fort Wagner.

Putnam (ISRAEL), b. at Salem, Mass., Jan. 7, 1718. Denied the means of obtaining more than a very rude education, his natural vigorous mental endowments enabled him to exercise a wide influence upon the exciting events of his time, while his strong physical powers and daring disposition were displayed in the many romantic adventures related of him. In 1739 he married and removed to Pomfret, Conn., where he became a successful farmer and a large wool-grower. After having suffered severe losses in their flocks from the depredations of a she-wolf and her whelps, the neighbors turned out to destroy her, and after a vigorous hunt succeeded in driving her into her den, a rocky cavern. After exhausting all means to force the animal from her retreat, Putnam at midnight descended the cavern on his hands and knees, bearing a torch in one hand and a musket in the other, and shot the beast at the moment she was about to spring upon him. This incident added greatly to his already established reputation for courage—a reputation he subsequently maintained in the French war, in which he commanded a company of Connecticut troops with distinction at Crown Point and Ticonderoga. In Aug., 1756, while in command of a party, he was captured by the enemy and bound to a tree, where during the continuance of the action he was frequently exposed to the fire of both friend and foe, but miraculously escaped unhurt. He was, however, borne away by the enemy in their retreat, and at night the fire had been lighted to burn him alive when he was saved by the intervention of the French officer, Molang. Taken to Ticonderoga, and subsequently to Montreal, he was, by the influence of Col. Schuyler, himself a prisoner at the latter place on Putnam's arrival, exchanged in 1759, and promoted to be lieutenant-colonel. Returning to his farm on the restoration of peace, the news of the battle of Lexington reached him while ploughing. Turning his cattle loose, he left his plough, mounted his horse, and rode rapidly to Cambridge. After a brief consultation he returned to Connecticut, when he was made brigadier-general by the legislature, of which he was a member, and a week later was on his way back to Cambridge at the head of a regiment which he had raised. Spurning the offers of rank and money made to him by the British, he entered with zeal upon the great struggle for independence, and soon conducted several successful expeditions. At the battle of Bunker Hill he displayed his usual energy and bravery throughout the day, as well as in the subsequent endeavor to rally the overpowered and retreating troops. Upon the arrival of Washington to assume command (July 2) he bestowed upon Putnam one of the four major-generals' commissions he bore from Congress, but the other three were not then delivered. Upon the evacuation of Boston, Putnam was ordered to take command at New York, and after the battle of Long Island and evacuation of New York was sent to Philadelphia to complete the fortification of that city; subsequently stationed at Crosswick and Princeton, N. J., he was in May, 1777, assigned to command the army in the Highlands of New York. It was while here he sent his famous reply to the threatening demand of Sir Henry Clinton for the release of one Palmer, a Tory officer captured within the American lines. It was as follows: "Sir: Edmund Palmer, an officer in the enemy's service, was taken as a spy, lurking within our lines; he has been tried as a spy, condemned as a spy, and shall be executed as a spy. ISRAEL PUTNAM. P. S. He has been accordingly executed." Owing to the dissatisfaction created by the surprise and loss of Forts Montgomery and Clinton in the summer of 1777, Putnam was removed from his command, although a subsequent court of inquiry acquitted him from blame in their capture, and he was restored to command. While in the Highlands he selected West Point as the site for a fortification; the ruins of the old fort bearing his name yet exist. In the winter of 1778, Putnam, while in command in Connecticut, was at Horseneck, one of his outposts, guarded by 150 men and 2 cannon, when attacked by Gen. Tryon with a force numbering 1500. After exchanging a few shots Putnam directed his men to a swamp out of reach of the enemy's cavalry, but being himself closely pursued, he turned his horse toward a steep hill, down which he dashed, escaping with a bullet through his hat. While on a visit to his home in Connecticut in 1779 he was stricken with paralysis, from which he only partially recovered. D. eleven years later at Brooklyn, Conn., May 19, 1790. G. C. SIMMONS.

Putnam (Mary Lowell), sister of James Russell Lowell, b. at Boston, Mass., Dec. 3, 1810; was early distinguished by her extraordinary attainments in languages, ancient and modern, including the Oriental, Slavonic, and Scandinavian groups; was married in 1832 to Samuel R. Putnam, a merchant of Boston (d. 1861); resided in Europe 1851–57; published a *History of the Constitution of Hungary and its Relations with Austria* (1850), *Records of an Obscure Man* (1861), *The Tragedy of Errors*, and *The Tragedy of Success* (1862), the latter two a dramatic poem in two parts, illustrative of slavery; has written a memoir of her son, William Lowell Putnam (killed at the battle of Ball's Bluff, 1861); has contributed largely to the *North American Review* and the *Christian Examiner*; translated from the Swedish Fredrika Bremer's novel, *The Neighbors*, and is understood to have been long engaged upon a *History of Hungary*.

Putnam (Rufus), b. in Sutton, Mass., Apr. 9, 1738; a millwright by trade, he abandoned his occupation to serve as a private in the French war of 1757–60; resuming his business on the return of peace, by diligent study during spare time he acquired a good knowledge of mathematics and surveying; in 1773 visited Florida, and was appointed deputy surveyor of that province. In the war of the Revolution, as lieutenant-colonel of a regiment, he superintended the defences of Roxbury, Mass.; was appointed chief engineer with rank of colonel, and charged with the defence of New York by fortifications; constructed the fortifications at West Point, and commanded a regiment in Wayne's brigade until the close of the war; in Jan., 1783, was appointed a brigadier-general; was frequently a member of the Massachusetts legislature, and aide to Gov. Lincoln during Shays's rebellion 1787; formed the Ohio Company, which purchased large tracts of land in that State and founded Marietta, the first permanent settlement in the North-west; was judge of the supreme court of the North-west Territory 1792; appointed brigadier-general 1792, he accompanied Gen. Wayne's army to Detroit against the Indians, and subsequently as U. S. commissioner negotiated an important treaty with numerous tribes. From 1793 to 1803 he was U. S. surveyor-general. D. at Marietta, O., May 4, 1824.

Putnam Valley, p.-v. and tp., Putnam co., N. Y. P. 1566.

Putnamville, p.-v., Warren tp., Putnam co., Ind., on Louisville New Albany and Chicago R. R. P. 219.

Put'ney, p.-v. and tp., Windham co., Vt., on Connecticut River and Vermont Central R. R. P. 1167.

Putrefaction. See Fermentation, by Prof. C. F. Chandler, Ph. D., M. D., LL.D., M. N. A. S.

Put'ty, a cement used by glaziers for fastening window-glass in place, and by painters for filling holes in wood over nail-heads, etc. It is composed of whiting (carbonate of lime) and linseed oil, often colored with different pigments. C. F. Chandler.

Putty Powder, oxide of tin, or a mixture of this oxide with oxide of lead, used for polishing glass, etc. It is prepared by calcining tin or a mixture of tin and lead. For the optician's use it is prepared by precipitating a solution of tin in aqua regia with ammonia, washing, drying, and igniting the product. C. F. Chandler.

Puy-de-Dôme, central department of France, comprises an area of 5070 sq. m., with 566,463 inhabitants. The ground is high and the surface mountainous, covered with branches of the Cevennes and the Auvergne mountains, whose conical peaks and their extinct craters (*puys*), together with the large masses of lava and basalt, show the volcanic character of the country. The soil is generally fertile, but agriculture is not in an advanced state. Wheat and wine are produced; on the fine pastures of the mountain-plateaus cattle and sheep are reared, the former of a good, the latter of an inferior breed. Iron, lead, and silver are found in small quantities; marble, granite, and millstones are quarried. Of 75,223 children of school age, 18,847 received no school education in 1857.

Puy, Le, town of France, capital of the department of Haute-Loire, is picturesquely built in terraces on the side of Mount Anis, near the left bank of the Loire. It has celebrated bell-foundries and manufactures of yarn, laces, linen, and woollen fabrics and cloth. P. 19,532.

Puzzolana, or **Pozzuolana.** See Cements, by Gen. Q. A. Gillmore.

Pyæ'mia [Gr. πύον, "pus," and αἷμα, "blood"], a very fatal disease which occurs during the progress of suppuration in some part of the body, and believed to be due to the entrance of purulent matters into the blood. As it is most frequently met with in hospitals where there are many wounded persons, some surgeons regard the exciting cause in these cases to be a miasm which arises from unhealthy wounds and poisons healthy wounds. The disease is ushered in with a chill, followed by a febrile, and then by a sweating stage. The chills are often repeated and at irregular periods, sometimes as many as three occurring in a day. Toward the termination of the case they are less frequent. Though the surface feels cold during the chill, the temperature of the body rises, and in the hot stage may reach 105° to 108° F. There is loss of appetite, thirst, want of sleep, emaciation, sallow skin, and prostration. Acute cases run a course of from six to ten days, and in chronic cases from three to four weeks. Death results from exhaustion, due to the poisoning of the blood; secondary inflammations, as pleurisy; and the formation of abscesses in internal organs, as the lungs, liver, and spleen, or in the joints and cellular tissue. Stephen Smith.

Pyat' (Félix), b. at Vierzon, department of Cher, France, Oct. 4, 1810; studied law and was admitted to the bar, but devoted himself exclusively to literature; became a contributor to the *Siècle*, and afterward editor of the *National*; produced in 1832, in conjunction with Théodore Burette, the play *Une Révolution d'autrefois*, which was suppressed at the Odéon, but printed in *Revue des Deux Mondes*; composed several other plays which were performed with success; left in 1846 the *National* for the radical *Réforme*; was elected a member of the Constituent Assembly in 1848; sided with the Socialists; fled in 1850 to Switzerland; returned in 1869 to Paris; was arraigned and sentenced to imprisonment in 1870 for some articles in the *Rappel*, but escaped to London; returned again to Paris after the fall of the Empire; edited the *Combat* and the *Vengeur*; was elected a member of the Commune in 1871, and is generally made responsible for some of the most violent and arbitrary measures; escaped to London after the downfall of the Commune.

Pycnog'onum [Gr. πυκνός, "compact," and γόνυ, "joint"], a genus of marine organisms now considered to be spiders, but for a long time supposed to be crustaceans. Some regard them as pœcilopod entomostracans. They are placed, with some others, in a family, Pycnogonidæ, and are the types of a peculiar order.

Pydna, a Greek colony on the Thermaic Gulf, became after various vicissitudes a Macedonian possession during the reign of Philip II., and was the scene of the final overthrow of his empire, Perseus being totally defeated by P. Scipio Nasica in the plain before its walls (June 22, 168 B. C.). At present its exact site cannot be recognized.

Pygma'lion, a king of Cyprus, fell, according to ancient legends, in love with an ivory statue of a maiden he himself had made, and prayed to Aphrodite to make the statue living; which prayer was granted.

Pyg'my [Gr. πυγμαῖος, "one who measures a πυγμή," the length from the elbow to the hand], one of a race of dwarfs mentioned by Greek writers. Homer states that every year they waged war with the cranes. Many writers speak of them as living on the upper Nile; and the existence of a race of very small men near the upper Nile has been fully confirmed by recent travellers. But even if the ancient tales with regard to the pygmies had any reference to this people, they certainly overlaid the truth with a great amount of palpable fiction. The pygmy graves and bones found in Tennessee are supposed to belong to children.

Pyles'ville, p.-v., Dublin tp., Harford co., Md. P. 38.

Py'lus, town of Messenia, on the promontory of Coryphasium, and one of the last towns taken by the Spartans in the Second Messenian war. In 424 B. C. the Athenians built a fort on the site of the town, which became very famous in the Peloponnesian war. The present name, *Navarino*, is a corruption of *Avarino*, the Avars having settled here in the sixth century.

Pym (John), b. at Brymore, Somersetshire, England, in 1584, of an ancient and wealthy family which possessed large estates at Woolavington Pym, near Bridgewater; spent some years as a gentleman commoner at Pembroke College, Oxford, 1599–1602, but did not graduate; studied law at one of the inns of court; was elected to the Parliament of 1614, in which he became one of the leaders of the "country party;" was one of the twelve commissioners chosen in 1621 to confront James I. at New Market in behalf of the privileges of Parliament; was, with other leaders, at the expiration of the session of that year, imprisoned for his opposition to government measures; was returned to the first Parliament of Charles I., in which he was actively engaged in the impeachment of the duke of Buckingham 1626; was prevented by royal proclamation from emigrating to New England 1637; presented himself to the country, along with Hampden, in 1639 as the champion of the popular cause, and negotiated with the commissioners

of the Scotch Covenanters; was the recognized leader of the "Short Parliament" of 1640 and of the "Long Parliament," which assembled in 1641; managed the impeachment of Strafford and the trial of Laud; presented the "grand remonstrance," which set forth all the evils endured from the beginning of the reign of Charles I.; was the chief of the "five members" whose attempted seizure by the king precipitated the civil war (Jan., 1642); was the real head of the provisional executive established at London after the king's flight; issued a manifesto in 1643 defending himself in moderate language from the king's accusation of treasonable dealings with the Scots; was appointed lieutenant of the ordnance in November. D. suddenly at Derby House, London, Dec. 8, 1643. He was buried with pomp in Westminster Abbey, and having impoverished himself in the cause of his country, £10,000 was voted by the House of Commons to pay his debts. By the royalists he was nicknamed "King Pym," and Clarendon testifies that at the opening of the Long Parliament he was "the most popular man in that or any other age." Modern historians have confirmed this high estimate. (See Forster's *Arrest of the Five Members* (1860), *The Debates on the Grand Remonstrance* (1860), and *Statesmen of the Commonwealth* (1864); Goldwin Smith's *Three English Statesmen* (1867); and J. R. Green's *Short History of the English People* (1875).) PORTER C. BLISS.

Pymatu'ning, tp., Mercer co., Pa., on Shenango Creek, includes the village of Clarksville. P. 2549.

Pymosa, tp., Cass co., Ia. P. 2120.

Pyn'chon (JOHN), the only son of William (1590), b. in England in 1627, and brought to New England at a very early age; married Amy, the daughter of Gov. George Wyllys of Hartford; succeeded his father in the government of Springfield and in the management of the affairs of the Connecticut River Valley, the greater part of which, for himself and others, from Enfield and Suffield in Connecticut up to the line of New Hampshire and Vermont, he purchased from the natives; distinguished for his public spirit, and for his skill in the management of the Indians, by whom he was greatly beloved; was the first colonel of the Hampshire regiment, and assistant under the old Massachusetts charter; one of the governor's council for New England under Sir Edmund Andross, and a councillor under the new Massachusetts charter. D. at Springfield June 17, 1703.

Pynchon (JOSEPH), son of William Pynchon of Springfield and Catharine Brewer, and great-grandson of the preceding, b. at Springfield Oct. 30, 1737; graduated at Yale College 1757; married Sarah, daughter of Rev. Thomas Ruggles of Guilford, Conn.; prominent in the politics and affairs of that colony; a loyalist during the Revolution, and retired to Shelburne in Nova Scotia; after the war he returned to Guilford, and devoted the remainder of his life to scientific pursuits.

Pynchon (THOMAS RUGGLES), M. D., only son of the preceding, b. at Guilford in 1760; educated in the city of New York, and during the Revolution pursued his medical studies in the hospitals of the English army; after the war returned to Guilford, where he soon acquired great celebrity in his profession; married Rebecca, daughter of Abraham Tomlinson of Stratford. D. in 1796, in consequence of a fall from his horse.

Pynchon (THOMAS RUGGLES), D. D., grandson of the preceding, b. at New Haven Jan. 19, 1823; educated at the Boston Latin School and at Trinity College, Hartford, where he graduated in 1841, M. A. 1844; was tutor 1843–47; ordained deacon at New Haven June 14, 1848, and priest at Boston July 25, 1849; rector of Stockbridge and Lenox, Mass., 1849–55; elected Scovill professor of chemistry in Trinity College Oct. 2, 1854; received the degree of D. D. from St. Stephen's College, New York, in 1865; elected president of Trinity College Nov. 7, 1874; author of a treatise on the chemical forces and of various sermons and pamphlets.

Pynchon (WILLIAM), one of the original patentees of the Massachusetts Bay Company; b. in Essex, Eng., about 1590; came to New England in 1630 with Winthrop and other patentees, and settled at Roxbury; in 1636 removed to Connecticut River and founded Springfield, named after his own residence at Springfield, Essex, England; in 1650 published in England a book entitled *The Meritorious Price of Man's Redemption.* In consequence of the disfavor with which this book was received, and the persecution to which it subjected him, he returned to England in Sept., 1652, and purchased property at Wraisbury, Buckinghamshire, opposite Magna Charta Island in the Thames, near Windsor. D. Oct. 29, 1662. Was also author of a treatise on the Sabbath, and another upon the Jewish synagogue.—He left one son, JOHN, to whom he bequeathed all his vast landed estate in the valley of Connecticut River.

Pynchon (WILLIAM), son of William Pynchon of Springfield and Catharine Brewer, b. at Springfield in 1723; graduated at Harvard College in 1743; settled at Salem; until the Revolution one of the most distinguished lawyers in the colony of Massachusetts Bay; a staunch loyalist. D. Mar. 14, 1789.

Pynol (C_4H_5N), an oily base found in the products of the destructive distillation of all animal and vegetable substances, containing nitrogen. It occurs in tobacco-smoke. It is made from bone oil, and by distilling mucate of ammonia alone or with glycerine. Pynol-red is formed by heating pynol with hydrochloric or sulphuric acid. C. F. CHANDLER.

Pyr'amid [Gr. πυραμίς, πυραμίδος], a polyhedron having any polygon for a base, the remaining faces being triangles meeting at a common point called the *vertex*. The triangular faces taken together make up the *lateral surface* of the pyramid. A spherical pyramid is a portion of a sphere bounded by any spherical polygon, called the *base*, and by corresponding sectors of great circles. The vertex is at the centre of the sphere.

Pyr'amid. The pyramids of Egypt are collected into several groups at a considerable distance from each other. Looking out from the citadel of "El Karo," one can obtain a view of several of these groups, stretching far away to the southward along the western bank of the Nile. The whole number is variously reckoned, but not more than 38 are really entitled to the name, and of these many are in the most ruinous condition. They extend from 29° 59′ to 29° 26′ N. lat., a space measuring from N. to S. something over 50 miles. Thirty-three of these pyramids belong to the province of Memphites, as defined by Diodorus Siculus, and the several particulars concerning them are most concisely exhibited in the following table, abridged from the 13th vol. *Astronomical Obs.* (Edinburgh, 1872). Commencing at the most southerly, we find—

Pyramid or Pyramids.	Present height in British inches.	Ancient height in British inches.	Probable date of erection, B. C.
Two of Biamoo	360	x	1800
One of Howara (ruinous)	1270	x	1850
One of Illahoon (ruinous)	1580	x	1850
One of Meydoom (flat-topped)	1494	x	1850
Southern of Lisht (ruined)	822	x	1900
Northern of Lisht (ruinous)	1080	x	1900
Southern of Dashoor (brick)	1872	3208	1900
Small of Dashoor	816	1281	1950
Southern stone of Dashoor (2 slopes)	3834	4029	1950
Northern stone of Dashoor	3918	4111	1950
Northern brick of Dashoor	980	2586	1950
Base of Mustabet El Farahoon	650	720	1950
9th at Saccara (ruined)	900	x	2000
8th at Saccara (ruined)	1044	x	2000
7th at Saccara (ruined)	330	x	2000
6th at Saccara (ruined)	960	x	2000
5th at Saccara (ruined)	480	x	2000
4th at Saccara (ruined)	740	x	2000
3d at Saccara (the great)	2200	2405	2050
2d at Saccara	1300	1758	2000
1st at Saccara (ruined)	700	x	2000
Small of Abooseir	216	564	2050
Great of Abooseir	1970	2734	2100
Middle of Abooseir	1284	2056	2100
Northern of Abooseir	1400	1953	2100
Northern of Reegah (2 slopes)	500	1150	2100
Northern of Zowat El Arrian (ruined)	730	x	2100
Northern of Aboo Roash (ruined commencement)	480	x	2100
9th at Jeezeh	960	1221	2100
8th at Jeezeh	660	1332	2100
7th at Jeezeh	540	1332	2100
6th at Jeezeh	834	1440	2100
5th at Jeezeh	1000	1119	2100
4th at Jeezeh	834	1440	2130
3d at Jeezeh	2436	2616	2100
2d at Jeezeh	5370	5451	2130
The Great at Jeezeh	5410	5818	2170

It will not be necessary to describe particularly all the pyramids mentioned in the above table. We select, therefore, a few of the more important. Fifteen miles S. of Cairo are the pyramids of Dashoor; very little is known of the history of this group. They are five in number—two of stone and three of crude brick. The two former exceed all the other pyramids in Egypt in size, except the first and second at Jeezeh. The northern one is partly cased, and has an entrance in the northern face, leading by a descending passage to the sepulchral chambers, which stand upon a level with the foundation. The southern stone pyramid of Dashoor has a peculiarity of form which strikes the eye disagreeably, and is in strong contrast with the symmetrical shape of the Jeezeh group. The lower

portion is at an angle of 54° 14′, but about halfway up the inclination suddenly changes to 42° 59′. Whether this was to gratify a whim of the builder or because it could not be completed on the original scale, cannot now be determined.

Two miles N. of Dashoor are the pyramids of Saccara, nine in number. The largest and most remarkable is called, from its peculiar construction, the Pyramid of Steps. It is not square at the base, like the Jeezeh pyramids. Beneath it are several passages, and a gallery supposed to have been made subsequently to the completion of the structure. In the centre, but below the surface-level of the ground, is a narrow, lofty chamber, and near it a small one lined with blue tiles. In the latter an inscription was found containing the name and titles of an early king, Ra-nub-rokee; if this be Manetho's Necerôchis, as some have supposed, and the head of the third dynasty, this pyramid would antedate those at Jeezeh: its ruinous condition has also been supposed to indicate its great age. This, however, it is far more likely, is due to wretched construction and poor material; and Dr. Lepsius, in the folio vols. of his *Denkmäler*, unhesitatingly places it as more recent than the Great Pyramid of Jeezeh. Two miles N. of the Saccara group are the pyramids of Abooseir, the largest of them about equal in size to the third of Jeezeh. These pyramids stand on an elevated ridge of the Libyan chain, 7 miles S. of the Jeezeh group, and are easily seen from the Great Pyramid hill. The group consists of three large and one very small. The northernmost is said to have been the work of Shura (or Sôris) of the fourth dynasty.

We come now to the well-known "memorials of the world's youth," ever fresh and the most familiar monuments on our globe, "the pyramids of Jeezeh." They are about 12 miles from Cairo and 7 from the banks of the Nile, at the southern apex of the Delta-land of Egypt, and the point of curvature of the northern coast. Belonging to the childhood of the human race, erected before history began, the questions, Who built them? And for what purpose? are not easily answered. The Jeezeh group of pyramids consists of nine, three of which, the so-called first, second, and third, are of great size; of the smaller ones, three are on the E. side of the first, or Great Pyramid, and three on the southern side of the third pyramid. The smaller ones are all in a ruined condition, and it will only be necessary to describe briefly the three larger. The accompanying map will show their relative positions:

Fig. 1.

The Pyramids of Jeezeh.

The smallest and most southerly is the third pyramid, with three still smaller ones in a ruinous condition directly S. of it. When Col. Howard Vyse entered it in 1837 he found it had already been ransacked. There was in it, however, a very elaborately-carved sarcophagus (which was lost at sea near Carthagena on its way to England) and part of a mummy-case, bearing the name Ra-men-ka, which is now in the British Museum. Herodotus and Diodorus attribute the erection of this pyramid to Mykerînos, but Manetho makes it the work of Queen Nitôkus, the former the fourth ruler of Manetho's fourth dynasty, the latter ending the sixth. Bunsen supposes, from the fact of its having two chambers and its evident enlargement after completion, that it was the sepulchre of both. The two chambers are subterranean, and entered by inclined passages, but not at the same angle. This pyramid has been much lauded for its casing of red granite, now tumbled off and so badly weather-worn that the angle of slope can only be approximately obtained. In its construction it is inferior to the second pyramid, which is at a distance from it of about 700 feet in a north-easterly direction. With the exception of the Great Pyramid, this is the largest and best built of the Egyptian pyramids. On its E. side are the remains of a small temple; still farther eastward, and a little S., is the tomb of Cheops, near which, in a south-easterly direction, is the Sphinx, and still farther in the same direction the magnificent tomb of Shafre, the builder of this pyramid. The stones of the casing at the N. E. angle have been removed or broken, so that the ascent, though hazardous, is not unfrequently made by the Arabs, and sometimes by Europeans. It was the work of two architects, and the different style of workmanship shows itself in the most marked manner. There are two entrances to the pyramid on the northern side. Through the upper one Belzoni entered it in 1818, to find it had been already ransacked some 900 years before. A sarcophagus was found buried level with the floor; it had a tight-fitting lid, but the body, if one was ever in it, was gone. There is but one sepulchral chamber, and this is partly below the level of the base of the pyramid. The lower entrance was first opened by Col. Howard Vyse; it was closed by rectangular and rough blocks, and the inclination was some 4° less than that of the upper. Neither of these passages is finished like those of the Great Pyramid. Herodotus and Diodorus attribute the erection of the second pyramid to Chephren (or Shafre), whose statue in diorite was found by Mariette in the splendid tomb to which we have already alluded. It remains to describe the Great Pyramid, and to notice briefly the extraordinary claims that some have made in its behalf. It stands upon the extreme N. E. boundary of the hill, so near the margin of the cliff that the ancient builders have strengthened the hill in that direction by all the stone clippings, forming immense rubbish-heaps. The selection of this locality, when as yet no other pyramid had been erected on the hill, can only be explained on the supposition that an attempt was made to put it exactly in lat. 30° N.; and such is really the elevation of the pole if we disregard refraction. The true latitude, as determined by Prof. Smyth, is 29° 58′ 51″, and according to the French astronomer, M. Nouet, 29° 59′ 6″. Like all the other Jeezeh pyramids, it is oriented, but much more exactly. As the pyramid now stands, with its external polished limestone casing stripped off to build modern Cairo and the neighboring villages, it would have been impossible to determine the original orientation except for the fortunate discovery by the French engineers of two of the original sockets for the corner casing-stones. Subsequently, under the direction of the Scottish astronomer, all four were uncovered. The mounds of débris at the centre of the four faces of the pyramid are some 40 feet in height; through the northern one Col. Howard Vyse made a cross-cut, disclosing the ancient pavement and two huge casing-stones in place, with the fragment of a third still adhering to one of the others by the tough cement. He tells us that the masonry was unrivalled; not the thinnest paper could be anywhere inserted between the joints. These casing-stones were again covered, but they have since disappeared, coveted for the fine quality of the stone for burning into lime. On the E. side the variation of the line of sockets from true N. and S. was 4′ 44″ W. The entrance-passage on the northern side is still nearer to the

Fig. 2.

Socket of N. E. corner of Great Pyramid.

meridian—only 4′ 35′ W. The discovery of the sockets enables a measurement to be made of the original base-side

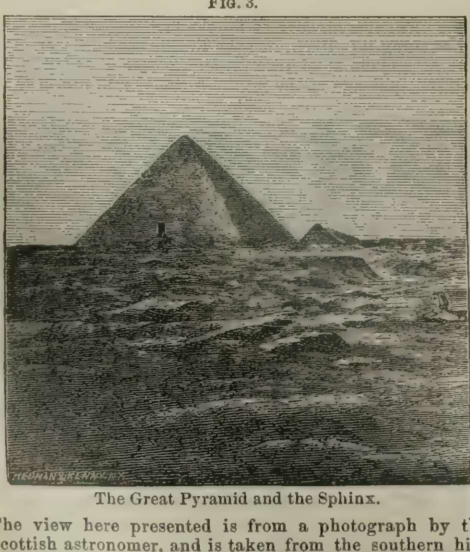
length, though indeed with some difficulty over the intervening mounds of rubbish. The view in Fig. 2 is of the socket at the N. E. corner, about 29 feet distant from the present corner of the pyramid; it is from a photograph by Piazzi Smyth.

Two of the 100-inch rods neatly measured the diagonal, and so accurately was the floor levelled that Mr. Inglis, the engineer who uncovered it, reported, "I have examined it all over the surface with a spirit-level and find no error in it." The measurements between the sockets for the base-side length are—

	British inches.
The French engineers in 1800	9163
Col. Howard Vyse, 1837	9168
Mr. Inglis for Mr. Aiton, 1865	9110
Royal engineers, direction of Sir H. James, 1868	9130
Simple arithmetical mean	9142

The base would therefore cover some 13 acres, and the huge structure is reared with the distinctive peculiarity that each layer is of uniform height throughout—a feature belonging to none of the other pyramids except the upper and better portion of the second. Attempts have been made from the base-side length to recover the ancient standard (or cubit) used by the builders. Thus, Sir H. James in 1869, adopting the smallest of the above measures, and conjecturing that the cubit was contained 500 times in one side of the base, obtained a length of 18.22 British inches, which he considered also as the length of the Greek cubit. Piazzi Smyth, observing the frequent occurrence of a length exceedingly near to that of the British inch or its multiples, especially in 5s and 10s, supposes the standard employed to have been the same fraction of the polar radius of the earth that the French mètre was designed to be of the quadrant of the meridian passing through Paris—*i. e.* 25.025 British inches; in round numbers, 25 pyramid inches, as he calls them; and this length he considers that of the sacred Hebrew cubit. On this supposition, reducing the above 9142 British inches to pyramid inches—*i. e.* 9133—and dividing by the cubit, or 25, he finds the cubits in one side 365.3—very near the length of the tropical year. For reasons derived from the more accurately-measured interior he considers the true length as 9140 British inches, or 9131 pyramid inches, giving now 365.242 as cubit length of base side. The angle of slope of the pyramid was measured by Mr. Brettel for Col. Vyse when the casing-stones were uncovered. Two sets of measurements were made—the angle directly, 51° 50′; and the length of the several sides, giving by computation 51° 52′ 15.5″. The mean of the two is 51° 51′ 7.7″, differing only 6.4″ from the theoretical angle of a pyramid whose height is to the perimeter of the base as the radius of a circle to its circumference—a coincidence first noticed by the late John Taylor. In most of the views given of the Great Pyramid the Sphinx appears in the foreground, and of such magnitude as almost to eclipse the pyramid itself.

FIG. 3.

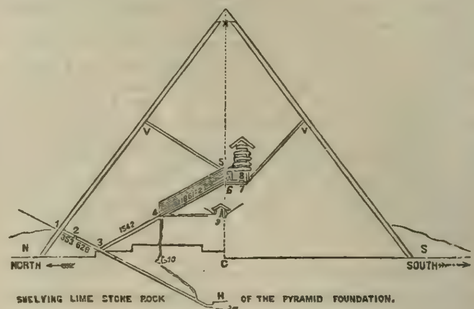


The Great Pyramid and the Sphinx.

The view here presented is from a photograph by the Scottish astronomer, and is taken from the southern hill, at such distance as to show more nearly the relative sizes of the pyramid and the Sphinx. The opening in the S. face of the pyramid is known as "Col. Vyse's hole," an attempted forced passage from the S.; the smaller pyramids are shown on the eastern side.

The true entrance to the Great Pyramid is by an inclined passage in the northern face, some 40 feet from the base and 25 feet E. of the centre. This passage is mentioned by Herodotus, and was the only one known to him. The angle of slope is 26° 27′, and it is lined with polished limestone with exquisitely fine joints. The passage ends in a subterranean chamber cut out of the living rock, but never finished. It is shown at H in the accompanying diagram, the commencement of the descending passage being at (1):

FIG. 4.



Plan of the Great Pyramid.

The ascending passage commences at (3), about 82 feet from the original face of the pyramid, and ascends at an angle of 26° 18′. Below (3) the descending passage is now blocked. Originally, the ascending passage was concealed, but the ceiling-stone fell during the attempt of the caliph Al Mamoun to force his way into the pyramid by cutting an entrance (A. D. 820), the true entrance being at that time unknown. The length of the ascending passage is about 128 feet; it is blocked above (3) by two granite stones, and is entered behind these stones through Al Mamoun's hole. At (4) is the commencement of the grand gallery, which is 157 feet in length, with a height of 28 feet, and breadth of 7 feet, nearly; a ramp, or stone bench, 2 feet high, is on either side, and by means of holes in these one is enabled to climb up the steep and slippery floor to the entrance of the ante-chamber at (6). A horizontal passage, the entrance, originally covered by the floor of the grand gallery, and just at its commencement near (4), conducts to the so-called queen's chamber (9), a distance of some 126 feet. This chamber is the only one that has an inclined roof; it is lined with polished white limestone. In the eastern side is a niche 15 feet high and 40 inches deep; its centre is 25 inches from the middle of the room. No explanation has been given of this niche upon the tombic theory. Just within the entrance of the grand gallery a small and tortuous passage, now closed, leads to a subterranean grotto (10) cut in the living rock, and thence descends until it meets the principal entrance-passage. Entering into the ante-chamber (6), by a small passage-way from the top of the grand gallery with its seven overlappings, we find ourselves in a remarkable little room with a floor mostly of granite, and two granite wainscots on either side. Four grooves are cut in these wainscots, as if to receive a stone portcullis, though there are now no remains of such, if any existed. The first groove was not cut down to the floor, and in it now rests, firmly cemented, a rectangular granite block, with another, either broken or partially finished, cemented above it; under this suspended granite stone or leaf one passes in fully entering the chamber. The total height of the chamber is 149.5 British inches, and the centre of the suspended granite leaf divides this into 91.4 and 58.1 inches, or the $\frac{1}{100}$th of the base-side length and height of the pyramid. The total length of the ante-chamber is 116.3 British inches, or 116.26 of Piazzi Smyth's pyramid inches—*i. e.* diameter of a circle with circumference 365.242—while the granite portion of the floor, and also height of E. wainscot, each 103.03 pyramid inches, is the side of a square having the same area as a circle with a diameter of 116.26. A low passage conducts to the king's chamber (8), with the so-called sarcophagus or coffer (7). This noble chamber is lined with polished granite—five courses of equal height, 47 inches each, except the lower, which is reduced to 42 inches by a rise of the granite floor of 5 inches. Very careful measurements have been made of this room and of the coffer, which is rectangular and cut out of a solid block of red granite, and very carefully polished. It is remarkable that the cubical dimensions of the exterior of the coffer are double those of the interior, and half the mean perimeter is the diameter of circle with circumference of 365.6 British inches. The astronomer-royal for Scotland finds in this coffer a standard of weight and measure, and traces a connection between it and the dimensions

of the king's chamber and sacred cubit, giving several earth relations and astronomical truths which our space will not permit us to notice. The ceiling of the king's chamber is composed of nine granite slabs carefully polished, and, like all the rest of the chamber, with exquisite joints. To remove the pressure of the superincumbent mass, five chambers of construction, so called, or rather hollows, are above it. A small passage leads from the upper portion of the grand gallery to the lower of these hollows, and forced passages have been made to the others; the roofs of all are carefully smoothed, but the floors are rough. In some of these, chalk or paint quarry-marks were found indicating the positions, and, roughly, the name of Cheops; these are the only ancient markings anywhere to be found in the pyramid. Two ventilating shafts *v v* regulated the temperature of the king's chamber, and in 1874, Mr. Dixon, an engineer resident at Cairo, discovered two for the queen's chamber, which, however, curiously enough, had never been opened in the walls of the finished room.

With regard to the date of erection, if we discard the theory proposed by Sir John Herschel, that the carefully-polished entrance shaft was directed to the then polar star at its lowest culmination, very little can be said. It has been placed by the Egyptologists at periods between 2000 and 6000 B. C. The astronomical theory gives for the date of erection 2170 years B. C., so that, if this be correct, the pyramid was about 700 years old at the date of the Exodus. At this time α Draconis was the polar star, at a distance of 3° 33′ from the pole, if we take the angle of slope of the descending passage as the correct elevation at the commencement of the structure; and 3° 42′ from the pole at the finishing of the grand gallery, corresponding to an interval of 25 years. At this date (2170 B. C.) it is found that when α Draconis was culminating below the pole, the Pleiades and vernal equinox were also culminating above. The angle of slope of the second pyramid is 52° 20′, somewhat near that of the Great Pyramid, of which it was probably, in external appearance, a copy. The Great Pyramid—differing from all the others in having upper ventilated rooms; in its superior construction; in its peculiar angle of slope, giving the π ratio; in its remarkable situation and careful orientation—was, it is claimed by Piazzi Smyth and others, built for higher purposes than sepulture, which was undoubtedly the object of the remaining pyramids, though, indeed, these have nothing of true Egyptian architecture about them as we find it in later temples and tombs. It has been asserted that the Sphinx is of older age than the pyramid on the strength of an inscription in very *mediocre style* on a stone found by Mariette near one of the small pyramids, E. of the Great Pyramid. This has since been pronounced by Brugsch to bear a lie on the face of it; he declares that the inscription is simply a legend scratched at a late date, and cannot be quoted as an authority. Mr. Proctor has, in one of his recent lectures, suggested that the Great Pyramid was erected for astrological purposes. The entire absence of hieroglyphs and planispheres forbids this assumption. Piazzi Smyth, in view of the difficulty of admitting at such an early date the mathematical and astronomical knowledge which he thinks may be found in the dimensions of the pyramid, and from what appears to be a prophetic indication of the number of years to elapse from the date of its erection to the commencement of the Christian era—this latter being two fine lines ruled on the polished walls of the descending passage near (2) in our diagram, and which are at a distance of 2170 inches (or an inch for a year) from the commencement of the grand gallery, supposed typical of the commencement of the Christian era—does not hesitate to attribute its erection to supernatural aid, and even names Melchizedek as the architect. Finally, we may note that the queen's chamber is situated on the 25th course of masonry, and the king's on the 50th; the height of the king's chamber floor above the base is such that the area of a cross-section of the pyramid there is one-half the area of the base. The rise of the pyramid, as shown by Sir H. James, being 9 of height to 10 of base at the corners (the angle of slope of arris line being 41° 59′ 18.7″), Mr. Petrie concluded that the height of the pyramid $\times 10^9$ represented the sun's distance, or 91,840,000 miles! Our space will not permit discussion of these claims, and we must leave our readers to judge for themselves. The prominent facts to be accounted for on any theory have been given. H. L. SMITH.

Pyramid Lake lies in Roop co., Nev. It receives Truckee River, and is among lofty mountains. It is 32 miles long and 10 miles wide. Elevation, 4000 feet. It abounds in large trout. It has no outlet.

Pyr′ene ($C_{16}H_{10} = C_{10}H_6(C_6H_4)$), or **Phenylene-Naphthalene,** a solid hydrocarbon occurring with chrysene in the last portions of the distillate obtained in distilling coal-tar to coke. The two bodies are separated by means of carbon disulphide, which dissolves the pyrene and leaves the chrysene. The carbon disulphide is distilled off, and the residue is repeatedly extracted with warm alcohol, and the cooled solution is mixed with an alcoholic solution of picric acid as long as a crystalline precipitate of pyrene picrate is produced. The precipitate is washed with alcohol, decomposed by ammonia, washed with water, and recrystallized from alcohol till the melting-point is constant at 142° to 144° C. Pyrene crystallizes from hot alcohol in laminæ resembling those of anthracene. It is usually yellow, from impurities, but may be decolorized by exposing the solution in benzol to sunlight. It is very soluble in benzol, ether, and carbon disulphide. It melts at 142° C., and distills at a temperature considerably above 360° C. With nitric acid of different strengths it forms mono-, di-, and tetra-nitro-pyrene. It forms a di- and tri-brom-pyrene, and with sulphuric acid a sulpho-acid. Pyrene quinone ($C_{16}H_8(O_2)''$) is obtained as a red powder by the action of chromic acid on a hot solution of pyrene in glacial acetic acid. Heated with hydriodic acid and amorphous phosphorus, it yields hydrides, among them the hexhydride ($C_{16}H_{16}$). (See Laurent, *Ann. Ch. Phys.* [9], lxvi. 136; Schorlemmer, *J. Chem. Soc.*, x., 1872, 445; Graebe, *Ann. Chem. Pharm.*, clviii. 285, 299; Morton, *Am. Chemist*, v. 115.) C. F. CHANDLER.

Pyr′enees, a lofty mountain-chain which forms the boundary between France and Spain, and stretches in one continuous range from the Mediterranean to the Bay of Biscay. Its entire length is 270 miles, its greatest breadth 90 miles. It is broadest and highest about midway, where the two almost parallel lines of which the range consists are connected with a number of wild, towering peaks, of which the highest are Pic Nethou, 11,168 feet; Mont Perdu, 10,950 feet; Vignemale, 10,820 feet; and Pic du Midi, 9540 feet. In their eastern course, toward the Mediterranean, the Pyrenees fall rapidly to an average height of 2000 feet, while the western part of the chain retains an average height of 5000 feet, with many peaks rising 8000 feet. Northward, toward France, the Pyrenees slope gradually, sending out forest-clad offshoots which enclose beautiful valleys; southward, toward Spain, they present steep, abrupt, and barren but bold and picturesque slopes. There are seven passes with carriage-roads leading over these mountains, all at an elevation of over 7000 feet. The most important are those of Bidassao, Pamplona, and Perpignan.

Pyrénées, Basses. See BASSES-PYRÉNÉES.

Pyrénées, Hautes. See HAUTES-PYRÉNÉES.

Pyrenées-Orientales, department of France, bounded S. by Spain and E. by the Mediterranean, comprises an area of 1571 sq. m., with 191,856 inhabitants. It is covered with offshoots of the Pyrenees, which slope gently down toward the sea. The soil is fertile and the climate exceedingly mild. Grapes, olives, mulberries, and oranges grow abundantly, but the summer is often extremely dry and scorchingly hot, and large tracts of land along the coast are very unhealthy. Of 22,948 children of school age, 10,582 received no school education in 1857.

Pyrenomy′cetes, an order of ascomycetous fungi, in which the asci are borne on the inner surface of cavities called perithecia, the walls of which are composed of a dense stroma, and not of a membrane consisting of a layer of polygonal cells, as in the Perisporiaceæ. Besides the spores contained in the asci, most of the Pyrenomycetes have several kinds of secondary fruit, known as conidia, stylospores, pycnidia, etc., which were supposed by the older mycologists to be distinct species of fungi, which they placed in the orders Mucedines, Sphæronemei, Sepedoniei, and Dematiei. (For illustrations of the different kinds of fruit of the Pyrenomycetes the reader is referred to vols. ii. and iii. of Tulasne's *Carpologia Fungorum Selecta*.) The process of fertilization by means of a structure known as an ascogone has been studied by Woronin in *Sphæria Lemaneæ*, and by Gilkinet in the genus *Sordaria*. The Pyrenomycetes inhabit stumps, branches, and leaves, and several of them grow upon insects. Ergot is the sclerotium state of *Claviceps purpurea*, found on rye and other grains. Most of the species are of slower growth, and are less affected by changes of temperature, than other fungi, and many of them, as the black-knot (*Sphæria morbosa*, Schw.), do not ripen their spores until mid-winter.

W. G. FARLOW.

Pyrheliom′eter [Gr. πῦρ, "fire," ἥλιος, "sun," and μέτρον, "measure"], an instrument to measure the heat of the sun, invented by M. Pouillet, consisting of a shallow circular silver vessel containing water or mercury, in which a thermometer is plunged. The upper surface of the vessel is covered with lampblack, and the thermometer enters

the under side, extending below. In use, the rays of the sun are caused to fall perpendicularly upon the surface of the vessel. The area of the exposed blackened surface and the amount of water raised through a certain number of thermometric degrees being known, the absolute heating effect of the sun, acting upon a given area under the conditions of the experiment, may be readily found.

Pyridine (C_5H_5N), an oily base found in bone oil, shale oil, peat-tar, coal-naphtha, and the products of the destructive distillation of cinchonine. It occurs in tobacco-smoke. It is produced artificially by the action of nascent hydrogen on azodinaphthyl-diamine, and by the dehydration of amyl nitrite. C. F. CHANDLER.

Pyri′tes [Gr. πυρίτης, "firestone," because it strikes fire with steel], in its widest sense a native mineral, massive or crystalline, composed of a metallic sulphide or arsenide, or both. Iron, copper, nickel, and cobalt pyrites are the ones generally mentioned. Iron pyrites is often found crystallized in cubes or in other forms. It is sometimes massive, and occasionally globular. From its bright yellow color it is sometimes mistaken for gold. It is a more or less pure iron-bisulphide. It is of great value for the manufacture of sulphuric acid and the sulphates and other commercial sulphur compounds. It also yields not unfrequently a handsome amount of silver, copper, or gold. Chemical reagents derived even remotely from it are apt to contain appreciable amounts of arsenic. Copper pyrites is an impure double sulphide of iron and copper. It is extensively employed, not only as a source of sulphuric acid, but of metallic copper.

Py′ritz, town of Prussia, province of Pomerania, is an old place, with some remembrances of its Wendish origin. It trades a little in corn and fish, and has some linen and cotton manufactures. P. 7521.

Pyrogallic Acid. See PYROGALLOL.

Pyrogallol, called also **Pyrogallic Acid** [Ger. *Brenzgallussäure*], discovered by Scheele by subliming gallic acid of gall-nuts, but held by him to be identical with the latter. Leopold Gmelin and Braconnot proved it to be a peculiar substance, and it was hence called *pyrogallic acid.* It forms a beautiful mass of snow-white crystals, extremely light and feathery. Having been held of late years to be a body belonging to the phenols—a triatomic phenol, and no true *acid* substance—the name has been changed to *pyrogallol.* Its formation from gallic acid by the action of heat is simply as follows:

$$\underset{\text{Gallic acid.}}{C_7H_6O_5} = \underset{\text{Pyrogallol.}}{C_6H_6O_3} + CO_2.$$

Pyrogallol is a highly remarkable body, and a useful reagent in the chemical laboratory, by reason of the fact that in the presence of alkaline substances it has an intense affinity for atmospheric oxygen at ordinary temperatures; and it was therefore proposed by Liebig as an agent in analysis of gaseous mixtures containing oxygen, a method now in universal use. During such oxidation it forms also, in presence of alkalies, colored bodies of very intense tinctorial power, and was proposed in 1872 by the present writer as a reagent for the detection and determination of oxygen in aqueous solutions—as in natural waters. This latter method has been appropriated and used, without credit, by French chemists in the determination of dissolved oxygen in urine and other liquids.

HENRY WURTZ.

Pyro′la, in botany, a genus of the Pyroleæ, a sub-order of the Ericaceæ or breathwort family, characterized by a calyx free from the ovary; the corolla polypetalous; anthers extrorse in the bud; seeds with a loose and translucent cellular coat much larger than the nucleus; is nearly herbaceous and evergreen, with broad leaves. The sub-order contains three genera—*Pyrola, Moneses,* and *Chimaphila.*

Pyroleic Acid. See SEBACIC ACID.

Pyrolig′neous Acid, a name often applied to impure acetic acid, produced by the distillation of wood. It contains empyreumatic tarry matter, which gives it a dark color and peculiar smell. It may be completely freed from these impurities. C. F. CHANDLER.

Pyrom′eter, an instrument for measuring temperatures above the range of the mercury thermometer, or, as its name indicates, a measure of the temperature of fire (Gr. πῦρ, "fire," and μέτρον, "measure"). All the earlier instruments for this purpose depended on the change of dimensions of various refractory solids, which were measured usually in linear expansion, and converted into thermometric degrees either by a direct comparison at lower temperatures and estimating those of higher range as proportional, as in Daniell's pyrometer, or by an arbitrary scale, as in Wedgwood's instrument. Instruments of this description have given place to the more exact indications of Regnault's mercury and hydrogen pyrometers, Deville and Troost's iodine pyrometer, or the more recent one of Siemens, called the resistance thermometer. These several instruments are mentioned below.

Wedgwood's pyrometer was first described by him in 1782 in the *Philosophical Transactions* (vol. lxxii. p. 305; *Ibid.,* lxxiv. 358, and lxxvi. 390), and depended on the contraction of a cylinder of clay under heat, the dimensions of which were measured in a wedge-shaped groove in a plate of porcelain graduated on the edges by an arbitrary scale, the zero of which was taken to equal 1077½° F., being the temperature of a red heat visible by daylight. The extremity of Wedgwood's scale = 240° W. = 32,277° F. (!); each degree W. = 130° F. Daniell subsequently proved that Wedgwood's degrees were nearly ten times too high. Thus, his 240° W. = 32,277° F. were proved by Daniell to correspond actually to only 3300° F., the highest temperature of a good wind-furnace. Wedgwood's pyrometer had no scientific basis. It was soon found that a long-continued low red heat produced the same contraction in the dimensions of a clay cylinder as a much higher temperature for a shorter time; and there was no certainty of finding any two samples of clay having the same coefficient of expansion.

Daniell's Pyrometer.—The late Prof. J. Frederick Daniell of King's College, London, first described his "register pyrometer" in 1821 (*Quarterly Journal of Science,* vol. xi. p. 309), and in its later form in his *Introduction to Chemical Philosophy* (1839, p. 98–101). The figure he there gives is found in most works on chemical physics, and need not be reproduced here. This instrument is well considered, and depends on the accurate measurement of the difference in linear expansion between a rod of platinum and a solid bar of black-lead earthenware highly baked, and called the register. The scale by which the expansion is measured is independent of the register, and consists of two rules of brass accurately joined together at a right angle by their edges, and fitting square upon two sides of the black-lead bar. The motion of expansion is multiplied by a lever, which is also the radius of a circle graduated in degrees and thirds of degrees and read by a nonius. "This scale is connected with that of the mercury thermometer by immersing the register in boiling mercury, whose temperature is as constant as that of boiling water, and has been accurately determined. The amount of expansion for a known number of degrees is thus determined, and the value of all other expansions may be considered as proportional." Daniell's pyrometer furnished the first reasonably exact means of measuring high temperatures, and it is yet in vogue for a large number of observations. By it the melting-points of many metals and alloys were for the first time determined, but it is not adapted to meet numerous cases, as, for example, the interior of furnaces and other heated spaces. As by its means the melting-points of numerous metals and alloys have been determined, these may in turn be used to test, approximately, the temperature of heated spaces by exposing in them equal-sized portions of different metals and noticing their successive fusion, until, for example, it is found that a given space has a temperature below the fusion-point of copper, of gold, of silver, etc., when these are successively exposed for a definite time, as one minute, in the spaces to be measured for temperature. The temperature of gases escaping from a furnace is thus found with sufficient exactness by exposing in the flues metals of known melting-points until they soften or fuse; thus, bismuth fuses at 507° F., lead at 620°, zinc at 782°, and antimony at 842°, etc.

The Zinc Pyrometer of Whitwell is an application of this mode of observation, with the addition of limits of time, which he has experimentally fixed in the use of his well-known "stove" for heating the blast of the high iron furnace. He states that a rod of zinc five-eighths of an inch in diameter melts in 2½ seconds in a temperature of 1400° to 1450° F., in 6 seconds in a temperature of 1100°, and if the temperature is 1000°, the melting-time is 7 seconds. For each second added to 7, 33° are deducted from 1000°; thus, if 10 seconds are required to melt the zinc rod, the temperature is $1000° - 33° \times 3 = 901°$ F.

Mr. I. Lowthian Bell, in many of his experiments on the temperature of highly-heated spaces, employed a copper tube with walls only thick enough to stand the pressure of a volume of confined air, the amount of its compression being measured by a mercurial gauge, the temperature being deduced from the known coefficients of expansion. This instrument gave very prompt and uniform results—more so than were obtained from quenching a mass of copper of known weight, which had been exposed to the temperature of the heated spaces, in a known quantity of water, and estimating by the laws of calorimetry the temperature of the gases from the increased temperature of

the water. (Bell, *Chemical Phenomena of Iron-Smelting*, p. 36.)

Iodine Pyrometer.—Messrs. Deville and Troost have used in place of an air thermometer of glass (see THERMOMETER), which is limited to comparatively low temperatures, a globe of difficultly fusible porcelain of about 300 c. c. capacity, having a long neck, in which iodine by its volatilization replaces air, with the advantage that greater differences of weight may be had for corresponding differences of temperature. The flask or globe, charged with a sufficient quantity of iodine to expel all or nearly all the air, is placed in the furnace or other medium to be measured, and when it has attained the same temperature, its mouth, which is previously nearly closed by a loosely-fitting stopper of porcelain, is sealed hermetically by the oxy-hydrogen jet. It is, after cooling, completely cleaned and weighed, and its neck is then broken under water or mercury. The flask is then weighed again with the water or mercury which had entered. If a portion of air remains unexpelled, this will displace just its own volume at that temperature, and will require more water or mercury to be added, and a second weighing to determine this value. The empty flask is then dried and weighed. From the several weights obtained are calculated the capacity of the globe, the volume of air not expelled by the iodine vapor, and the excess of the weight of the flask and iodine vapor over the empty globe. Each experiment requires the following observations: (1) temperature of the balance $= t^\circ$; (2) the atmospheric pressure $= h$ mm.; (3) excess of weight of globe filled with iodine vapor, after sealing, over globe filled with air $= i$ grm.; (4) capacity of globe $= v$ c. c.; (5) residual air $= a$ c. c. To calculate the temperature at which the globe was sealed—*i. e.* the temperature sought—we must know (6) weight of 1 c. c. of air at 760 mm. pressure $= 0.001293$ grm.; (7) density of iodine vapor (air $= 1$) $= 8.716$; (8) coefficient of expansion of air for 1° C. $= 0.00366$; (9) coefficient of cubic expansion of Bayeux porcelain for 1° C. $= 0.0000108$. The temperature T may now be calculated thus: Let $I_w \left(= \frac{v - a.001293}{1 + .00366t} \cdot \frac{h}{760} + i\right)$ be the total weight of iodine vapor contained in the flask at the moment of sealing; then $\frac{I_w}{0.001293 \times 8.716}$. $\frac{(1 + 0.00366\,T)\,760}{h} = I_v$ will be the volume of this vapor at the same moment; but $I_v + \frac{a(1 + 0.00366\,T}{1 + 0.00366t} \cdot \frac{760}{h} = v$ $(1 + 0.0000108\,T)$. T, the temperature sought, being the only unknown quantity in this equation, is soon found. By this pyrometric method Messrs. Deville and Troost determined the temperatures of fusion and density of vapors of sulphur, tellurium, cadmium, zinc, mercury; chloride, bromide, and iodide of aluminium, chloride of zirconium, phosphorus, etc. The apparatus is figured and the method in full detail given in their memoir in *Ann. de Ch. et Phys.* [3], lviii. pp. 257–299, 1860—a memoir of great interest.

Hydrogen and Mercury Pyrometers of Regnault (*Ann. de Ch. et Phys.* [iii.], lxiii. 40–45, 1861).—To determine quickly and with precision the temperatures of the porcelain furnaces at Sèvres, M. Victor Regnault, at that time the director of these works, devised his hydrogen pyrometer, which depends on the conversion of pure hydrogen into water, and from the weight of the water thus obtained calculating the space it filled at the temperature to be determined. The simplicity and accuracy of the method are worthy the genius of Regnault, and in striking contrast to the want of scientific accuracy in the Wedgwood pyrometer. An iron tube of one to two inches diameter crosses the furnace whose heat is to be measured. Its ends are sealed save by capillary openings connected by capillary iron tubes with 3-way stopcocks, by means of which a current of pure and dry hydrogen can be passed through the apparatus until all air is removed, and any oxide of iron in its path reduced. The hydrogen gas is then shut off, while the open end of the tube is connected with a copper tube containing cupric oxide, to be heated to redness by gas-jets. By means of an aspirator dry air is then forced through the tube, chasing all the hydrogen over the hot cupric oxide, where it is burned to water, which is collected in a tarred U-tube containing pumice soaked in sulphuric acid. From the increase of weight in this U-tube the weight and consequent volume of hydrogen which filled the tube at the unknown temperature, T, is known, and from these data the value of T is easily obtained. This method is of course limited to temperatures at which wrought iron maintains its form unchanged.

The mercurial pyrometer of Regnault is a vessel shaped like a bottle of cast iron, of from half to one litre capacity, in which is placed a sufficient quantity of mercury—15 to 20 grammes—to expel all the air from the iron vessel. The temperature of the space is determined by weighing the residual mercury found in the vase after it is cooled. A simple ball-valve affords a sufficient stopper to shut out the dust and currents of the furnace. The constants of temperature and pressure-weight of 1 c. c. of mercury vapor at temperatures already known, the coefficient of expansion of the substance of the bottle and its capacity in c. c. at 0° C., being the needful elements of the calculation. This method of pyrometry is more simple than that by iodine, already described, but both fail to meet the case of the highest temperature of furnaces in which iron melts, and even the most refractory porcelain softens. Hence the necessity for a method which shall meet the conditions of very high temperatures, and this has been supplied by *Siemens' resistance thermometer.* This instrument depends on the circumstance that the electrical resistance of a metallic conductor conveying an electric current increases with an increase of temperature. The experimental data upon which this conclusion rests have been obtained, it is true, at comparatively low temperatures—0° to 350° C.—by observations of Matthiessen, Werner, Siemens, and others. But these have been lately extended by another set of experiments to 1000° C. by C. W. Siemens. In measuring furnace temperatures the platinum wire constituting the pyrometer is wound upon a small cylinder of porcelain contained in a closed tube of iron or platinum, which is exposed to the heat to be measured. If the heat does not exceed a full red heat—or, say, 1000° C.—the protected wire may be left permanently in the stove or furnace whose temperature has to be recorded from time to time; but for temperatures above 1000° C. the tube is exposed during a measured interval of, say, three minutes to the heat, sufficient for the protecting casing and wire to acquire in a given time the temperature to be measured, but not sufficient to soften the porcelain cylinder upon which the wire is wound. In this way heats exceeding the welding-point of iron and approaching the melting-point of platinum can be measured by the same instrument, by which slight variations at ordinary temperatures are told. A thermometric scale is thus obtained embracing without a break the entire range of temperature from the lowest to the highest. The usual methods of measuring electric currents in use by the system of Sir W. Thompson or Mr. Wheatstone are employed. But more recently Mr. Siemens has proposed a differential voltameter for the same purpose, the details of which are beyond our present limits. (For pyrometers to test petroleum, see PETROLEUM.) B. SILLIMAN.

Pyrometry. See PYROMETER.

Pyr'ope [Gr. πῦρ, "fire," and ὄψις, "appearance"], the precious garnet, a fine dark-red garnet, much used in jewelry, and incorrectly called hyacinth, ruby, and carbuncle. It comes from Ceylon, Germany, Scotland, etc.

Pyr'ophone [Gr. πῦρ, "fire," and φωνή, "sound"], or **Flame Organ,** the name given to a very curious musical instrument, first constructed by Kastner, in which the tones are produced by means of the flames of ordinary gas burning in tubes of different lengths. When the various jets of flame come together, as they do by touching a key, the sound ceases, and reappears on being separated by touching another key.

Pyroph'ori [Gr. πῦρ, "fire," and φέρειν, to "bear"], a term applied generally to some substances which kindle spontaneously and enter into combustion when exposed to the air, the term being confined, however, to *solid* substances, and not applied to spontaneously inflammable liquids. *Carbon, phosphorus,* and many easily-oxidable *metals* may be made pyrophoric by preparation in a state of extreme division. "Homberg's pyrophorus" is formed by mixing intimately *alum* and *sugar*, drying and charring first in an open pan, then igniting in a closed vessel. In this case the active ingredient is supposed to be *sulphide of potassium* in fine division. *Phosphorus*, when left by evaporation of its solutions in very volatile liquids, like bisulphide of carbon, is pyrophoric. *Iron* may be obtained in pyrophoric form by many methods, even by simple reduction of the oxide with hydrogen gas at a minimum temperature. A *lead* pyrophorus is obtained by charring dry tartrate of lead in a close tube. If, after cooling, the tube be crushed, a beautiful *shower of fire*, metallic lead and carbon in combustion, makes its appearance. The present writer has observed that some common *lignites*, very finely pulverized and thoroughly dried by heat, are pyrophoric when warm. Numerous other cases are described in chemical works. H. WURTZ.

Pyrophorus. See PYROPHORI.

Pyrophosphates. See PHOSPHATES.

Pyrophosphoric Acid. See PHOSPHORIC ACIDS.

Pyro′sis [from πύρωσις, a "burning"]. This name is applied to an affection of the stomach characterized by the regurgitation of a considerable quantity of liquid when the stomach is empty of food. The liquid expelled may be insipid to the taste or saltish, and it is sometimes acid. It is not vomited, but regurgitated, and the regurgitation is not accompanied by the sense of nausea which usually attends acts of vomiting. The popular name for the affection is water-brash. The regurgitation takes place especially in the morning, before food has been taken. A sensation of burning is generally felt in the region of the stomach, and frequently in the throat during and after the passage of the liquid. This burning sensation is implied in the name *pyrosis*. The regurgitations in pyrosis are to be distinguished from those which are incident to indigestion. The latter consist of food or drink which has been taken into the stomach, and which excites irritation in consequence of the chemical changes arising from defective digestion; whereas the liquid regurgitated in pyrosis is the morbid product of secretion from the glands of the stomach. Pyrosis may be associated with indigestion or dyspepsia, but not infrequently the digestive processes are but little or not at all disturbed. The affection occurs oftener in women than in men. It is an affection of middle or advanced life, being of extreme infrequency in young persons. It is of more frequent occurrence in some countries than in others. It is said to be a frequent malady in Scotland and Ireland. It has been attributed to the use of oat-meal largely as an article of diet. Persons living on a poor, insufficient diet are more likely to suffer from it than those who live well or generously. It is not a grave affection, nor does it denote a tendency to any important disease in the stomach or elsewhere. It is generally controlled very speedily by the carbonate or subnitrate of bismuth in doses of from 20 to 30 grains, given twice or thrice daily. The treatment, in other respects, embraces the use of tonic remedies, nutritious alimentation, and hygienic influences to invigorate the system. A. Flint.

Pyroso′ma [Gr. πῦρ, "fire," and σῶμα, "body"], a genus of tunicates of the family Pyrosomidæ, remarkable for the intense light they emit by night. Each Pyrosoma is a compound mass of innumerable molluscoids. In the Mediterranean they often clog the fishermen's nets by their great numbers, and Humboldt says that they sometimes so illuminate the sea as to render fishes visible.

Pyrotech′ny, the art of making fireworks of different colors for the purpose of amusement or for signals at night, either on land or sea. The powder for fireworks is compounded upon the same principle as gunpowder—*i. e.* at least one of the ingredients contains much oxygen in combination, while the others are readily combustible, or when heated impart some characteristic color to the flame. The principal ingredients of all the fires are potassic chlorate, nitre or some nitrate, and sulphur, with which gunpowder is sometimes mixed. To obtain various colors the following are generally used: *Violet*, potassium salts, chlorate and carbonate mixed; *blue*, potassa salts, with ammonio-copper sulphate and antimony sulphide or copper carbonate and alum; *greenish blue*, zinc-filings, copper sulphate, with sal ammoniac; *green*, barium carbonate or nitrate, verdigris, with copper sulphate and sal ammoniac or boracic acid; *yellow*, sodium salts, resin, or amber; *orange*, lime salts, usually the carbonate; *red*, strontia nitrate or carbonate, or a mixture of lampblack and gunpowder; *rose-red or pink*, potassic chlorate and chalk, or other mixtures of potassium and calcium salts, or lampblack, gunpowder, sulphur, and nitre, or lycopodium. For *white* fire, nitre and sulphur; gunpowder is sometimes mixed with them. Iron-filings are frequently introduced into the mixtures to cause brilliant scintillations; long filings or those made with a coarse file are preferred. The famous Bengal lights are made with nitre, 7 parts; sulphur, 2; antimony sulphide, 1. Rocket and Roman-candle stars are compressed portions of the powder. They usually contain the same constituents as ordinary gunpowder, the proportion of charcoal being somewhat reduced; steel-filings are sometimes added. Camphor, gum benzoin, and storax are frequently mixed with the powders to give an aromatic odor and mask the unpleasant odors arising from the firing of the mixtures without such addition. (Ure's *Dictionary of Arts*, etc., vol. i. p. 727, and vol. ii. p. 531, articles "Fireworks," "Pyrotechny Fires;" Richardson and Watts, *Chem. Technology*, i. [4], 551, 611; Websky, *Lustfeuerwerkkunst* (6te Auf., Breslau, 1858).) E. Waller.

Pyroxene. See Augite.

Pyroxylic Spirit. See Methyl Alcohol, by Prof. C. F. Chandler, Ph. D., M. D., LL.D., M. N. A. S.

Pyrox′yline [Gr. πῦρ, "fire," and ξύλον, "wood"], the technical name for gun-cotton. (See Explosives.) It is manufactured by steeping dry and clean cotton in a mixture of 3 parts nitric acid to 5 of sulphuric acid. The cotton is withdrawn after twenty minutes, and washed with water containing a little ammonia, then dried with great caution at a temperature not exceeding 200° F. It is extremely combustible, inflaming at a temperature of 277° F., and has an explosive force nearly four times greater than gunpowder. A solution of pyroxyline in a mixture of alcohol and ether forms Collodion (which see), a substance largely used in photography. The chemical formula of the most explosive kind of pyroxyline is $C_{36}O_{30}H_{21} + 9NO_4$.

Pyrrha. See Deucalion.

Pyr′rhic Dance, a famous Dorian war-dance among the ancient Greeks, represented in the non-Doric Greek states by a minuet—*i. e.* dance of the same name. The Pyrrhic dance was also very popular at Rome. It was a lively dance, accompanied by flutes and enlivened by gymnastic feats and the tricks of tumblers.

Pyr′rho, a native of Elis; was first a painter, but afterward studied philosophy, attracted by the writings of Democritus, and followed his teacher, Anaxarchus, in the expeditions of Alexander the Great, which brought him into connection with the Magians and the Indian gymnosophists. On his return he was elected high priest by the Eleans, and gathered a great number of disciples around him, but his teaching was oral only, and of his system we know nothing except that it was one of the earliest forms of skepticism. His most celebrated pupil was Timon of Phlius; he left written works, but they have perished.

Pyr′rhus, king of Epirus, b. about 318 B. C., a son of Æacides, who claimed to descend from Pyrrhus, the son of Achilles, and was a brother of Olympias, the mother of Alexander the Great. This latter relationship implicated Epirus in the Macedonian embroilments after the death of Alexander, and the Epirotes, disgusted at these disturbances, dethroned Æacides and expelled his family from the country. Pyrrhus, at that time only two years old, was brought to Glaucias, king of the Taulantians, who educated him well, and placed him on the throne of Epirus when he was about twelve years old. Once more, however, he was expelled from his native country, and he now joined his brother-in-law, Demetrius Poliorcetes, married to his sister, Deïdamia; by his side he distinguished himself so greatly in the battle of Ipsus (301) that his name became celebrated throughout the whole Grecian world. Nevertheless, the battle was lost, and he repaired to Egypt as a hostage for Demetrius. Here he married Antigone, the step-daughter of Ptolemy, and by his aid he returned to Epirus in 295 and established himself firmly on the throne of his ancestors. He immediately embarked in wars with Macedonia, with Greece, etc., achieved many brilliant successes, and was at one time even acknowledged king of Macedonia; but the permanent result of all his exertions was nevertheless very far from satisfying his ambition. Like all great military commanders of that age, he dreamt of playing over again the rôle of Alexander the Great and establishing a world-empire; and of the many competitors for this honor he seemed to be the one best fitted for the task. Besides his military genius, there was something in his personal character which reminded all of his great cousin. He had the same talent for discipline, the same power of concentrating the enthusiasm of the soldiery on his own person, a similar imperiousness and audacity, connected with lofty magnanimity, splendid liberality, and a most impressive personal appearance. Thus, when in 281 an embassy from Tarentum invited him to come to Italy to defend the Greek cities against the Romans, a brilliant prospect at once unfolded itself to his eyes—the conquest of Italy, Sicily, Africa—the world, and he embraced the opportunity with passionate eagerness. But this Western theatre was very different from that Eastern one on which Alexander had performed his exploits. Here was no colossal empire liable to tumble down from one or two well-directed blows, but three distinct powers, of which none could be conquered except by an alliance with the two others. This situation Pyrrhus misunderstood, and his expedition, although of such vast importance in the history of the world, brought to himself nothing but disappointment and failure. The Greek cities in Magna Græcia and Sicily formed no confederacy. Each community was a state by itself, jealously watching and rivalling its neighbors. Great wealth had been accumulated in these cities by the energy, versatility, and shrewdness characteristic of the Greeks; and it was freely enjoyed. The inhabitants, although very refined and still capable of brilliant heroism under some sudden emergency, were luxurious, licentious, and destitute of any kind of discipline. On his arrival at Tarentum, Pyrrhus had to employ force in order to compel the young men to serve in the army, and the order and discipline he introduced soon made him so hated among

the Greeks that they became his worst foes. The Romans formed a state of the most solid and compact organization. They could be defeated by the higher military art of Alexander the Great and the new weapon, the elephant, hitherto entirely unknown to them, but they could hardly be subdued. After the victories at Siris (280) and Asculum (279), Pyrrhus felt this. He determined to direct himself against the Carthaginians; crossed over to Sicily, and opened negotiations with Rome. But Carthage, too, was a well-organized state; she had immense resources, and she spent them on no dreams of a world-empire, but on simple, plain commercial purposes. When the brilliant progress of Pyrrhus threatened to drive her out of Sicily, she gathered her whole strength and took a firm stand at Lilybæum. Hardly was the check felt before all the Greek towns of Sicily which Pyrrhus had conquered or liberated rose in revolt in the rear of his army. Disgusted, he determined to return to Italy, and, the negotiations with the Romans having failed, he now opened negotiations with the Carthaginians. These too failed. Just after crossing the sound between Sicily and Italy in 276, his fleet was attacked and defeated by the Carthaginians, and in the following year his army was completely routed at Beneventum (275) by Curius Dentatus. His return to Epirus took place soon after, but it looked very much like a flight. Restless as he had become, he immediately plunged himself into wars with Macedonia and Greece—wars which led, and could lead, to nothing; but in 272 he was killed in the streets of Argos during a riot. CLEMENS PETERSEN.

Pyrus. See APPLE, ASH, and PEAR.

Pythag'oras, a Greek philosopher, supposed to have been b. at Samos about 582 B. C.; to have been the son of Mnesarchus; his earliest teacher to have been Pherecydes the Syrian, from whom he may have received Egyptian and Zoroastrian lore; his next teacher to have been Anaximander, who taught that the principle (ἀρχή) of things is the unlimited or indefinite (ἄπειρον); in early life to have travelled through Ionia, Phœnicia, and Egypt, where he was initiated into the mysteries by the priests. Some would have it that he was even carried away to Babylon, with other Egyptian prisoners, by Cambyses, who made his raid on Egypt in the year 525 B. C., but the weight of authority favors the view that he repaired to Crotona in Lower Italy, 529 B. C., and there established a society with ethical, political, and philosophic tendencies. His school was allied with the aristocratic party, and consequently incurred the animosity of the democratic party. This occasioned (about 510 B. C.) the retirement of Pythagoras to Metapontum, where he died soon after. His school spread rapidly, and, after the manner of Oriental systems, was semi-ethical and religious, semi-political and social, tending to produce a fusion of state and hierarchy. It has bequeathed to us a multitude of philosophemes on mathematics, music, and astronomy, as well as on ethics. The doctrines of metempsychosis, of the cyclic return of events, of contraries (ἐναντία)—according to which he added to the principle of his master, Anaximander (which was "the unlimited"), its opposite (περαίνοντα)—indicate Persian or Egyptian influence. This Oriental tendency may have had another origin than those named (his teachers or his travels), so far as the writings of his school are concerned (for no writing of the master has come down to us), in the Crotonian school of medicine, of whom Democedes, the celebrated physician, had resided at the Persian court under Darius. What belongs to the disciples and what to the master cannot be told. Pythagoras is said to have anticipated the Copernican doctrine, making the sun the centre of the cosmos; also to have discovered the numerical ratio existing between musical tones of the gamut (either by length of strings or by their degrees of tension). He laid the greatest stress on the discipline of the will into obedience, temperance, silence, self-examination, simplicity in personal attire, and self-restraint in all its forms. The original sources of information regarding him are Aristotle (*Met.*, i. 5; *Phys.*, iii. 4; *De Cœlo*, ii. 13 and 9; *Eth. Nic.*, v. 8), the writings of Aristotelian commentators, Herodotus (ii. 81; iv. 94–96, etc.), and the (mostly spurious) writings of his disciples, Philolaus, Ocellus Lucanus, Timæus Locrus, Archytes of Tarentum, Epicharmus, and the Neo-Platonists Iamblichus and Porphyry; Diodorus Siculus and Diogenes Laertius are to be added to this list.
WILLIAM T. HARRIS.

Pyth'eas, a native of Massilia, who in the time of Alexander the Great made two voyages of discovery along the western and north-western coasts of Europe, which he described in two works written in Greek, Περὶ τοῦ Ὠκεανοῦ and Περίπλους. Of these, only a few fragments have come down to us, preserved by other authors in the form of quotations. They were collected and published by Arvedson (Upsala, 1824). By many ancient authors, as Polybius and Strabo, the statements which Pytheas made were considered as fables, or even lies, but in the light of modern science most of them have proved true and very interesting. The most remarkable particulars of Pytheas's statements, as far as they have come down to us, refer to a land which he calls *Thule*, situated at a distance of six days' sail to the N. of Britain. Here, he says, the day and the night were each six months long—a phenomenon which the Greeks had heard of before—but he adds that in those regions there was neither earth, sea, nor air, but a sort of mixture of all these, like to the Mollusca, and that earth and sea were suspended in this mass, which was impenetrable to travellers; he affirms that he has seen this with his own eyes. What country he meant for Thule, whether Iceland or some part of the Scandinavian peninsula, is uncertain; nor is it easy to give his description any striking correspondence to reality. What he tells of the Guttones, on the contrary, bordering on Germany and dwelling along a gulf of the sea called Mentonomon, and of the island Abalus, whither amber was brought every spring by the waves, and used by the inhabitants as firewood or sold to the neighboring Teutoni, seems to be based on something actually seen and experienced. (See Bougainville, *Sur l'Origine et sur les Voyages de Pythéas*, in *Mémoires de l'Académie des Inscriptions*, vol. xix.; Ukert, *Bemerkungen über Pytheas*, in his *Geographie der Griechen und Römer*; and Straszewick, *Pythéas de Marseille et la Géographie de son Temps* (Paris, 1836).)

Pyth'ian Games, or **Pythia** [Gr. πύθια], one of the great national contests of the Greeks. (See GRECIAN GAMES.)

Pythias. See DAMON AND PYTHIAS.

Python. See BOA.

Pyx [Gr. πυξίς, "a box of boxwood"], a sacred vessel, having usually the form of a covered cup with a foot, used in the Roman Catholic Church to contain the sacred wafer when preserved after consecration.

Also the strong box used in the mint for the safe keeping of coins set apart from each successive coinage to be examined by a commission of experts for the purpose of testing their accuracy as to weight and fineness. The examination of these reserved coins is called the "trial of the pyx," and in Great Britain, by the latest coinage act, passed in 1870, it is provided that this trial shall take place "at least once in every year in which coins have been issued from the mint." The act requires a jury to be summoned by the queen, with the advice of her privy council, to consist of "not less than six out of the competent freemen of the mystery of goldsmiths of the city of London, or other competent persons." The jury must attend at the trial, "with the proper officers of the treasury, the board of trade, and the mint." Before the trial the jury are sworn. The reserved coins are then delivered to them, and tested by weighing and by assay; after which a verdict is drawn up in writing. Should the coins have been found accurate in weight and fineness within the limits allowed by law, commonly called *tolerance* or *remedy*, no further proceedings are taken; but in case the coinage in either or both these respects be found inexact, the officers of the mint are liable to censure or more serious penalties.

In the U. S. it is provided that a trial of the pyx shall be made at the mint in Philadelphia on the second Wednesday in February, annually. This takes place before the judge of the district court of the U. S. for the eastern district of Pennsylvania, the comptroller of the currency, the assayer of the New York assay-office, and such other persons as the President shall from time to time designate for the purpose. A majority of the commissioners constitute a competent board. Their examination is to be made in the presence of the director of the mint. The number of coins reserved for the assay from each delivery made by the chief coiner is prescribed by the director; and the reserved pieces, after being carefully sealed up and labelled, are deposited in the pyx provided for the purpose, which is kept under the joint care of the superintendent of the mint and the assayer, each of these officers securing it by an independent lock. The reserved coins from the coinage of other mints besides that at Philadelphia are transmitted quarterly to the Philadelphia mint; and in addition to these the director may at pleasure take any other pieces as tests. The commissioners are not put under oath, but after the examination they prepare a certified report of the result, which, if the coins are within the limits of tolerance in fineness and weight, is satisfactory, and is simply filed; but if deviation in either or both respects is discovered exceeding the limits of tolerance, the fact is to be certified to the President of the U. S., and "if, on a view of the circumstances of the case, he shall so decide, the officer or officers implicated in the error are thenceforward disqualified from holding their respective offices." F. A. P. BARNARD.

Q.

Q, a mute, in most languages is followed by *u*, which is often silent, as in Spanish and French. In Latin, Italian, and English *qu* has exactly the power of *ku* or *kw*. *Q.* is the abbreviation for *Question, Queen*, and *Quintus*, the proper name, and *q.* for *quart.*

Qua-Bird, or **Quawk.** See NIGHT-HERON.

Quack'enbos (GEORGE PAYNE), LL.D., b. in New York City Sept. 4, 1826; graduated at Columbia College 1843; taught school in North Carolina; studied law in New York; established there a private school 1847; edited the *Literary American* (1848–50); contributed to literary periodicals; edited Spier and Surenne's *French Dictionary*, and prepared numerous school-books, the most important being manuals of grammar, composition, rhetoric, and history. In 1876 he issued a popular *History of the United States.*

Qua'co (P. O. ST. MARTIN'S), thriving v., St. John co., N. B., on the Bay of Fundy, 30 miles E. by N. of St. John. It has important shipbuilding, and has some handsome buildings. At Quaco Head there is a lighthouse with a white revolving light. P. about 1000.

Qua'di, an ancient people of what is now Austro-Hungary. They were intimately associated with the Marcomanni, and were long among the most formidable enemies of Rome in this quarter. Tacitus supposed them to be Germans, but it is probable that they were either Slavic or Celtic. We read, in later times, of Quadi in Spain, where they were associated with the Suevi.

Quadrages'ima [Lat., "fortieth"], a fast called Lent, preceding Easter. Originally it was a fast of 40 hours only. In the beginning of the seventh century it had been extended to 36 days, and was afterward extended to 40, but whether by Gregory I. (d. 604) or Gregory II. (d. 731) writers are not agreed. The name is also applied to the first Sunday in Lent. R. D. HITCHCOCK.

Quad'rant [Lat. *quadrans*, the "fourth part"], in its common signification, a quarter of the circumference of a circle, or ninety degrees. In navigation and astronomy, an instrument for measuring angles, having a limb divided to ninety degrees. Astronomical quadrants of large dimensions were employed by the early observers for measuring meridian altitudes, being for this purpose firmly fixed in the plane of the meridian, in the manner since employed for securing the mural circles which have superseded them. The quadrant has the advantage over the circle in the respect that, within the same general dimensions, it may have a much larger radius, and therefore more ample divisions; but this advantage is greatly overbalanced by the inevitable errors of centering—errors which in the complete circle are compensated by the readings at the opposite extremities of the same diameter. It has on this account chiefly been disused in astronomical observations. The nautical quadrant, commonly called Hadley's quadrant, is an instrument in which, by an ingenious use of the principle of reflection, angular measurements of great accuracy are made practicable, notwithstanding that the observer and the instrument are both in motion. The limb is an octant rather than a quadrant, but each half degree of the division corresponds to an entire degree in the measurement, and the numbering on the limb accords with the real measurement. The sextant, which measures angles to 120° on a limb which is actually one-sixth part of a circumference (60°), has to a large extent taken the place of the quadrant for nautical purposes. The reflecting circle, an instrument of still higher accuracy, involving the same principles, is frequently employed in geodesy and astronomy. (For the construction of all these instruments see SEXTANT.) The invention of the quadrant is commonly ascribed to John Hadley, a friend of Newton, on the ground that the instrument was first described by him in a paper read before the Royal Society in 1731. But the invention was independently made in 1730 by Thomas Godfrey of Philadelphia, whose description was given to the same society in 1732; and the society decided the honor of the invention to belong equally to both. The real originator, however, of the ingenious idea on which the invention is founded was Sir Isaac Newton, who so early as 1727 communicated it to Halley, then astronomer-royal, in a paper which came to light only after the death of the latter in 1742. F. A. P. BARNARD.

Quadrat'ic Equation, an equation of the second degree, containing but one unknown quantity. Every quadratic equation may be reduced to the form

$$x^2 + 2px = q, \qquad (1)$$

in which p and q are known quantities; and when so reduced its two roots are

$$-p + \sqrt{q + p^2}, \text{ and } -p - \sqrt{q + p^2}. \qquad (2)$$

If $q < p^2$, the roots are both real; if q is negative, and numerically equal to p^2, the two roots are equal; if q is negative, and numerically greater than p^2, both roots are imaginary. If p is equal to 0, the equation is said to be incomplete, and its roots are then numerically equal with contrary signs; in this case the roots are real when q is positive, and imaginary when q is negative. The following properties are common to all quadratic equations, after being reduced to the form (1): (1) Every quadratic has two roots and only two. (2) If all the terms are transposed to one member, that member can be resolved into two factors of the first degree with respect to the unknown quantity, the first term of each factor being the unknown quantity, and the second terms being the two roots, each taken with a contrary sign. (3) The algebraic sum of the two roots is equal to the coefficient of the second term with its sign changed. (4) The product of the two roots is equal to the second member with its sign changed. (5) If the second term is negative, and numerically greater than the square of half the coefficient of the second term, both of the roots are imaginary.

A quadratic equation may be solved by the method of *completing the square*, or more expeditiously by the following rules: reduce the equation to the form (1); the *first root* is then equal to half the coefficient of the second term, taken with a contrary sign, *plus* the square root of the second member increased by the square of half the coefficient of the second term; the *second root* is equal to half the coefficient of the second term *minus* the square root of the second member increased by the square of half the coefficient of the second term. Many equations of a higher degree than the second may be reduced to the form of quadratics, and then solved. To this class belong all equations that can be reduced to the form

$$x^{2n} + 2px^n = q.$$

Such equations have $2n$ roots given by the expressions

$$x = \sqrt[n]{-p + \sqrt{q + p^2}} \text{ and } x = \sqrt[n]{-p - \sqrt{q + p^2}}.$$

W. G. PECK.

Quad'rature [Lat. *quadratura*], the operation of finding an expression for the area embraced within a curve and limited by the axis of abscissas and any two ordinates. The most expeditious method of finding an expression for an area of this kind is by means of the integral calculus. The formula for a plane area limited by a curve, the axis of x, and any two ordinates, is,

$$A = \int y\,dx. \qquad (1)$$

In applying this formula to any particular case, we first find the value of y in terms of x from the rectangular equation of the given curve, and substitute this value for y in equation (1); we then perform the indicated integration between proper limits. For example, let it be required to find an expression for the area of a common parabola whose equation is

$$y^2 = 2px, \text{ or } y = \sqrt{2p} \times x^{\frac{1}{2}};$$

This value in (1) gives—

$$A = \int \sqrt{2p} \times x^{\frac{1}{2}} dx = \frac{2\sqrt{2p}}{3} x^{\frac{3}{2}} + c,$$

or, by reduction,

$$A = \tfrac{2}{3}x\sqrt{2px} + c = \tfrac{2}{3}xy + c.$$

If we suppose the area to be estimated from the vertex of the curve, the value of c will reduce to 0, and we shall have—

$$A' = \tfrac{2}{3}xy; \qquad (2)$$

that is, the area is equal to two-thirds of the circumscribing rectangle. If we wish the area to terminate at the ordinate through the focus, we have $x = \frac{1}{2}p$ and $y = p$, which in (2) gives—

$$A'' = \tfrac{1}{3}p^2.$$

This is the area of the upper half of the parabolic segment; doubling it, we have for the entire area of the segment—

$$A'' = \tfrac{2}{3}p^2 = \tfrac{1}{6}(2p)^2;$$

that is, the area of the segment cut off by the double ordinate through the focus is one-sixth of the square described on the parameter of the curve.

The *method of quadratures* used by the ancients consists in drawing ordinates of the bounding curve at equal distances, and then uniting the extremities of these ordinates by lines, thus forming an inscribed polygon made up of trapezoids; by taking the sum of these trapezoids as the true area of the curve, they found an approximate result, which they caused to approach the true area by diminishing the distance between the consecutive ordinates. In many cases it is found that the areas of the trapezoid form a series whose law can be determined; and in those cases the area can be found by the known method of summing the series. A modification of the method just explained is often used by practical men. The distance between the extreme ordinates is divided into an *even* number of equal parts, and ordinates drawn through the points of division. The area is then found by the following rule: Add together the extreme ordinates, four times the sum of the even ordinates, and twice the sum of the odd ordinates; then multiply the result by one-third of the distance between any two consecutive ordinates. The nearer the ordinates are taken to each other, the more accurate will be the result. (For a demonstration of the preceding rule, as well as for an example of using it, the reader is referred to Bartlett's *Synthetic Mechanics*, pp. 52–54.) W. G. PECK.

Quadrature of the Cir′cle. The problem of the quadrature of the circle consists in the construction of a square equal to the surface of a given circle, or, what leads to the same result, a finite expression for the ratio between the diameter and circumference. One of the principal objects of mathematical science is the study of ratios, but in most cases the quantities compared have no common measure, and therefore their ratios cannot be expressed in finite numbers. Arithmetic gives numerous examples of the latter case in the so-called irrational quantities ($\sqrt{2}$, $\sqrt{7}$, $\sqrt[3]{4}$, etc.), which are all incommensurable with whole numbers or finite fractions. Geometry gives illustrations in the sides and the diagonal of the square, in the diameter and circumference of the circle, etc. The reason that the latter ratio is especially remarkable is its practical importance, causing many minds to occupy themselves with the same from time immemorial; and while the most eminent mathematicians have long ago solved the problem and demonstrated the nature of the ratio, persons utterly deficient in mathematical training labor even at the present day under the illusion that it is still unsolved.

The credit of having proved the peculiar nature of the ratio in question belongs to J. Bernouilli, who, while investigating the logarithms of the so-called imaginary quantities, found the following expression, in which, as customary, the Greek letter π stands for the value of the circumference, the diameter being $= 1$:

$$\frac{1}{2}\pi = \frac{\log\sqrt{-1}}{\sqrt{-1}}.$$

Wronski, in his *Introduction à la Philosophie des Mathématiques* (p. 26), remarks that in order to obtain an expression which will reveal the nature of a quantity, we must use only primitive functions; and as the expression of Bernouilli contains logarithms, which are derivative functions, he transforms it thus:

$$\frac{1}{2}\pi = \frac{\infty}{\sqrt{-1}}\left\{(1+\sqrt{-1})^{\frac{1}{\infty}} - (1-\sqrt{-1})^{\frac{1}{\infty}}\right\},$$

in which only primitive functions appear, and which, therefore, at the same time reveals the nature of the number π; for, since the equation is neither of the second, third, fourth, nor any definite degree, but is of an infinite order, the expression demonstrates that there can exist no finite algebraic formula, nor any geometrical construction, solving the problem, and that all that is possible in this respect are approximations. These have been accomplished in various ways with an accuracy far surpassing any other calculation ever performed in the whole field of mathematical science. The first approximation was made 480 years before our era, as Plutarch informs us, by Anaxagoras, highly praised by Plato as a great mathematician. That, however, at early periods, ignorant persons already meddled with this problem is shown by Aristophanes, who ridicules them in one of his plays. Eutocius (*Comm. in Librum de Dim. Circuli*) gives the details of the most ancient labor in this field of which we have any knowledge; it is that of Archimedes, who 220 years before our era calculated the peripheries of the inscribed and circumscribed polygons of 96 sides, and deduced from this that for the diameter 1 the circumference must be between $3\frac{10}{70}$ and $3\frac{10}{71}$; whence he concluded that the ratio 7 : 22 exceeds the truth only to a small extent. Apollonius (200 B. C.) and Philon of Gadara found other approximate ratios correct to within $\frac{1}{10000}$th part of the diameter; and then the investigation rested until the revival of mathematical sciences in the middle of the fifteenth century. The most remarkable approximation obtained in the sixteenth century was that of Peter Metrus in Holland, who by means of polygons of 1536 sides came to the ratio 113 : 355, which is correct to within $\frac{3}{10000000}$ths part of the diameter. Vieta, a French mathematician, carried the approximation even farther, but was in his turn eclipsed by Romanus, another mathematician of Holland, who calculated the peripheries of the inscribed and circumscribed polygons of 1,073,741,324 sides, and expressed the relation in numbers of 16 figures, until finally Ludolf van Keulen in 1590 demonstrated that if the diameter is expressed by 1, followed by 35 ciphers, the circumference is between the number 314,159,265,358,979,323,846,264,338,327,950,288 and the same number plus 1. This is the so-called Ludolphean number, and is engraved on the tombstone of Van Keulen in Leyden, Holland. It is so near the truth that if we make a circle of which the radius is equal to the distance of the nearest fixed star, it enables us to calculate the circumference correctly to within a space less than the thickness of a hair.

Various methods to facilitate these calculations were afterward given by Wallis in his *Algebra*, charta 86, and Nicole in the *Mémoires de l'Académie*, 1747. Snellius found other shorter and easier methods than the use of polygons, so as to obtain even closer approximations; his theorems were demonstrated by Huyghens, and led to a ratio expressed by 55 figures; while by a further investigation the latter found methods allowing an accuracy far surpassing all previous attempts. But this was again eclipsed by Lagny, a French mathematician, who in 1719 calculated this number to 121 decimal figures, while in the Radcliffe Library, at Oxford, the number of 155 decimals was found, for a long time supposed to be the most extreme approximation which would ever be attempted. However, in recent times the subject was taken up again, and Dr. Rutherford of Woolwich presented to the Royal Society a calculation of 200 figures. Dr. Clausen of Dorpat calculated 250 decimals, and proved that all the figures added by Dr. Rutherford to those of Lagny were erroneous; then Mr. Shanks of Durham extended them to 315 decimals, and Dr. Rutherford to 350; then a jealousy appears to have instigated Mr. Shanks, who continued the calculation to 527 decimals. Dr. Rutherford reviewed them, found them correct to 411 decimals, and then gave it up. Not so Mr. Shanks, however, who continued the calculation to 607 decimals, and published the results obtained in the *Contributions to Mathematics* (London, 1853). His decimals are the following:

π =	3.14159	26535	89793	23846	26433
	83279	50288	41971	69399	37510
	58209	74944	59230	78164	06286
	20899	86280	34825	34211	70679
	82148	08651	32823	06647	09384
	46095	50582	23172	53594	08128
	48111	74502	84102	70193	85211
	05559	64462	29489	54930	38196
	44288	10975	66593	34461	28475
	64823	37867	83165	27120	19091
	45648	56692	34603	48610	49432
	66482	13393	60726	02491	41273
	72458	70066	06315	58817	48815
	20920	96282	92540	91715	36436
	78925	90360	01133	05305	48820
	46652	13841	46951	94151	16094
	33057	27036	57595	91953	09218
	61173	81932	61179	31051	18548
	07446	23798	34749	56735	18857
	52724	89122	79381	83011	94912
	98336	73362	44193	66430	86021
	39501	60924	48077	23094	36285
	53096	62027	55693	97986	95022
	24749	96206	07497	03041	23669
	29133	32 +, etc.			

The limits of this approximation are so excessive as far to surpass the ratio of the distance of the farthest star seen with the most powerful telescope to the dimensions of the smallest object visible under the microscope.

We have no room for the many expressions for the ratio. They are of two kinds—infinite series and continued fractions. Among the first we notice that of Leibnitz:

$$\pi = 4\left(1 - \tfrac{1}{3} + \tfrac{1}{5} - \tfrac{1}{7} + \tfrac{1}{9} - \tfrac{1}{11} + \tfrac{1}{13} -, \text{etc.}\right)$$

That of Wallis:

$$\tfrac{1}{2}\pi = \frac{2,\ 2.\ 4.\ 4.\ 6,\ 6,\ 8.\ 8,\ 10,\ 10,\ \text{etc.}}{1,\ 3,\ 3,\ 5,\ 5,\ 7,\ 7,\ 9,\ 9,\ 11,\ \text{etc.}}$$

De Montferrier gives this expression:

$$\tfrac{1}{2}\pi = 1 + \frac{1}{2.3} + \frac{3}{2\times4\times5} + \frac{3\times5}{2\times4\times6\times7} + \frac{3\times5\times7}{2\times4\times6\times2\times9}, \text{ etc.}$$

Also—

$$\tfrac{1}{6}\pi = \tfrac{1}{2} + \frac{1\times1}{2\times3\times2^3} + \frac{1\times3\times1}{2\times4\times5\times2^5} + \frac{1\times3\times5\times1}{2\times4\times6\times7\times2^7} +, \text{ etc.}$$

The latter series converges so rapidly that by taking only ten terms we obtain the value of π correct to within eight decimal places.

The continued fractions expressing the ratio in question are quite remarkable in their nature. Breunker gives the following:

$$\tfrac{1}{2}\pi = \cfrac{1}{1 + \cfrac{1}{2 + \cfrac{9}{2 + \cfrac{25}{2 + \cfrac{49}{2 + \cfrac{81}{2 +, \text{ etc.}}}}}}}$$

De Montferrier found this:

$$\tfrac{1}{4}\pi = \cfrac{1}{1 + \cfrac{\frac{1}{1\cdot3}}{1 + \cfrac{\frac{4}{3\cdot5}}{1 + \cfrac{\frac{9}{5\cdot7}}{1 + \cfrac{\frac{16}{7\cdot9}}{1 +, \text{ etc.};}}}}}$$

which may be transformed and made more convergent thus:

$$\tfrac{1}{4}\pi = \cfrac{1}{1 + \cfrac{1}{3 + \cfrac{4}{5 + \cfrac{9}{7 + \cfrac{16}{9 + \cfrac{25}{11 +, \text{ etc.}}}}}}}$$

The latter fraction is so convergent that by only taking, for instance, eight terms, we obtain a number correct to within $\frac{1}{1000000000}$th part of the diameter.

A remarkable peculiarity of these fractions is that, unlike the continued fractions expressing irrational quantities, there is no periodicity in them; but it is evident that this cannot be the case, while then they would be reducible to irrational expressions, which is proved to be contrary to the nature of the number π. It is by the latter means, the reduction of series and continued fractions, that modern mathematicians have obtained the high degree of accuracy described; while the principal stimulus which induced these exaggerated calculations has been the desire to prove the fallacy of the calculations of the ignorant circle-squarers, whose fruitless labors have been so extensive that a record of them would fill much more space than the labors of all the able mathematicians in the same field.

P. H. Van der Weyde.

Quadra'tus, a bishop of Athens, author of an *Apology* presented to the emperor Hadrian about 130 A. D. It is now no longer extant, though a manuscript copy of it was in existence in the seventh century. (See Eusebius, *Hist.*, iii. 37; iv. 3.) R. D. Hitchcock.

Quadrille' [Fr.], a dance originally performed by four couples or four persons; now essentially the same as the *cotillon*, which is a more antiquated style of the quadrille. —Quadrille in cards is a game nearly identical with the "ombre" described in Pope's *Rape of the Lock*. As a social game it is one of the very best.

Quadrivium, the four highest of the so-called "liberal arts." (See Arts, Degrees in.)

Quadruma'na [Lat. *quatuor*, "four," and *manus*, "hand"], a name employed by Blumenbach (in 1791) as an ordinal designation for the monkeys, lemurs, and related types, man having been isolated as the representative of a peculiar order named Bimanus. The views thus expressed were for a long time predominant, but a closer study of the structure of the forms indicated by those names has convinced almost all living naturalists that they were erroneously separated, and the two types are now generally combined in one order named Primates, under which head man and the monkeys are combined together in one sub-order (Anthropoidea), and contrasted with the lemurs, which constitute another sub-order (Prosimiæ). (See Primates.) Theodore Gill.

Quadrum'ana, Fossil. Remains of Quadrumana or monkeys are rare in fossiliferous deposits, as might be expected from the habits of the animals. None of them are aquatic, and they do not usually frequent low and moist regions, but prefer the upland and rocky places. Most of the species are arboreal, and would thus escape destruction by floods that would overwhelm terrestrial and burrowing animals. Nevertheless, their remains have been found in both hemispheres, and in regions far beyond the tropical or sub-tropical zones to which existing species are now confined. The first quadrumanous fossils known were discovered in 1836 in the Pliocene (?) deposits of India, and the species were allied, more or less closely, to living monkeys, one of them closely resembling the orang. A full account of these discoveries, with illustrations, may be found in the *Fauna Antiqua Sivalensis*, Falconer and Cautley. Early in the following year M. Lartet announced to the French Academy the discovery of a fossil monkey in the Miocene lacustrine deposits of the S. of France. These remains are apparently allied to the gibbons. In Greece, near Athens, and at the base of Mount Pentelicus, famed in classical history for its marble, many bones of a fossil monkey have been found. These remains have been very ably discussed and figured by M. Gaudry, in his *Geology of Attica*. This genus, *Mesopithecus*, was regarded by Wagner as also related to the gibbons. From England two species of *Macacus* have been described by Prof. Owen, but their quadrumanous affinities have since been questioned by palæontologists. The bone-caves of Brazil have yielded several species closely allied to existing South American forms. Full descriptions of these species by M. Lund, their discoverer, were published in the *Memoirs* of the Royal Society of Denmark (1838 and 1839). The most interesting forms yet known are from the Eocene of Wyoming, where their remains occur in considerable abundance. The most common of these forms was named by Dr. Leidy *Hyopsodus*, under a misapprehension of its affinities. Later investigations upon more perfect specimens have shown that this animal was not an ungulate, but a monkey, allied, remotely, to living South American species, but possessing also many lemurine characters. The teeth of these Eocene forms are more numerous than in any other known Quadrumana. In *Limnotherium*, Marsh, the formula is, apparently, incisors $\frac{2-2}{2-2}$, canines $\frac{1-1}{1-1}$, premolars $\frac{4-4}{4-4}$, molars $\frac{3-3}{3-3}$—40 in all. In *Hyopsodus* the number seems to have been 42, while in *Lemuravus*, Marsh, there were 44 teeth, the so-called typical number in mammals. They were, moreover, in a continuous series, and the canines were small. The brain in these monkeys was small and nearly smooth, and the cerebellum mostly behind the cerebrum. The tail was elongated, and probably, in some genera at least, prehensile. The orbit was open behind, and the lachrymal foramen without the orbit, as in the lemurs. Besides the genera *Lemuravus* and *Limnotherium*, regarded as typical of two distinct families, several other genera are now referred to this order, as *Thinolestes*, *Telmatolestes*, *Notharctos*, *Hipposyus*, *Microsyops*, *Palæacodon*, *Mesacodon*, *Bathrodon*, and *Antiacodon*. The only known North American monkey of any later formation than that above mentioned is *Laopithecus robustus*, Marsh, from the Miocene Bad Lands of Nebraska. This animal was about the size of the coati, and the crowns of its molar teeth resembled those of some South American monkeys, or still more those of the Eocene Limnotheridæ. O. C. Marsh.

Quæs'tors [Lat. from *quæro*, to "inquire"], in ancient Rome were at first two inquisitors or state's attorneys (*quæstores parricidii*) who prosecuted those accused of capital crimes. They are not mentioned after 366 B. C. Their functions were transferred partly to the *triumviri capitales*, partly to the *ædiles* and *tribuni*. The *quæstores classici* were the officers commonly called quæstors. They

had charge of the treasury, the revenues, and the expenditure of moneys. There were originally two quæstors, afterward four, and still later, at times, even more. The first increase of the number of the quæstors took place in 422 B. C., when their number was doubled. The two new quæstors accompanied the consuls in their campaigns, and had at first only to superintend the sale of the booty, the produce of which was either divided among the legion or transferred to the *ærarium;* but subsequently they kept all the funds of the army, and became the paymasters. The number of these quæstors was increased by Sulla to twenty, and by Cæsar to forty. This increase was made necessary, partly at least, by the extension of the empire, but it had also a political reason, as the quæstors were entitled to take seats in the senate, and a law of 421 B. C. determined that at least one-half of the quæstors elected should be plebeians. The proconsuls and the prætors, who administered the provinces, were also accompanied by quæstors, whose office and duties corresponded exactly to those of a quæstor stationed with an army in the field. For Sicily two quæstors were appointed, corresponding to the old division of the island into a Carthaginian and a Greek portion. One of them resided at Lilybæum, the other at Syracuse.

Quagga. See ZEBRA.

Quahaug. See CLAM.

Quail. See ORTYGINÆ.

Quak′er Gap, tp., Stokes co., N. C. P. 1749.

Quak′ers, or **Friends,** called by themselves **The Religious Society of Friends,** a form of religious societies originating in England through the preaching of George Fox (1648–90), distinguished for a reliance on the inward teachings of Christ or the light within for guidance, an avoidance of forms and written creeds, a conscientious refusal to engage in war, and a dispensing with the aid of priests or a paid ministry.

The vigor and independence of religious thought in England was a remarkable feature of the period which gave birth to the Reformation, and which established Protestantism as the religion supported by the civil authority in England and Germany. The reform did not stop with the establishment of a Church, which, however decidedly it might protest against Romish power, commenced almost at the outset to exercise despotic power in enforcing conformity to its own creed: it went further, and renewed the higher forms of Protestantism itself in the Quakers and the Puritans. The relation which these dissenters held to the Church of England was only higher, in the relative advancement of their views, than that of the revolt against Rome. The same sturdy English love of liberty that rejected Roman Catholicism subsequently developed the Puritans first, and the Friends or Quakers next, without such original difference between them as would, at this distance of time, appear essential to keep them apart. Both were the natural protests of the free religious mind of the race against the despotic demand for conformity which religious authority at that time enforced. The Friends justly claim this difference, however—that the Puritan was often intolerant, and when in power was disposed to the severest persecutions; whereas Penn often interfered generously and successfully in behalf of every class persecuted for religious beliefs. Both the Puritans and the Friends attained a great measure of success and a conspicuous place in history. The reforms they advocated were more effectively urged and their permanence better secured by the singular ability and persistence of the Friends than by any or all other agencies. The history of the earlier labors of George Fox and Robert Barclay shows in a strong light the rightfulness of their claim to be regarded as the true representatives of the original spirit of Protestantism. In Scotland, where Fox preached with great success in 1657, some of the best of Cromwell's adherents were among his converts, among them John Swinton and Col. David Barclay; also his son, Robert Barclay, who subsequently became second only to Fox in the energy with which he preached that which he claimed was "the perfection of Protestantism," insisting that there was no middle ground between the doctrines he taught, on the one hand, and those of the Church of Rome, on the other. The founder of the Society of Friends, George Fox, was a native of Leicestershire, England, of humble origin. He began in 1647 a ministry of the most unpretending character, but which became very conspicuous and influential through his earnestness and zeal, united as they were with the highest ability. He found adherents among the wealthy and educated classes, as well as with the body of the people, and twice visited the Continent. He spent some time in Scotland, and twice visited America, spending two years here in effective ministrations. Though much persecuted and often imprisoned in the earlier part of his career in England, he gave so much force and dignity to his work as to command more respect from the civil authorities than was usually accorded to dissenters. In 1660, Thomas Loe, one of Fox's earliest converts at Oxford University, made an impression never afterward effaced on the mind of William Penn, then a student sixteen years of age at the university, and but few years elapsed before the zeal, devotion, and ability of William Penn made him the leading figure in the great struggle for religious reform. Penn was greatly aided by the high position of his family, and by the claims of his father, Admiral Penn, upon the government for distinguished services; and though imprisoned and persecuted at times, as all dissenters were, he regained his influence with the king, and obtained concessions of religious liberty, not alone for himself and his society, but for all other dissenters. As a part of these concessions, as well as in settlement of a claim due his father, he secured the grants of land out of which his great work grew of founding a state. Of the many attempts made during that period, this alone was entirely successful, and it was only just to call it by his name. But the great struggle that absorbed the chief attention of the early Friends was in England, where a succession of adverse as well as favorable events tried their strength to the utmost. In all these trials, however, they vindicated their rights with remarkable ability, and their courage when arraigned before the judges gave to the name *Quaker*, originally applied in disparagement, a significance which took from it all reproach. On several occasions they won substantial victories in these contests, and there are few essays or writings on any similar subject or drawn forth by like circumstances equal in strength and in dignified assertion of the right of conscience to the vindications put forth by William Penn and Robert Barclay: "We are a free people by the creation of God, by the redemption of Christ, and by the provision of our never-to-be forgotten honorable ancestors; so that our claim to these privileges, rising higher than Protestantism, could never justly be invalidated on account of nonconformity to any tenet or fashion it might prescribe. This would be to lose by the Reformation, which was effected only that we might enjoy property with conscience." (Penn's *England's Present Interest Considered*, 1674.) In the period extending from 1671 to 1685 the influence of the Friends was largely extended among the Protestants of Holland and Germany, where many notable persons embraced their views. Penn went to the Continent in 1671, and again in 1676, and both then and long afterward kept up an active correspondence with eminent persons there. In 1676 the acquisition of large interests in the colonies of East and West Jersey, both by himself and by other leading Friends, gave a new direction to Penn's energies, and, being restored in a great degree to the influence his family had formerly held at court, he formed extensive plans for establishing his views of liberal government in the New World. These movements gave to members of his society practical possession of most of Jersey, as well as the newer colony called by his name, and greatly enlarged their sphere of influence, as well as their responsibility. It is but just to ascribe to them the most complete success as colonists; their justice to the Indians, and the success which it secured to them in the peaceful acquisition of the Indian title to lands, was the most conspicuously honorable feature of colonial history. They committed no material mistakes, and never sullied their fame as protestants against despotic power in England by any exercise of similar tyranny in the colonies they controlled. They avoided war as a matter of conscience, and were rewarded by unbroken peace with the savages for more than half a century, and by entire exemption from the losses and horrors of savage warfare during the entire colonial period. Their principles and practice made a profound impression on the savage mind, and it is to the distinctive features of their form of religion and of their discipline as a society that these remarkable exemptions from the misfortunes of other colonies are to be ascribed. Almost a century of peaceful progress followed the active life of the founders, broken only by one severe struggle (1715–25) against an attempt to revive an old and most oppressive law against the Quakers and to extend its operation to Pennsylvania. The sturdy resistance of the colonists was again successful, and they obtained in 1725 full confirmation of their rights, not again to be disturbed. The growth of the settlements in America continued to draw from the parent societies in England so largely as to leave their numbers in that country with little change, while on the Continent the general tone of social and religious life was not favorable to the free growth of the society. Fewer striking events attended their condition after the death of Fox and Barclay than before. Both died in 1690, and there was less of despotic interference to oppress them, and perhaps less of the aggressive enthusiasm of their early history on their part.

No account of the numbers embraced in the society appears recorded during a long period of time following, and comparison on that point with the present is therefore impossible. The various transfers from one colony or locality to another in America were effected without collision, except partially in New England, where they were repelled, and for a time persecuted. Ultimately, they were distributed quite widely, Virginia and North Carolina receiving many, and Maryland, New England, and New York each a small number. When Western New York and Eastern Ohio were opened to settlement, a considerable number established themselves in each, and still later they removed in large numbers to Ohio, Indiana, Illinois, and Iowa. Of the North Carolina Friends, some have settled in Alabama, but the distribution has been small in the South—in part, because of their uniform testimony against slavery.

The distinctive religious belief of the Friends has been defined to be a reliance on the inward divine light for guidance, and an avoidance of written or formal creeds or of reliance on an established priesthood. This belief remains the same, and in defining it no other terms are still given than the language and words of the founders. It is a religion of inward experiences, as contrasted with one of outward forms. Believing that the Spirit of God does move and direct the truly religious man, they hold it to be man's first duty to seek that direction and to be guided by it. They establish and enforce a discipline which orders the conduct of life rather than asserts doctrines. "The society adopted no written creed, but received the gospel in the love of it, as free and unfettered as it was left by Jesus Christ and his apostles. . . . No systematic theory of religious opinions founded upon private views or the judgment of individuals was imposed upon one another by this society." (Cockburn's *Review.*) "They distinguish between imposing any practice that immediately regards faith or worship (which is never to be done, nor suffered, nor submitted to) and requiring Christian compliance with those methods that only respect church business in its more civil part and concern, and that regard for the discreet and orderly maintenance of the character of the society as a sober and religious community." (William Penn, *Preface to Fox's Journal.*) The discipline of the society was not to interfere with the faith of the members, but to superintend the practice. (*Cockburn.*) The unity which members of the society always earnestly sought was threatened only by the tendency, elsewhere universal, to reliance on written doctrines in matters of religious belief; and as a large number of the early accessions came to them from the Established Church, it required earnest and constant assertion of their principles to preserve the society in its purity. On the whole, its success in this respect was, for a century or more, most remarkable, but ultimately the growing tendency toward a discipline of doctrines became oppressive to many, and for some years previous to 1827 the discontent was general, particularly in Pennsylvania. Those in authority sought to impose a degree of restraint on the conscience and to exact a conformity to precise dogmas which was resisted as an infringement of the liberty secured by the founders. The result was, that a large majority of the members of the society in and near Philadelphia separated from the meetings and organized new ones, in a majority of cases retaining the meeting-house, but in others yielding it where the adhering number was greatest. They did not propose any departure from the teachings of Fox, Penn, and Barclay, but rather a return to them from a point to which they considered they had been removed. They had nothing new in doctrine or in practice to propose; they only felt that to permit the course of things then in progress to go on would be to lead the whole society into error, and would be an approach to the formalism which the early Friends had made great sacrifices to escape from. At the Philadelphia yearly meeting of 1827 a large number of members came to the conclusion to separate: they alleged that those in control of the society had "infringed on the religious liberty Friends had asserted and enjoyed." "Measures have been pursued which we deem oppressive, and in their nature and tendency calculated to undermine and destroy those benefits to establish and perpetuate which should be the purpose of every religious association." "It is under a solemn and deliberate view of this state of affairs that we feel bound to express to you, under a settled conviction of mind, that the period has fully come in which we ought to look toward making a quiet retreat from this scene of confusion; and we therefore recommend you to adopt such a course as truth, under solid and solemn deliberation, may point to in furtherance of this object, that our society may again enjoy the free exercise of its rights and privileges. And we think proper to remind you that we have no new gospel to preach, nor any other foundation to lay than that already laid and proclaimed by our forefathers, even Christ within, the hope of glory, 'the power of God and the wisdom of God.' Neither have we any other discipline to propose than that which we already possess, believing that whilst we sincerely endeavor to live and walk consistently with our holy profession, and to administer it in the spirit of forbearance and love, it will be found sufficient for the government of the Church." Immediately following this declaration active measures were taken to meet the emergency, and during the few months preceding the yearly meeting of 1828 the several quarterly meetings throughout New Jersey, Delaware, and Eastern Pennsylvania had separated, in most cases the old or orthodox division being much the smaller in numbers. Measures were taken to ascertain the relative proportion in each, and "so far as ascertained up to 1829," the numbers of each division in Philadelphia quarterly meeting were nearly equal, 2676 being attached to the new meeting and 2643 to the old one. But for the whole yearly meeting of Philadelphia it was estimated that 18,486 were attached to the new and 7344 to the old society,

The active ministry of Elias Hicks occurred during this period. He was a man of great earnestness and firmness of purpose, who visited many parts of the country distant from his own home near New York. It is not, however, conceded that he was in any proper sense the originator of the movement which resulted in separation. No new doctrines were advocated by him, nor was there any such unusual following of his ministrations as would render it proper to attach his name to the movement. The earnestness and frequency of his appeals to the original course of George Fox, as contrasted with the greater formality and restraint of the society as it had then become, led to much severity of criticism, for which no sufficient cause appears at this distance of time. While holding the teachings of Elias Hicks in great respect, the society has at all times declined to accept him as a distinctive leader.

The subsequent history of the Friends of both divisions in the U. S. confirms the view that the hasty exclusions and disownings of 1828 had no sufficient justification. Both have, however, been generally prosperous, and antagonism between them has long since ceased. Always foremost in great reforms and works of benevolence, the Friends have been especially prominent in public influence, furnishing a large number of representative men and women whose names are conspicuous as leaders of great reforms both in England and in the U. S. For more definite information as to the precise views held by those who participated in the great division the reader is referred to the writings of James Cockburn, Dr. William Gibbons, and Samuel M. Janney. Each of these has written the history of the separation with ability and candor. It is not easy to determine the exact differences between their views and those of Gurney, who, though one of the Orthodox, declares, that "were I required to define Quakerism, I should not describe it as the system so elaborately wrought out by Barclay, or as the doctrines and maxims of Penn, or as the deep and refined views of Pennington, for all these authors have their defects as well as their excellencies. I should call it the religion of the New Testament of our Lord and Saviour Jesus Christ, without diminution, without addition, and without compromise." This is the essential point of liberty of interpretation which the most advanced representatives of the society claim.

The entire written law of the Society of Friends, other than the simple text of the Scriptures, is found in the *Rules of Discipline*, a code made up of rules which at intervals were adopted by the society as occasion arose for the correction of some irregularity or for provision against some known danger. "For the more regular and effectual support of this order of the society, besides the usual meetings for the purpose of divine worship, others are instituted subordinate to each other; such as, *first*, preparative meetings, which commonly consist of the members of a meeting for worship. *Second*, monthly meetings, each of which commonly consists of several preparative meetings. *Third*, quarterly meetings, each of which consists of several of the monthly meetings. *Fourth*, the yearly meeting, which comprises the whole. These meetings have all distinct allotments of service." Any person dissatisfied with the judgment of a monthly meeting may appeal to a quarterly meeting, and from a quarterly meeting to a yearly meeting, whose decision is final. Arbitrations are provided for in all cases of difference respecting property, and appeal to the usual course of law is permitted only when one party refuses to arbitrate or when the point at issue can be reached only by legal proceedings. Moderation is especially enjoined in all proceedings, forms, and ceremonies, avoiding ostentation and expense. Charity and unity among members are earnestly enjoined. The acceptance

of office in civil government is discouraged, especially where the functions of such office may conflict with entire freedom of conscience or may require participation in war. Fasts and feasts are discouraged; strict justice is enjoined; and "frequent waiting in stillness on the Lord for renewal of strength" is prescribed as the proper course in difficulty and the proper form of religious preparation. Gaming and diversions, including dancing and attendance on theatres, are forbidden, and those who persist in attending them after due remonstrance are to be disowned. "This is the extent of the society's censure against irreclaimable offenders: they are disowned as members of our religious community; which is recommended to be done in such a disposition of mind as may convince them that we sincerely desire their recovery and restoration." Marriages are regarded as contracts of a religious nature, to be considered and approved by the society, and marriages with members of other principles and professions of religion are discountenanced. Forms of notice and marriage certificates are prescribed in the rules of discipline, and violation of these rules and forms is to be treated as an offence. Elders and ministers are called by the society upon evidence of their gifts, and ministers receive a letter of testimony if visiting other societies, to be given by a monthly meeting, and confirmed by a quarterly meeting of ministers and elders. Women may become ministers equally with men, and none are to be paid a salary or for services as minister under any circumstances, though the expenses of those travelling by direction of the society may be paid. The most earnest testimonies of the society are recorded against slavery and against war, and members are positively forbidden to engage in either. The poor of the society are to be faithfully provided for within its own organization. Plainness of apparel is enjoined, and members are cautioned against secret societies. Many other recommendations and advisory provisions are made in the *Rules of Discipline*, most of which are closely observed by the members, and constitute the peculiarities by which they are distinguished. Some of these undoubtedly tend to limit the membership and retard the growth of the society, particularly those which exclude the families of members marrying out of the society from recognition as fully belonging to it, though agreeing in general sentiment and practice with the society.

The present numbers and organization of the Society of Friends are, so far as can be ascertained, nearly as follow: The original society first experienced a division during the Revolutionary war, at which time Samuel Wetherill, with about 1000 others, asserted in Philadelphia the duty of aiding in defensive war. A society of Free Quakers was organized, which was active and influential for the time, erecting a building at Fifth and Arch streets, Philadelphia, which is still owned by representatives of that society. Next was the separation in 1827, before referred to, and more recently the Orthodox branch has been divided between the adherents of John Wilbur and those of Joseph John Gurney, the former claiming the name of Primitive Friends. Another body of persons have called themselves Progressive Friends, but, though they are mostly descended from Friends, they are to be regarded as a voluntary association in aid of general reforms, rather than as a distinct religious body. They meet at Longwood, Chester co., Pa. Through careful recent inquiries the following statement of the number of yearly meetings and of members is made up, as being reasonably near to exactness. Of the Friends not called Orthodox there are seven yearly meetings: Philadelphia, with 15,000 members; New York, with 3600; Genesee, 2954; Baltimore, 3800; Ohio, 2509; Indiana, 3500; Illinois, 1500; total, 32,854. Of the Orthodox Friends there are in the U. S. eleven yearly meetings, with membership nearly as follows: Philadelphia, 3500; New York, 3300; New England, 4500; Baltimore, 650; North Carolina, 4200; Ohio, 3200; Indiana, 16,000; Western, 11,700; Iowa, 8650; Kansas, 3420; total, in the U. S., 59,120. In England and elsewhere there are the London meeting, with 14,200 members; Dublin, 2935; Canada, 1630; and Australia, 300. Grand total, 111,039. The Orthodox branch have separated in New England, New York, and Ohio; in the last named nearly one-half of the yearly meetings are distinguished as agreeing with Wilbur and the Primitive Friends, dissenting from the views of Joseph John Gurney and the regular Orthodox. The like division is smaller in New England and New York.

Any estimate of the influence which has been exerted by this society based upon a statement of their present numbers would be far from just or adequate. Independently of the important effect which the liberal legislation of the early period in Pennsylvania had upon other States, it is to be remembered that the rigid discipline of the society as to membership has thrown out of its technical circle a large number of capable persons imbued with its principles, and substantially representing them in the general society of the world. The number of eminent names so associated with Friends' teachings, and further impressing them on the general public both in England and the U. S., is very considerable. It has been the order of the Friends' society from the beginning that their poor should not become a charge on the civil authority or upon any other charity than their own. The Society of Friends has maintained a full proportion of charitable and educational institutions. Under Penn's instructions schools were founded and maintained in Pennsylvania for the education of the children of the society from the first settlement, and in 1790 a school of the most thorough course of instruction was established at Westtown in Chester co., at which great numbers of the children of the leading families have received instruction. Several similar schools have been established, and in 1870, Swarthmore College, a full collegiate institution, was established 10 miles from Philadelphia, in Chester co. It is liberally endowed, provided with able instructors, and confers the usual degrees on graduation from a course of four years in the classical and scientific departments. This institution was founded by the non-Orthodox branch of the society, and it represents a greater conformity with modern modes of instruction than was admitted previously. In Central New York and in some parts of Ohio the distinctive usages of Friends in regard to education, and also as to forms of religious services, are recently considerably modified. (For further information as to the views of the Orthodox branch see article FRIENDS of this work; and for the views of the other branch see Cockburn's *Review;* Janney's *History of Friends;* Gibbons's *Review;* Rupp's *History of Religious Denominations*, etc. And, generally, Clarkson's *Life of Penn; Select Works of William Penn;* Sewel's *History of the Quakers;* Besse's *Defense*, etc.) LORIN BLODGET.

Quakertown, p.-b., Richland tp., Bucks co., Pa., on the North Pennsylvania R. R. P. 863.

Quak'ing-Grass, a genus (*Briza*) of ornamental grasses. *B. maxima* and *media*, from Europe, are cultivated in gardens, and the latter is partly naturalized here. In Europe it is considered a good pasture-grass for poor mountain-lands.

Qual'itative Al'gebra. Common algebra has been regarded by Sir William Rowan Hamilton as the science of pure time in an essay published in vol. xvii. of the *Transactions* of the Royal Irish Academy. Any multiple algebra involves many different independent elements or units, each of which may be viewed as the representative of a peculiar quality. The various modes of the combinations of these elements give the especial characters of the different algebras. The most comprehensive algebra is that of logic, which combines every variety of element. A profound and penetrating algebra of logic has been presented by Boole in his *Laws of Thought*, the principles and relations of which have been discussed with many suggestive modifications and interesting applications by De Morgan, Ellis, Harley, and Mr. Charles S. Peirce. Another form of the algebra of logic has been introduced into his *Principles of Science* by Prof. Jevons, which treats the theory of the syllogism with singular simplicity. These algebras constitute the greatest addition to logic since the time of Aristotle. They are remarkable to the mathematician, because they do not involve numerical elements. A general investigation of the forms of multiple algebra was made by Hamilton in his *Theory of Sets*, published in vol. xxi. of the *Transactions* of the R. I. A. This theory contains special references to octonomial algebra, which terminated at length in the production of the wonderful algebra of quaternions. There are three principles of fundamental importance in the algebras—the distributive, the associative, and the commutative principles. The distributive principle refers to the distribution of the parts of the factors, and is represented by the formula—

$$(a + b)(c + d) = ac + bc + ad + bd.$$

There has been no algebra proposed in which this principle is not adopted, except, it may be, in the logical algebras. The associative principle refers to the multiplication of successive factors, and is represented by the formula—

$$a(bc) = (ab)c = abc.$$

This principle is adopted in quaternions, but rejected in the octades proposed by Cayley and Graves in the *Philosophical Magazine* for 1845 and 1848. The commutative principle refers to the order of the factors, and is represented by the formula—

$$ab = ba.$$

This principle is not retained in quaternions, nor in most of the proposed multiple algebras. Hamilton considered a variety of triple and quadruple algebras in his prelimi-

nary investigations which led to quaternions. De Morgan undertook the investigation of triple algebras in his *Memoir upon Triple Algebra*, published in *Transactions* of the Camb. Phil. Soc., vol. viii. In my *Linear Associative Algebra* (Washington, *lithog.*, 1870) I have undertaken the complete investigation of all possible algebras, subject to the distributive and associative principles, up to those of the sixth order. I found three double algebras, five triple algebras, eighteen quadruple algebras, seventy-one quintuple algebras, and sixty-five sextuple algebras, or in the aggregate one hundred and sixty-two algebras. Among them is one singularly simple class, which I have designated as quadrates, and of which quaternions is the simplest example. Mr. Charles S. Peirce had previously discovered this class of algebras by logical analysis, and has shown that all the other algebras are imperfect cases of this class, and has designed a very clear notation for its elementary units. In vol. iv. of the *Proceedings* of the Mathematical Society of London, Prof. Clifford has added a valuable element to quaternions, which practically doubles its original elementary units, and he calls the new algebra biquaternions, coinciding with me in the opinion that quaternions should legitimately include what Hamilton calls biquaternions. The same volume contains a learned analysis of the various multiple algebras in Mr. Spottiswoode's memoir on *Some Recent Generalizations in Algebra*. He especially describes Hankel's *alternate numbers*, which are the same with one of the forms of algebraic *keys* given by Cauchy in the *Comptes Rendus* of the French Academy for 1853. Among the elementary units, or, as they are perhaps better styled, the *vids* of the multiple algebras, the vids of inversion are of especial interest. These vids are in form square roots of unity—*i. e.* they are such that upon a repetition of their application they restore a quantity to its original value. The new primitive vid introduced by Prof. Clifford is an inverser. The vids of semi-inversion have ever been deemed as more important than those of inversion; they are such that upon a repetition or application any quantity is reduced to its own negative. All the units vector of quaternions are of this class, as well as the primitive octades of Cayley and Graves. The vids whose square is zero may be called nilpotents; they include all the vids of Hankel's alternate numbers, and their property becomes thereby a special case of the general defining property of these numbers, which is represented by the formula

$$ab = -ba.$$

BENJAMIN PEIRCE.

Qual'la Town, p.-v. and tp., Jackson co., N. C., inhabited chiefly by a remnant of the Cherokee Indians. P. 1697.

Quang-See', province of the Chinese empire, between lat. 22° and 26° N. and lon. 105° and 112° 30′ E. Area, 78,260 sq. m. P. 7,313,895. It is mountainous, rich in metals, and produces grain and cassia. Cap. Kwei-Lin-Foo.

Quang-Tong', province of the Chinese empire, between lat. 20° and 25° 30′ N. and lon. 108° and 117° E., bordering on the China Sea and the Gulf of Tonquin. Area, 79,451 sq. m. P. 19,174,030. The surface is mostly level and the soil is fertile. Rice, sugar, green tea of an inferior quality, cassia, betel-nuts, and cotton are produced. Cap. Canton.

Quan'tico, p.-v. and tp., Wicomico co., Md., on Nanticoke River. P. 1453.

Quantico, v. of Strafford co., Va., on Potomac River and Acquia Creek, is the southern terminus of Fredericksburg and Potomac R. R.

Quan'tity [Lat. *quantitas*], in mathematics, the property of substance which involves the capability of increase or diminution. *Continued quantity* is the equivalent of magnitude, and forms the object of geometry; while *discrete quantity*, of which the parts have a separate existence, is the equivalent of multitude or number, and forms the object of arithmetic. Quantity of *matter* is termed mass—quantity of *motion*, momentum.

Quantity, as a term in PROSODY (which see), is the length of syllables as employed in Greek and Latin versification. It is not adapted as a basis for verse in a language like English, where it would be overpowered by the strong accents, yet a careful poet can make efficient use of it, while many bad lines are due to its neglect. In Keats's distich—

> What I know not: but who, of men, can tell
> That flowers would bloom, or that green fruit would swell, . . .

there is no reason for the discrepant long quantities which dissimilate the second line from the first; as in the next by Pope, where, in accordance with the action described, the hurry of the first line is followed by the staid movement of the second:

> So tŏ thĕ fīght thĕ thĭck băttălĭŏns thrŏng,
> Shīelds ūrg'd on shīelds, and men drōve men alōng.

In Milton's lines, *Paradise Lost*, book 3, l. 588–589—

> There lands the Fiend, a spot like which perhaps
> Astronomer in the Sun's lucent Orb, . . .

the short syllables of "Astronomer" are the correlatives of "There lands the Fiend." Here, as the second line is prose, it should have had such a quantitative correspondence as would have enabled the rhythmic line to carry it through without much observation. S. S. HALDEMAN.

Quar'antine [It. *quarantina*, "forty days"]. The word is designed to express the measures of *isolation* imposed upon persons or things susceptible, on account of their nature or from contact with contaminated persons or things, of transmitting an epidemic or contagious affection of exotic origin. As originally employed, it indicated the limit of time (forty days) which seemed necessary to subject to observation individuals suspected of conveying pestilential contagion. It no more expresses this duration, but isolation, sequestration, and sanitary inspection, without reference to their duration—a duration which must vary not only with the season, but with localities, or again with the degree of danger recognized in the vehicle of transmission. Regarded in this light, the word comprehends all measures of a sanitary character destined to obstruct or destroy the march of an epidemic or contagious affection, it matters not whether these measures have for their object to oppose the transmission of the morbid germ, or by strictly hygienic efforts prevent its development. This happy accord allows, then, the application of the one or the other element, as may seem to the sanitary officer best applicable, and does away with that blind, almost fanatical and necessarily imperfect, series of measures which marks the past history of this institution.

History.—For our purpose it is most desirable to study this under three divisions of time, very unequal, it is true, but still representing best the growth or decadence of certain principles pertaining to the institution. The first, comprising all the Middle Ages, may be styled the period of *leprosy;* the second, commencing at the end of the fourteenth century to end with the early part of the present, the period of quarantines against *plague;* the third, wholly modern, corresponding to the sanitary measures employed against *yellow fever* and *cholera.* A study conducted under these heads will enable us to appreciate that there can be no blind formalism in the administration either in places or people, as the latter may be modified through hygienic efforts or climatic influences; or, second, from conditions in the nature of the epidemic, so variable at each explosion of one or the other of these diseases—conditions, blind though they may be, whose influence we must still admit, since we see them at one time spread over the whole habitable globe or at another limit themselves as circumscribed epidemics; or, again, in following them through a succession of centuries we see, it may be, the plague or cholera or yellow fever play successively the principal rôle among devastating scourges.

First Period.—Leprosy is one of the oldest of known diseases, and still exists as an endemic over vast regions of Asia and Africa. It might for this reason be objected that the limitation of this period should not be made to the fourteenth century; but the fact is recognized that with the irruption of the plague into Western Europe at this date it began to diminish, and in most localities entirely disappear. The isolation of lepers was an early law of societies; prescribed by Moses, it is still adhered to in the East. It is not without interest to notice the variable manner in which those affected with leprosy, not only in different countries, but at different epochs, were isolated. The most primitive method was to drive them out from among the population, and they settled either in the suburbs of a town or in huts by the travelled waysides. Gradually, establishments were built to receive them, usually at certain distances from the cities. Those in Spain were exceptional, being often built in the thickly-settled portions of the towns—a custom derived, probably, from their Moorish predecessors. Ultimately, the sequestration was sought to be more effectual by subtracting them wholly from the population, and concentrating them on the island of Samos, in the Mediterranean Archipelago. Another circumstance, not less interesting, as illustrating not only the different estimation in which those affected were held in different countries, but also the demoralization and frauds which gradually crept into the system, was the conduct of these asylums and the character of the persons admitted. In certain countries, to the dread of contact and the sight of those affected was added the sentiment of religious aversion, inspired by the idea that leprosy was a divine punishment. Solemn ceremonies, characteristic of an interment, marked their separation from society. On the other hand, in other countries

the superstitions of the time and place surrounded the lepers with a certain halo of glory and martyrdom. They became objects of special veneration, even elevated to the first dignities of the state or army, with places of honor assigned to them in the temples, etc.; orders of chivalry were established consecrated to their cure. While, on the one hand, the most severe penalties interdicted all contact, designating for them a particular dress, on the other the sequestration partook of an honorary character—so much so that the institutions in which they were established became the refuge of a crowd of lazy vagabonds, who, simulating the disease, found there a desirable home. To such an extent was this carried that in the seventeenth century several government commissions were formed to visit these asylums and diagnosticate critically those affected and those not with the disease.

Second Period.—It was not, however, until the appearance of the plague in 1348–50 that the régime of quarantine against pestilential affections was fully inaugurated. As for ages previous leprosy had been the principal disease in which isolation was ordered, we see, in looking over the regulations which existed in many of the places on the shores of the Mediterranean, that they were those adopted with regard to leprosy, save that the definitive isolation of the one was changed to the temporary sequestration of the other. About this time the recurrence of grave pestilential epidemics inspired the public, rather than physicians, with the notion of their transmissibility by those attacked. As a consequence, the restrictions were marked by the brutal and superstitious spirit which characterized the age. The murdering of physicians, the bloody persecutions against the Jews, self-imposed tortures by individuals to propitiate divine mercy, witness the superstition and barbarity of the epoch. Soon it was noticed that vessels and passengers coming from the East, though not attacked themselves, brought with them the morbid germ. Venice, rising from her lagoons, was then the most enterprising and the chief commercial city of the world. Covering the Mediterranean with her vessels, she made at the same time commerce and war; consequently, her port, more than any other, was subject not only to the black plague, but especially the Egyptian, then so frequent in its explosions. Induced by their frequent appearance, she proscribed the sale and destroyed the effects of those who had died. She created three protectors of health, a health bureau, and finally a lazaretto, which subsequently formed the models for all other ports. Her example was followed by all the smaller places on the Adriatic coast existing then as separate governments. It is probable that the terror inspired by the repeated visitations of the pestilence gave rise to that persistent hostility to strangers which still exists in many portions of Southern Italy. From this time, too, dates the period of *forty* days as necessary for the observation of suspected persons.

Another fact of interest in this connection is, that for the *first* time medical men, not only by the aid of scholastic arguments, but by the study of facts, interested themselves in the question, "How far contagion was concerned in the transmission of the plague?" About the middle of the sixteenth century the celebrated work of Fracastorius appeared. It is the first work which speaks of contagion as now understood. According to him, a specific virus rises by exhalation from the body of the sick, extends but a short distance, and attaches itself to certain substances, which thus become contaminated; this contamination remains, and may be transported unknown distances and infect entire communities. He recognizes also that certain other substances would not be contaminated. The public mind seized eagerly upon this distinction of contamination and non-contamination, the decision of which has been since then the source of so many discussions and such diversity of opinions. Independently of natural exaggerations, he wrought this double advantage: First, to show certain real dangers not before suspected, and recall to rational observation many minds misled by the belief in the influence of the stars or by their faith in the Galenist dogma of occult causes. Second, to dispel, on the other hand, that which was equally difficult—certain prejudices which exaggerated the property of transmission of such diseases, and admitted that they could be communicated by voice and expression of the sick. This opinion was still more fortified by a subsequent work by Masaria, who showed the immunity of persons who during an epidemic had remained shut up in their châteaux or in monasteries. He limited the ravages in isolating the sick outside the city. The success which followed this advice made his work an article of faith, and it was followed by the organization of similar establishments in all the Mediterranean ports.

From the beginning of the seventeenth century Europe found herself relative to the plague in analogous conditions to those in which we are relative to cholera. The disease had reached its maximum of diffusion through the civilized world, and was especially terrible in all the large capitals. Sanitary police were established in all or nearly all, and the most vigorous measures were adopted for the sequestration of those stricken. Both local and general authorities acted in concord—the one in defining the movements and restrictions of the inhabitants; the other in surrounding the infected city with troops to prevent ingress or egress except under definite regulations. The spirit of isolation was carried to such extremes that without doubt the scourge was intensified, by compelling the inhabitants to remain in the infected districts, and often by the inadequate supply of food to those so restricted. The eighteenth century was marked by the more decided use of lazarettoes. The effects were soon observed: the disease declined from the interior portions of Europe, and was chiefly confined to the maritime ports. The regulations assumed a more explicit and in some sense rational form, though the penalties were very severe and enforced with intense rigor. Explicit directions were given to all vessels trading with Egypt or the Levant, not with reference to passengers only, but also the cargo and the vessel itself. The increasing commerce of France with the East gave the port of Marseilles an especial prominence, and its lazaretto became the most celebrated in Europe, not only for the care manifested, but, as knowledge existed, for the best management. It enjoyed, too, the confidence of the citizens, by several times preventing the contagion from spreading to the city after its entrance into the lazaretto.

To one familiar with the history of the subject it is interesting to study the minute distinctions made not only with reference to the bill of health, but the measures of precaution taken with reference to passengers and merchandise—measures which, while they might protect the community, lost sight entirely of the rights and privileges of those suspected, and which, were there the least trace of fomites in the vessel or cargo, would be certain to attack the poor unfortunates, who were compelled to undergo an almost unlimited period of observation. During the latter part of this century observations were more carefully and systematically instituted, and the modes of propagation of the scourge more accurately noted. Chief among these was the great philanthropist John Howard. He visited successively the hospitals and lazarettoes of the Mediterranean where the plague prevailed; attacked energetically the defective appointments; established the importance of hygienic conditions in these establishments; sustained the inutility of quarantines imposed on merchandise, and really laid the foundation for the present English legislation on the subject. He dispelled the idea that corpses could communicate the disease—a point of great importance, since in many epidemics the dead were allowed to accumulate unburied, people flying from them in terror. He combated also the foolish and grotesque precautions taken by physicians and nurses to escape immediate contact with the sick, and dispelled the illusion that the contagion could be conveyed by their breath.

During the early part of the present century the doctrine of quarantine was affirmed with renewed energy, and the privileges accorded were if possible more decided; gradually, a more exact appreciation of facts induced a more eclectic tendency, preserving that which was useful and rejecting that which was exaggerated. We notice, too, in European governments the first steps taken to stifle pestilential maladies in their place of origin. The development of this idea resulted in the call of an international congress to consult upon the principles to be laid down in order to prevent their widespread diffusion.

An additional interest arises in the study of this subject from the modification of the list of diseases to which restrictive measures should be applied. Up to the commencement of this century no other disease than the plague had occupied the attention of quarantines. From 1821, however, the interest in this disease gradually subsided, to be replaced in a far greater degree by the questions of yellow fever and cholera. During the few years previous to this the anti-contagionists had inveighed severely against all restrictive measures in yellow fever, asserting that it could not be imported, and that those who thus affirmed were men without experience and of limited information. Scarcely had these positive opinions been enunciated, and even obtained some credence in public sentiment, when the terrible scourge of yellow fever which invaded Barcelona in 1821 appeared. Its transmission by sea was undeniable; reaching the quarantine of Marseilles, it was excluded from that city. For cholera a different order of circumstances presented itself. The danger to be apprehended here was not from the side of the sea, but from the land. For years European governments had watched the progress of the Indian scourge, the terror inspired by its ravages in Asia, and had hoped to arrest its progress

on the Russian frontier. It was thought that by creating a *cordon sanitaire* on the boundaries of each country its progress could be arrested. Various restrictions to intercourse were made, virtually establishing quarantines by land as well as by sea. We all know how useless were these efforts. The rapid march of the first cholera epidemic through Europe in 1831, and the fact that it did not appear in certain countries where no restrictive measures were applied, showed the utter uselessness of these *cordons sanitaires* in thickly-settled districts, and they were soon abandoned. It had the effect to revive the old discussions relating to its transmissibility from man to man, many asserting that it was wholly epidemic in its character—an argument which had a specious force from the rapidity and uncontrollability of its progress. Its contagion was treated by some as a chimerical belief; those who opposed the idea of contagion were considered truly men of progress, since they opposed restrictions to personal liberty, and their views were applied not only to cholera, but typhus and other diseases. These hesitations and differences more or less still continue among the different portions of Europe. Indeed, the futility of the effort to establish a uniform system of regulations for countries and seaports in different localities having different relations with countries from which malignant diseases are brought, is now acknowledged there—that which experience had long ago taught in this country. Matters remained very much in this unsettled state, both as to the principles which should govern the administration of quarantines and the varied action of different governments, when in 1850 a convention was called at Paris to decide if possible upon some uniformity of principle. It consisted of representatives from all the principal European powers. They were medical men, and with them were associated the consuls of the respective countries represented in France. Confining themselves to facts generally accepted, and by the aid of mutual concessions, they arrived at a code of international sanitary regulations which, though since modified in many particulars, has remained the basis of all subsequent quarantine legislation. This convention awakened a new interest in the subject, and was followed by another gathering in Constantinople in 1865. At this last the value of restrictive measures was recognized, and the still more important duty of applying if possible at the source of epidemics all the dicta of public hygiene was strenuously urged—to stifle them in their exotic cradles by removing the causes by which they are propagated, and thus diminish the zones over which they spread.

In looking over the quarantine legislation enacted at different times in New York, we are struck with the freedom from the prejudices and formalities which so long marked all European enactments. Each principle has seemed to spring from the necessity of the occasion, and, though greatly modified of late years, the working has been based on the experiences afforded by some epidemic just passed.

Prophylactic Value.—After this sketch of the origin and growth of the systems of quarantine, their prophylactic value may be considered. Various opinions exist on this point in Europe and this country—the one denying all sanitary value to their restrictions, the other claiming exaggerated benefits. On looking closer at the school opposing all sequestration, it will be found that its opinions are based on the surroundings and climate of their *particular localities*—where, from the nature of their position to neighboring countries, no restrictive measures could be applied; and on the other hand, countries situate in latitudes where the exotic pestilences, all of which find their endemic dwelling in the torrid zone, can, with the exception of cholera, find but a short season when temperature and hygrometric conditions favor their development. Such persons, studying alone from their own standpoint, attempt to apply general principles for all localities. Quarantines are not essential to the higher regions of the temperate zone, nor to the localities in the torrid where climate and temperature readily make cholera and yellow fever endemic.

Value of Sequestration.—Sequestration is only valuable in localities where a general supervision of the means by which disease may be brought is *easily made*, and which are separated by a natural zone from suspected districts. Such are localities on islands or in cities where the entrance of the disease would be almost wholly by sea. On the other hand, where topographical conditions are less favorable this isolation from contagious diseases is almost impossible, and consequently it is illogical to impose such conditions upon them. Still another series of conditions would modify the application of these measures. Such are countries situated in the endemic zone of the disease which it is desired to restrain. Before deciding upon its application for any given locality, it should be determined whether it does not already exist there, it may be in complete evolution or as a localized germ. To apply restrictive measures without first determining these facts is to establish useless barriers and renew under another form one of the principal abuses of the old system. If the general principles expressed are correct, it will not be difficult to make the particular application. Such application must be founded upon the natural history, the manner of transmission, and the period of incubation of the disease, and in shaping restrictive measures all incidental circumstances must be borne in mind. Wherever rational hygienic measures are faithfully pursued, not only at the source of the infection, but also on the vessels in transit, it should be a powerful modifying element in the restrictions applied to passengers, cargo, or vessel on their arrival in port.

Quarantine of the Port of New York.—The quarantine department of the port of New York consists of a boarding-station at Clifton, on Staten Island, a summer boarding-station on a station-ship anchored in the lower bay, 4 miles below the Narrows, and two artificial islands—viz. Hoffman Island, of about 3½ acres, and Dix Island, of about 3 acres. The burying-ground is at Seguin's Point, on the south-eastern part of Staten Island, about 1 mile N. of the Prince's Bay lighthouse. Besides these, the hospitals on Ward's and Blackwell's islands are used for the reception of certain patients, who are cared for under the law by the quarantine department. This quarantine was originally established to guard against the importation by shipping of yellow fever or any other infectious distemper in 1784. The diseases against which it now applies are "yellow fever, cholera, typhus or ship fever, and smallpox, and any new disease, not now known, of a contagious, infectious, or pestilential nature." In the management of these diseases, of which the four named are subject to treatment, smallpox patients are sent to the smallpox hospital on Blackwell's Island, typhus fever to the emigrant hospital for that disease on Ward's Island, and cholera and yellow fever to the quarantine hospital on Dix Island. If both the latter diseases are in the harbor at the same time, the station-ship is used as a hospital for the treatment of one of them. The two artificial islands of the department are wonders of artificial construction. They are built on the W. Bank, a shoal which forms the western limit of the ship-channel (E. Bank being on the other side of it), and at the time of their construction stood in water about 7 feet deep at low water. Dix Island, the most southerly, is covered by a hospital structure of wood one story high, containing eight hospital wards 100 feet long, and with room for beds on each side. Two additional buildings, of the same size, are used for attendants, for store-rooms and kitchen, and for the engine-house. The disinfection-chamber (where disinfection is practised with superheated steam, hot water, chlorine, or other gases, and liquid disinfectants as required), laundry, and workshop occupy another building about 100 feet long. The construction of the hospital is that known as the "American pavilion," of which style this is an improved and favorable specimen, the general plan being a long corridor, with doors along the sides opening into the wards, which are arranged passable to each other and at right angles with it, thus giving, by the windows and other means, the most unobstructed ventilation to a hospital built in a location where the surrounding conditions of hygiene are unexcelled. The record of this hospital shows the effect of these conditions in the unexampled recoveries from disease among those under treatment. Hoffman Island has three large brick buildings of full two stories each for the reception of well persons, including passengers and crew of vessels so infected with epidemic disease that their disembarkation is required before it can be stayed. The buildings are of brick, and the two larger ones not divided into rooms, each story being a large ward, in which berths can be placed for several thousand steerage, and the third building being divided into rooms for the other passengers. These islands were first recommended as possible by Gen. Benham, N. Y. engineer corps, in the New York assembly, Dec. 19, 1859, who furnished working estimate and plans, and their construction was commenced in 1867, and completed in 1874, at an expense somewhat above $1,000,000.

All vessels arriving from a foreign port during the entire year, and all vessels from any place in America in that ordinary range from which they pass S. of Cape Henlopen, arriving between the first day of April and the first day of November, and all vessels on board of which any person shall have been sick of quarantinable disease, are subject to the visitation, inspection, and decision of the health-officer of the port. After inspection they are permitted to proceed without detention if free from contagious diseases to the public health. In case of infectious disease being on board, the measures taken are based upon the circumstances surrounding each particular case. The sick are removed to one of the quarantine hospitals, and if there is no further danger apprehended the vessel is allowed to

pass. In summer, with yellow fever on board and from a port where yellow fever prevails, the vessel discharges her cargo in lighters in the stream before going to dock, and is cleansed carefully and her bilges washed, besides being thoroughly disinfected and ventilated.

The importance of deciding the detention and measures necessary in each case, upon an investigation of the circumstances surrounding it, is evident in the case of yellow fever and cholera. Under the process of quarantine practised formerly, and in the East still in use, the detention for a case of either of these diseases would be either for a month or perhaps the entire season. As it is at present, a single case of cholera having occurred before arrival, and a period elapsed equal to its time of incubation, and followed by no others, would only secure a detention long enough to furnish an accurate and thorough inspection of the vessel, her condition and that of the passengers. In case of an extensive and fatal epidemic of cholera occurring on a vessel arriving in warm weather, every person would be removed to Hoffman Island, and the vessel, after purification, permitted to proceed to the city. The people from her would be detained until no more disease appeared, those who became sick being at once removed to Dix Island in the steamboats which are kept for this purpose; and being under circumstances favorable for the suppression of the disease, and those attacked being treated for it in a place suitable for cure, there would result the least detention and fatality possible under the circumstances.

All the advances made in the New York quarantine have had for their motive the reduction of the detention and annoyance of delay in cases of disease which the fears and traditions of the populace would not permit ashore, and which were included in the meaning of the popular word "pest," while at the same time commerce should be as little embarrassed as possible. Naturally some evils crept into the management of affairs so delicate as the adjustment between business interest and sanitary requirement; but the march of improvement has at last placed this department in a position where the health-officer is sustained in all his official acts by the commercial interests of New York, which find in his pass a protection from the dangers to trade which would follow a commerce in which there was no sanitary restriction. Thus, the apparently incongruous interests, quarantine and commerce, are united at this port upon a system which is satisfactory to and adequate for both. S. Oakley Vanderpoel.

Quarles (Francis), b. at Stewards, Essex, England, in 1592; was educated at Christ's College, Cambridge; studied law at Lincoln's Inn; was a member of the suite of the queen of Bohemia, daughter of James I.; afterward secretary to Archbishop Usher in Dublin; was driven from Ireland with the loss of his property by the rebellion of 1641; was appointed chronologist to the city of London; espoused the royal cause in the great rebellion, joining King Charles I. at Oxford, and suffered sequestration of his property. D. in London Sept. 8, 1644. Author of *Divine Emblems* (1635), *The Enchiridion of Meditations* (1641), and other moral works filled with quaint conceits, which still procure them readers, and of *The Loyal Convert* (1644), a defence of the royal cause.—His son John, b. in Essex in 1624, was educated at Oxford, served in the royalist forces, and wrote books in a style similar to that of his father. D. of the plague in London in 1665.

Quar'ryville, p.-v., Eden tp., Lancaster co., Pa., at southern terminus of Lancaster and Quarryville Narrow-gauge R. R., ships vast quantities of lime.

Quartermas'ter-General, in the U. S. army, has the rank of brigadier-general, and is at the head of the quartermaster's department, which is charged with the duty of providing means of transportation by land and water for troops and for all material of war; it furnishes horses for artillery and cavalry; provides and supplies tents, camp and garrison equipage, forage and fuel, and all necessary material for shelter of troops; it builds barracks, hospitals, and storehouses; provides wagons, ambulances, and harness (except for artillery); constructs and repairs roads, military telegraphs, railroads, and bridges, docks and wharves; clothes the army; and is charged generally with all disbursements attending military operations not expressly assigned by law or regulation to other staff departments. The organization of the department, as now fixed by law, is as follows: 1 quartermaster-general, with rank of brigadier-general; 4 assistant quartermaster-generals, with rank of colonel; 8 deputy quartermaster-generals, with rank of lieutenant-colonel; 14 quartermasters, with rank of major; 30 assistant quartermasters, with rank of captain. There is also for each regiment of the line a regimental quartermaster, selected from among the lieutenants of the regiment, who is assisted in his duties by a quartermaster-sergeant. C. G. Sawtelle.

Quartet' [It. *quartetto*], in music, a composition written for only four instruments or voices, thus differing from a chorus of the same number of parts. The term is sometimes used in reference to the performers themselves.

Quar'to Sant' Ele'na, town of Sardinia, province of Cagliari, about 5 miles from the town of Cagliari. The houses are for the most part of a single story and built of crude bricks, the streets are in a bad condition, and the women perform both the agricultural and the domestic labor, the men being occupied in fishing, hunting, and lumbering. P. in 1874, 6117.

Quartz. See Geology, Chemical, by Prof. T. Sterry Hunt, LL.D.; and Silica, by H. Wurtz, A. M.

Quartz, tp., Plumas co., Cal. P. 810.

Quas'queton, p.-v., Liberty tp., Buchanan co., Ia., on Wapsipinicon River.

Quas'sia, in medicine, the wood of certain trees of the natural order Simarubaceæ. All the species of this order are noted for the intense bitterness of their wood, and until about the end of the last century quassia-wood was obtained from *Quassia amara*, a small tree or shrub native in Panama, Venezuela, Guiana, and Northern Brazil. But the wood of *Simaruba excelsa* being found to have the same properties, and the latter being a tree of much greater size, the quassia of commerce is now almost wholly obtained from this source. *S. excelsa* is a tree from fifty to sixty feet high, with small yellowish and greenish flowers, and the fruit a drupe, black and shining, and about as big as a pea. It is a native of Jamaica and the Caribbean Islands, where it goes by the name of *bitter ash*. The wood is whitish, but turns yellowish on exposure. It has no smell, but a most intense, though pure, bitter taste. The bitterness depends upon a neutral crystallizable principle called *quassine*. Commercial quassia-wood consists of pieces of the trunk and branches of the tree of various sizes. For use by the druggist it is supplied in the form of raspings or turnings. Quassia, like other pure vegetable bitters, tends in small quantity to excite appetite and promote digestion. In large dose it nauseates. It is sometimes used in medicine as a stomachic bitter, but other less harsh and disagreeable bitters are generally preferred. Cups turned out of the solid wood are sometimes employed to prepare a weak quassia infusion by simply allowing cold water to stand for a few minutes in them. The water speedily becomes impregnated with the bitter principle, and may then be drunk. Edward Curtis.

Quater'nions [Lat. *quaternio*, "a set of four"]. The calculus of quaternions is an algebra of four units, invented by the late Sir William Rowan Hamilton, Andrews professor of astronomy in the University of Dublin and royal astronomer of Ireland, for the purpose of expressing and investigating the relations of Space, directional as well as quantitative. The four units, in the common presentation of the subject, are the unit of number and three unit-lengths, denoted by i, j, k, taken in mutually perpendicular directions, and corresponding to the three dimensions of extension; but any four independent functions of these units may be substituted for them.

(1) The elements of quaternions are *numbers* and *directed right lines*. Hamilton calls numbers Scalars, regarding them as forming one continuous *scale*, which extends from $-\infty$ to $+\infty$. He refers the conception of number, in accordance with Kantian principles, to the intuition of Time, and calls common algebra the science of Pure Time, in contrast to geometry as the science of Pure Space. This view forms a part of a very interesting general theory of the nature of mathematics, but the principles of quaternions have no necessary dependence on it.

(2) A right line, regarded relatively to *both length and direction*, is called by Hamilton a Vector, because it represents that operator which *carries* a point from one definite position to another. A vector is the complete expression of the geometric *difference of position* of its extremities. Thus, we may write (using the signs in the geometric sense)—

$$\mathrm{AB} = \mathrm{B} - \mathrm{A}\,,\ \mathrm{B} = (\mathrm{B} - \mathrm{A}) + \mathrm{A} = \mathrm{AB} + \mathrm{A}\,;$$

and we have $\mathrm{BA} = -\mathrm{AB}$, as in Cartesian geometry, which may be regarded as only an imperfect form of quaternions. Two vectors are equal if they have the same length and the same direction.

Since a vector represents the relative position of two points, it involves three distinct numerical (or scalar) elements, answering to the three dimensions of space. These may be taken according to any system of Cartesian co-ordinates, or they may be left implicitly involved in a single symbol, such as α, used to denote a vector.

(3) Vectors are added *geometrically*. For if A, B, C are any three points in space,

$$\text{B} = (\text{B} - \text{A}) + \text{A},\ \text{C} = (\text{C} - \text{B}) + \text{B} = (\text{C} - \text{A}) + \text{A};$$
$$\therefore \quad (\text{C} - \text{A}) = (\text{C} - \text{B}) + (\text{B} - \text{A}),\ \text{or}\ \text{AC} = \text{BC} + \text{AB}.$$

This addition includes the *algebraic* addition used in Cartesian geometry as a special case. The theory of the parallelogram shows that the addition of vectors is *commutative;* that is, that $\alpha + \beta = \beta + \alpha$.

If $\alpha = \text{OA}$, and $\beta = \text{OB}$, then $\beta - \alpha = \text{AB}$. Again, $\rho = x\alpha + (1 - x)\beta$, where x is variable, is the equation of the line AB; $\rho = x\alpha + y\beta$ is the equation of the plane OAB; while *any vector* ρ may be written in the form $\rho = x\alpha + y\beta + z\gamma$, provided α, β, γ are not complanar, and (in particular) in the useful form

$$\rho = xi + yj + zk,$$

where i, j, k are the units already named, and x, y, z are the projections of ρ on the directions i, j, k, and represent the three scalar elements of ρ.

In general, $\rho = \alpha$ represents a point, $\rho = fx$ a curve, $\rho = f(x, y)$ a surface, and $\rho = f(x, y, z)$ any point in space, f in all these cases denoting a vector function.

(4) A vector α may be converted into any other vector β (or into a vector geometrically equal to β) either by *adding* to α the vector $\beta - \alpha$, or by *multiplying* it by a factor $\beta\alpha^{-1}$, which changes its length in the required ratio and turns it through the required angle in the plane $\alpha\beta$. This factor involves FOUR distinct scalar elements, which may be taken in various ways; for example, as the ratio of the lengths, the angle between the lines, and the two angles which determine the aspect of the plane. It is therefore called a QUATERNION.

(5) The *addition* of quaternions is defined by the formula $(q + r)\ \alpha = q\alpha + r\alpha$. Thus, if $\beta = q\alpha$, and $\gamma = r\alpha$, then $\beta + \gamma = (q + r)\alpha$; and we have, as for vectors, $q + r = r + q$.

The *multiplication* of quaternions is defined by the formula $pq\alpha = p.q\alpha$. Thus, if $\beta = q\alpha$, and $\gamma = r\alpha = p\beta = p.q\alpha$, then $r = pq$. In common algebra, multiplication is *associative, distributive,* and *commutative;* that is, it obeys the laws—

$$pqr = p.qr = pq.r,$$
$$(p + q)\ (r + s) = pr + ps + qr + rs,$$
$$pq = qp.$$

Quaternion multiplication is found to be associative and distributive, but in general NON-COMMUTATIVE. Hence, in quaternion formulas the order of the factors of any product must be carefully observed. But *scalar* factors are subject only to the rules of common algebra.

(6) If α and β are parallel, $\beta\alpha^{-1}$ is reduced to a single element; for it becomes a positive or negative scalar. Thus, scalars may be regarded as special forms of quaternions.

If α and β are perpendicular to each other, $\beta\alpha^{-1}$ involves only *three* arbitrary elements, since its angle is given. It occurred to Hamilton to consider a *vector,* perpendicular to the plane $\alpha\beta$, and bearing the same ratio of length to a unit-vector that β bears to α as a *multiplier,* equivalent to the quadrantal quaternion $\beta\alpha^{-1}$; and this procedure he justified by showing that it is consistent with the rules of addition and multiplication. It may be likened to the representation of a couple by its axis in mechanics. To the happy discovery of the possibility of this substitution, which makes a vector (as well as a scalar) a special form of quaternion, and enables us to express any quaternion in terms of the four units already named, and to combine scalars, vectors, and quaternions with perfect freedom, the simplicity and power of the system are largely due. The product of *any* two vectors, again, is a quaternion, by the principle $pq = r$, and, conversely, any quaternion may be represented by an expression of the form $\alpha\beta$, which is often preferable to the form $\beta\alpha^{-1}$.

Again, α and β being any two vectors, if β' and β'' are the resolved parts of β parallel and perpendicular to α, we have $\beta\alpha^{-1} = \beta'\alpha^{-1} + \beta''\alpha^{-1}$, of which the first term, being a scalar, is called the SCALAR of $\beta\alpha^{-1}$, $\text{S}\beta\alpha^{-1}$, and the second term, being a vector, is called the VECTOR of $\beta\alpha^{-1}$, $\text{V}\beta\alpha^{-1}$. Thus, any quaternion may be resolved by the formula

$$q = \text{S}q + \text{V}q,\ \text{or}\ q = w + xi + yj + zk,$$

a form which exhibits the four scalar elements of q as coefficients of the four units, $1, i, j$, and k. We have also $\text{S}(p + q) = \text{S}p + \text{S}q$, $\text{V}(p + q) = \text{V}p + \text{V}q$.

(7) Any quaternion q may be resolved into the product of two factors—a stretching factor, called the TENSOR of q, $\text{T}q$, which changes the length of the vector on which q operates; and a turning factor, called the VERSOR of q, $\text{U}q$, which changes the direction of the vector; and these two factors may be regarded as operating in either order. The tensor of a vector is its length, and the versor is a unit-length in the direction of the assumed vector. We have then

$$q = \text{T}q.\text{U}q = \text{U}q.\text{T}q,\ \alpha = \text{T}\alpha.\text{U}\alpha = \text{U}\alpha.\text{T}\alpha,\ \text{T}\frac{\beta}{\alpha} = \frac{\text{T}\beta}{\text{T}\alpha},\ \text{U}\frac{\beta}{\alpha} = \frac{\text{U}\beta}{\text{U}\alpha},$$

and in general $\text{T}(pq) = \text{T}p.\text{T}q$, $\text{U}(pq) = \text{U}p.\text{U}q$.

A tensor is always a positive, or more properly a *signless,* number. If α and β are equal in length, $\text{T}\alpha = \text{T}\beta$; if they are parallel, $\text{U}\alpha = \pm\,\text{U}\beta$; and for any two vectors, $\text{TU}\alpha = \text{TU}\beta = 1$. The tensor of a scalar is its arithmetical value; the versor of a scalar is ± 1. Again, $\text{S}q = \text{T}q.\cos \angle q$, $\text{TV}q = \text{T}q.\sin \angle q$.

(8) A unit-vector, regarded as a quaternion, is a *semi-inversor,* and hence its square is an inversor. That is, if $\text{T}\alpha = 1$, $\alpha^2 = -1$; and, in general, $\alpha^2 = -\text{T}^2\alpha$. *Any unit-vector* (or any quadrantal-versor), then, is a representation of $\sqrt{-1}$, which thus has *an infinity of different real values;* but all these are to be distinguished from the symbolical *scalar* $\sqrt{-1}$, which is without interpretation, and which may present itself in quaternions, as in ordinary analysis. Hamilton calls scalars, vectors, and quaternions which involve the scalar $\sqrt{-1}$, *biscalars, bivectors,* and *biquaternions.* But the expediency of using these distinctive terms is doubtful, since the imaginary appears to be a necessary development of scalar number. This, however, is a branch of the subject which remains to be more fully investigated. Hamilton has generally refrained from the use of scalar imaginaries in his applications.

(9) If i, j, k are so taken that rotation from j to k is positive relatively to i as an axis, we have the following important relations:

$$ij = -ji = k,\ jk = -kj = i,\ ki = -ik = j,$$
$$i^2 = j^2 = k^2 = ijk = jki = kij = -kji = -ikj = -jik = -1.$$

(10) Any quaternion q may be written in the form $m\,(\cos\theta + \alpha\sin\theta)$, where $m = \text{T}q$, $\theta = \angle q$, and α (a value of $\sqrt{-1}$) is a unit-vector perpendicular to the plane of q (and $= \text{UV}q$); or again in the form α^n, where $n = \frac{\angle q}{90°}$, $\text{T}\alpha = \sqrt[n]{\text{T}q}$, and $\text{U}\alpha = \text{UV}q$. The analogy of these forms to those used in Cauchy's calculus of imaginaries will be immediately recognized. Since the angle of the product of two complanar quaternions is obviously the sum of the angles of the factors, we have at once the rule for the multiplication of imaginaries and De Moivre's Theorem; and the general formulas of plane trigonometry are readily deduced from the same simple principle.

(11) The CONJUGATE of a quaternion $(= \text{S}q - \text{V}q)$ is an important form in the development of general equations and in effecting reductions in particular cases. But, within the limits necessarily allotted to this article, it is best to restrict the discussion to matters of general principle and a few of the most primary notations, without attempting to give any idea of the practical working of the calculus.

(12) Since the sum or the product of two quaternions is a quaternion, it follows that any algebraic function—and, by the doctrine of series, any transcendental function—of quaternions is a quaternion; and no more complicated orders of quantity can be introduced into the calculus, at least by *direct* functional operations.

We have considered equations of the forms $\rho = fx$, $\rho = f(x, y)$, $\rho = f(x, y, z)$. But the forms of equations most characteristic of quaternions are those which involve explicitly no scalar variables. The equation $\phi\rho = a$, where a is a given quaternion, is not generally possible, being equivalent to four *scalar* equations in three variables, unless the four elements of a are connected by one or more relations determined by the form of ϕ. If ϕ determines one relation, which a satisfies, the equation is determinate; if two, we have the equation of a curve; if three, the equation of a surface. Thus, a scalar equation in ρ is the equation of a surface; while a vector equation is regularly determinate, but may belong to either of the other classes. For example, $\text{S}\alpha\beta\rho = 0$ is the equation of the plane $\alpha\beta$; $\rho^2 = \alpha^2$, or $\text{S}(\rho + \alpha)(\rho - \alpha) = 0$, or $\text{T}\rho = \text{T}\alpha$ is the equation of a sphere; $\rho = \alpha$ and $\text{V}\alpha\beta\rho = \gamma$ give but one point each; $\text{V}\alpha\rho = \gamma$ is the equation of a straight line parallel to α, provided γ is perpendicular to α, and is otherwise impossible; $\text{V.V}\alpha\beta\text{V}\alpha\rho = 0$ is the equation of the plane $\alpha\beta$. The general solution of a quaternion equation of the first degree is treated fully by Hamilton in the *Elements,* and forms one of the most ingenious and profound sections of that great work.

(13) The *differential* of a function fq is a linear and homogeneous function of $\text{d}q$, but not generally reducible to the form $f'q.\text{d}q$, on account of the non-commutative character of quaternions. For example,

$$\text{d}(q^2) = \text{d}q.q + q.\text{d}q,\ \text{but}\ not = 2q.\text{d}q,$$

$$\text{d}(q^{-1}) = -q^{-1}.\text{d}q.q^{-1},\ \text{but}\ not = -\frac{\text{d}q}{q^2}.$$

In fact, $\frac{\text{d}fq}{\text{d}q}$ involves not only q, but also the arbitrary

ratios of the four scalar elements of dq. Hence, in quaternion differentiation the differential alone is sought; while the derivative has, in general, no meaning, unless the independent variable is a scalar. For the differentiation of an implicit or inverse function the solution of a linear equation is necessary.

For the sake of exhibiting the differential as a *finite function*, Hamilton has devised the following formula of definition, in which dq is an arbitrary finite quaternion:

$$\mathrm{d}fq = \lim_{n=\infty} n \left\{ f\left(q + \frac{\mathrm{d}q}{n}\right) - fq \right\}.$$

This definition is not essential to quaternion differentiation, which may be simplified by the use of infinitesimals, but it exemplifies Hamilton's extreme devotion to rigor of demonstration, and it is by far the best form of the method of limits that has been proposed, and equivalent to the Newtonian conception of a fluxion.

(14) The calculus of quaternions may be regarded in two lights—as a contribution to mathematical philosophy, and as an instrument of research. Its value, in the former point of view, is probably undisputed; and it has had a strong influence in deepening the channel of mathematical thought, and in reducing many obscure questions in first principles to their true elements. Its utility as a method was long regarded with much skepticism. But the mathematical world has been coming more and more to acknowledge its value; and it no longer seems extravagant to maintain that Hamilton's profound calculus is the most powerful instrument of investigation that mathematicians have yet possessed, and that by which the next great advance in their science is likely to be made.

Among the practical merits of quaternions may be named—the directness with which this calculus seizes on the fundamental relations of geometry and mechanics, without reference to arbitrary axes; the ease and naturalness of its conceptions; its power of embodying in one simple equation all that is expressed by several (generally more complicated) equations of ordinary analysis; the variety and facility of its transformations, whereby the leading theorems, including those commonly esteemed the most difficult, readily emerge from the axioms; the natural prominence it is found to give to those conceptions which have proved themselves the most fertile as principles of research; and the readiness with which its equations can be translated at any time into common algebraic language. The whole trigonometry of the plane triangle is contained in, and easily deduced from, the single obvious equation $\alpha = \beta + \gamma$. Spherical trigonometry, likewise, is embodied in one simple equation. The tangent to a curve of which ρ is the variable vector is dρ, while the curvature of a curve and the velocity and acceleration of a moving point are equal, in amount and direction, to $D_s^2\rho$, $D_t\rho$, $D_t^2\rho$; and $D_t^2\rho = D_s\rho D_t^2 s + D_s^2\rho(D_t s)^2$—which is one of the general formulas of the common differential calculus—gives at once the tangential and normal accelerations. The equations $\Sigma\beta = \Sigma V\alpha\beta = 0$ are equivalent to the six general equations of statics; and $\Sigma(mD_t^2\alpha - \beta) = \Sigma V\alpha(mD_t^2\alpha - \beta) = 0$ to the six general equations of dynamics. So compendious and so powerful is the quaternionic method that Hamilton has been able, in the compass of 270 pages, to treat the higher geometry very fully, and the leading principles of analytic mechanics, in such a way as to develop the great modern methods as natural outgrowths from what has happily been termed his "simple and symmetrical, yet massive," calculus.

The drawback to the use of quaternions lies in the necessity of forming new algebraic habits—of gaining the same command of quaternion transformations that the skilful analyst has of the ordinary methods. This difficulty is far less formidable than it seems at the first glance; but for its complete removal we must look to the study of quaternions by young mathematicians, which it is to be hoped the universities will soon more decidedly encourage.

(15) The first publication on the subject of quaternions was in a paper presented to the Royal Irish Academy in 1843 (*Trans.*, vol. xxi., 1848). Hamilton's *Lectures on Quaternions* (Dublin, Hodges and Smith) appeared in 1853, and his *Elements of Quaternions* (London, Longmans) in 1866. The former of these works is still valuable for its preface, containing an account of the researches which led up to the conception of quaternions, for its philosophical discussions, for the variety of interesting lights in which the fundamental principles of the subject are presented, and for its characteristic style, breathing the remarkable genius of its author, but made wearisome by its excessive fulness of expression and by a singular profusion of parentheses, italics, and capitals. As a systematic exposition it is wholly superseded by the later volume, which contains also many new developments (notably, the remarkable general solution of a linear equation and the physical applications), and is truly encyclopædic in the range and vastness of its learning. The author died just as this work was on the eve of publication, leaving it a few pages short of completion. Tait's *Elementary Treatise on Quaternions* (Clarendon Press, 1867; 2d ed. 1873) is much shorter than Hamilton's great volume, being limited, in the treatment of general principles, to matters of the first practical importance, and is invaluable to the student who wishes to gain a *working* knowledge of the new calculus. The principal original value of this work is in the physical applications (to electro-dynamics, etc.), where Prof. Tait has made important contributions to the development of the quaternionic method. Kelland and Tait's *Introduction to Quaternions* (Macmillan & Co., 1873) is meant for beginners. It closes with a valuable chapter by Prof. Tait, not included in his own treatise. The reader is further referred to an article by Hamilton in Nichol's *Cyclopædia of the Physical Sciences* (London and Glasgow, 1857); and, for an interesting account of Hamilton and of his various remarkable scientific achievements, to the *North British Review* for Sept., 1866; also to the *Proceedings of the London Mathematical Society* (vol. iv. p. 381) for a proposed extension of quaternions, under the name of biquaternions (not used in Hamilton's sense of the word), by Prof. W. K. Clifford, founded on a distinction between equal vectors not parts of the same line. (See also the article QUALITATIVE ALGEBRA.)
J. M. PEIRCE.

Quatre Bras. See WATERLOO.

Quatrefages' de Bréau, de (JEAN LOUIS ARMAND), b. at Berthezème, department of Gard, France, Feb. 10, 1810; studied medicine and natural science at Strasburg, Toulouse, and Paris; made extensive scientific voyages along the coasts of the Atlantic and Mediterranean, in Italy, and Sicily, and was appointed professor of natural history at the Lycée Napoléon in 1850, and in 1855 at the Historical Museum of anatomy and ethnology. Of his numerous writings, several have been translated into English: *Souvenirs d'un Naturaliste* (1854; London, 1857), *Métamorphose de l'Homme et des Animaux* (1862; London, by H. Lawson, 1864), *Histoire de l'Homme* (1869; New York, by Miss E. Youmans, 1875), *Charles Darwin* (1870), *La Race prussienne* (1871), *Crania Ethica* (1875).

Quatremère' (ÉTIENNE MARC), b. at Paris July 12, 1782; studied Oriental languages; became professor of Greek at Rouen in 1809, of Hebrew, Chaldaic, and Syriac at the Collége de France in 1819, of Persian at the School of the Living Oriental Languages in 1827. D. at Paris Sept. 18, 1857. He wrote *Recherches sur la Langue et la Littérature de l'Égypte* (1808), *Mémoires geographiques et historiques sur l'Égypte* (1810), *Observations sur quelqués Points de la Géographie de l'Égypte* (1812); edited and translated Rashid ed-Din's *Histoire des Mongols en Perse* (1836) and Makrizi's *Histoire des Soultans Mamlouks* (1837–40).

Quatremère de Quincy (ANTOINE CHRYSOSTOME), b. at Paris Oct. 28, 1755; studied archæology and art; took part very actively, but always as a staunch royalist, in the various movements of the Revolution; was appointed superintendent of public monuments in 1815; professor of archæology in the Royal Library in 1818; censor in 1824. D. at Paris Dec. 28, 1849. His most remarkable works are *Le Jupiter olympien* (1814), *De l'Imitation dans les Beaux-Arts* (1823; translated into English in 1837 by C. Kent), *Raphaël* (1824), *Canova* (1834), *Michel-Ange* (1835), *Monuments et Ouvrages d'Art antique restitués* (1826–28).

Qua'ver, in music, a note which in point of duration is an eighth of a semibreve, a quarter of a minim, or the half of a crotchet.

Quebec', Province of, formerly **Lower Canada** or **Canada East,** the second in population of the provinces of the Dominion of Canada, having an estimated area of 210,000 sq. m. It lies almost entirely in the valley of the St. Lawrence, extends indefinitely northward toward Hudson's Bay, is bounded E. by Labrador and the Gulf of St. Lawrence, S. E. by New Brunswick, Maine, and New Hampshire, S. for a short extent by the States of New York and Vermont, and S. W. by the province of Ontario, from which it is for the most part separated by the navigable river Ottawa.

Geology and Physical Geography.—The level country (the Champaign of Canada) on either side of the St. Lawrence is limited by a range of mountains—the Laurentides on the N. and the Notre Dame range on the S. The former are connected by transverse spurs with the Adirondack system; the latter are continuous with the Green and White mountains. The great northern hill-region is composed of Laurentian rocks, and is scarcely habitable except in low fertile valleys, but it affords immense supplies of timber. On the S. E. of the Champaign of the valley of the St. Lawrence occurs the wooded hill-country called the Seigniories; and still farther E. and S., the "Eastern

Townships," on the S. E. slope of the southern hills. The crystalline rocks of this region are softer than those of the Laurentides, and the country is a succession of fertile, prosperous valleys, with hills densely timbered and rocks bearing copper ores, iron, galena, small quantities of silver and gold, many varieties of marble and serpentine, and excellent granites, slates, and soapstones. The champaign country is for the most part productive, though much injured by generations of improvident and unskilful tillage. Bog-iron ore, sandstone, limestone, etc. are found. The Gaspé peninsula is a rocky but fertile region, much resembling the Eastern Townships, and having small amounts of gold, with petroleum from the Devonian limestone, and also sandstone, shell-marl, etc.

Crown and other Lands.—Three-fourths of the area of Quebec consist of crown-lands, the timber of which is sold by agents, who have also the power to sell lands to settlers and others, the settlers having easy terms granted them for payment. There are also limited areas of free-grant lands which are given away to actual settlers. Some lands settled under the French *régime* are held in fiefs and seigniories, other lands in free and common socage, and others still are held by letters patent. Since 1850 there has been an extensive colonization of new lands, mostly by French-speaking natives of the province. The newly-settled tracts are the valley of the upper Saguenay, the valley of the St. Maurice, that of the Ottawa, parts of the Eastern Townships, the Matapediac Valley and vicinity in the E. of the province, and the fertile but rocky peninsula of Gaspé.

Climate.—The climate of this province is severe in the long winter and warm in the summer, except on the lower St. Lawrence, where the summers are usually cool. The valley of the upper Saguenay is sheltered from the N. winds, and hence has a mild climate. The same is true of the south-eastern counties to the N. of Vermont, and of the Gaspé region. Wheat, oats, barley, potatoes, buckwheat, dairy products, fruit, and wool are extensively raised, and cattle and horses are largely exported to the U. S. Indian corn does well, but not in all parts.

Territorial Divisions.—Quebec is divided into 64 counties, inclusive of Saguenay, Labrador (the S. coast), and the Magdalen Islands, and exclusive of the proposed counties on the island of Anticosti. The counties are representative and registration districts, the province being for judicial purposes divided into 20 districts. Superior courts and courts of general sessions and queen's bench are held at Montreal and Quebec. The parts of the colony settled by the French are divided into seigniories and parishes, the latter established by the Roman Catholic bishops, but only on requisition of the majority of the inhabitants. The English-settled regions are divided into townships, which are, when practicable, ten miles square. Both the civil and the common law are administered in the courts. The provincial government has its seat at Quebec. It is administered by a lieutenant-governor and an executive council or ministry of seven members. The provincial parliament consists of a legislative council of 24 members, appointed for life, and a legislative assembly of 65 elected members. To the Dominion Parliament Quebec sends 20 senators and 65 members of the House of Commons.

Ecclesiastical Affairs.—The majority of the people of the province are Roman Catholics. In 1871 they numbered 1,019,852, the Protestants 169,232, Jews 549, and all others 1883. The Anglican Church has a bishop at Montreal (metropolitan of Canada) and another at Quebec. The Roman Catholics have an archbishop at Quebec and bishops at Montreal, Ottawa (diocese partly in Quebec), Three Rivers, St. Hyacinthe, and Rimouski. The Presbyterian Church of Canada is a branch of the Kirk of Scotland. The Canada Presbyterian Church is independent. The Baptists, Congregationalists, the various Methodist churches, and others have but little strength in this province as compared with Ontario.

Education is under a minister of public instruction, assisted by a council of 21 members—14 Roman Catholics and 7 Protestants. Public schools are maintained by a moderate tax, and in small municipalities are assisted by a government contribution. If a majority of the local school commissioners are conceived by the minority to manage the schools too decidedly in the interest of any particular sect or Church, they are allowed to establish dissentient schools. There are two Roman Catholic and one Protestant normal school supported by the province. The other public schools are called primary, model, and special schools (agricultural, high, commercial, industrial, classical, reformatory, etc.). The classical schools in 1869 numbered 15. There are two Protestant universities—the University of Bishop's College at Lennoxville, and the McGill University, to which are affiliated McGill College, Montreal, St. Francis College and Grammar School at Richmond, Morrin College, Quebec, and the Congregational College at Montreal. The Laval University at Quebec is a Roman Catholic institution. There are also a large number of Roman Catholic and a few Protestant schools known as colleges, some of them large and prosperous institutions, and others merely commercial or grammar schools. The religious of the various Roman Catholic orders of nuns sustain a large number of schools for young ladies, many of them of high order. There are 6 Roman Catholic seminaries for priests, and attached to the universities there are medical and law schools and Protestant divinity schools.

Industry and Commerce.—The accessible Dominion returns upon these subjects do not fully discriminate between the statistics of the various provinces. But the trade of Quebec is enormous, and in 1871 it afforded 50.26 per cent. of the whole customs revenue of the Dominion, although a large part of the goods dutiable at Quebec and Montreal are consumed in Ontario and the N. W. provinces. The exports (chiefly to Great Britain, the U. S., and British and Spanish West Indies) are manufactured forest products, fish and fish oils, horses, wool, furs, cattle, hides, shipping, grain, flour, and the ores of metals. A large proportion of these are produced in Ontario.

History.—In 1534, Jacques Cartier entered and named the Bay of Chaleurs and took possession of the Gaspé country for the French king. In the following year he entered and named the gulf and river of St. Lawrence, and sailed as far up as where Montreal now stands. In 1541 the French temporarily colonized the country, but the first permanent settlement was at Quebec in 1608. In 1627 the viceroyalty was abolished, Canada was granted to the "Company of One Hundred Partners," and the feudal system established. In 1629, Quebec was taken by the English, but in 1632 was restored by treaty to the French. Montreal was settled in 1642. From 1640 to 1701 the French colonists were engaged almost constantly in bloody warfare with the Iroquois, who were the allies of the English colonists in what are now the U. S., and the hereditary enemies of the Algonkins, allies of the French. The frequent wars between Great Britain and France during this period extended to the colonies, and the French in Canada gave and received many cruel blows in the contests with the English colonies to the southward—contests embittered by the religious bigotry of both parties. In 1759, Quebec was taken by Gen. Wolfe, and in 1760, Canada was surrendered to the British—a surrender confirmed by the Treaty of Paris (1763). The people were kept under military rule, which caused the greatest discontent, but in 1774 the "Quebec act" established the civil law and granted religious freedom to the Roman Catholics. The denunciation of this act by the Philadelphia Congress in that year effectually alienated the Canadians from any sympathy with the American Revolution, and the subsequent efforts of Franklin and others, who promised all that the Canadians had demanded, failed to accomplish anything toward drawing Canada into the union of the more southern colonies, and the invasion of the Revolutionists entirely failed (1775–76). In 1791, owing to jealousies between the English and French speaking colonists, the province was divided into Upper and Lower Canada, and representative governments were established. But the mutual jealousies caused by differences of race and religion still existed, and in 1837–39 numbers of the Catholic party joined with the republicans of Upper Canada in insurrection, the causes of French discontent being chiefly the establishment of Anglican rectories in Upper Canada upon government lands and the proposed reunion of the provinces. The union was accomplished in 1841, and Lower Canada took the name of Canada East, but the local government was abolished, and the seat of government of the province of Canada was established, first at Kingston (1840–43), then at Montreal (1843–50), then at Toronto (1850–52), and then at Quebec (1850–58); but in the latter year Queen Victoria named Ottawa as the permanent seat of government. Great discontent prevailed in Canada East, especially at the proposal of the English-speaking residents to establish representation according to population—a measure which would give great preponderance to Canada West. This discontent led to the division (in 1867) of the province of Quebec from that of Ontario, and the formation of the Dominion Government. (See CANADA, DOMINION OF.) This change has led to the happiest results. Local jealousies have been appeased and most unexpected commercial prosperity has followed.

The capital is at Quebec. White pop. in 1640, about 300; in 1661, less than 2500; in 1665 (first census), 3261; in 1698, 13,815; in 1719, 22,000; in 1744, nearly 50,000; in 1754, 55,000; in 1760 (at the conquest), 67,000; in 1770, 91,078; in 1791, 125,000 (120,000 speaking French); in 1806 (according to Bouchette), 250,000; in 1825, 450,000; in 1821, 397,000 (estimate of W. Kingston); in 1831,

548,214 (census); in 1841, 661,380 (W. Kingston); in 1851 863,860 (W. Kingston); in 1861, 1,111,566 (census); in 1871 (Dominion census), 1,191,575. Between the years 1861 and 1871, says Kingston, not less than 150,000 persons removed from Lower Canada to the U. S.

CHARLES W. GREENE.

Quebec, county of the province of Quebec, Canada, extending N. W. from St. Lawrence River and reaching far into the northern wilderness. Much of its surface is bold and broken, presenting remarkable scenery. Cap. Quebec. P. exclusive of city, 19,607; total p. 79,406.

Quebec,* city, capital of the province of the same name, was founded July 3, 1608, by Samuel de Champlain of Broccage in Saintonge, France, who became equally famous as a geographer, a navigator, and a discoverer. The city lies on the left bank of the river St. Lawrence, at its confluence with the St. Charles, 250 miles from the mouth of the St. Lawrence, at Point des Monts, 180 miles N. E. of Montreal, lat. 46° 48′′ 17′′′ 3. Mean temperature in winter, 10°; in summer, 68° F. Mean temperature of the year, 39°. Until 1791, Quebec was the capital of Canada, then known under the name of the province of Quebec; the confederation of the British provinces in 1867 restored it to its former honors in Eastern Canada; it then resumed its place as capital and seat of government of the old province of Quebec. The city is very picturesquely situated between the two rivers, at the N. E. extremity of a narrow but elevated table-land, which for about 8 miles forms the left bank of the St. Lawrence from Cape Rouge. Cape Diamond, the eastern end of this promontory, is 333 feet above the level of the river, to which it presents a nearly precipitous face; it slopes more gradually toward the little river St. Charles, so named from the grand vicaire, Charles de Boues. The Indians, says Layard, on account of the multitude of its windings, called it Cahir-Cantiat.† Opposite Cape Diamond the St. Lawrence is contracted to a breadth of 1133 yards 2 feet 9 inches from the Queen's to McKenzie's wharf, but immediately below, at the confluence of the St. Charles, it spreads out into a broad and beautiful basin more than 2500 yards wide, forming a capacious and excellent harbor, in which the spring tides rise 18 feet. Quebec is divided into the upper and lower town. The upper, which occupies the highest part of the promontory, is surrounded by high and massive walls, and until lately had five very picturesque gates—Prescott Gate, rebuilt by Gen. Robert Prescott in 1797; St. Louis Gate, which dates from the era of Frontenac (1694); St. John's Gate, of the same date, but rebuilt in 1869 by the municipality of Quebec according to plans sanctioned by the royal engineer department; Palace Gate, which existed in 1760, but was rebuilt about 1815; and Hope Gate, built in 1786 under the administration of Gen. Henry Hope. The lower town, the seat of wholesale commerce and shipping, is built around the base of Cape Diamond, on a narrow strip of land reclaimed from the St. Lawrence by the construction of wharves. On the St. Charles side the water at flood-tide until 1816 washed the very foot of the rock, but from time to time wharf after wharf has been projected toward low-water mark, and foundations made sufficiently solid on which to build whole streets where seagoing vessels formerly rode at anchor; at the end of some wharves there is as much as 50 feet of water at low tide, and the water in the harbor, if anything, is too deep, if such could be reckoned a fault.

The arrivals of ships from sea at Quebec average about 1200 to 1300, a large proportion of which are ocean-steamers of very large tonnage. Over and above the Allan line, one of which leaves the port in summer every Saturday at 10 A. M., there are two other English lines. The size of the harbor and its depth can be estimated from the fact that the Great Eastern rode securely in it for several days in 1861. Quebec is accessible all the year round by means of the Grand Trunk Railway and its magnificent Pullman cars. During the summer months the superb steamers owned by the Richelieu Co. bring every morning their myriads of wealthy tourists attracted by the unrivalled scenery of Quebec, its historical memories, and its fortifications, beautiful drives, and the sea-bathing in the lower St. Lawrence.

Quebec for more than a century was the Gibraltar of French power in America, until its capitulation by Chevalier de Ramsay to Brig.-Gen. Townsend on Sept. 18, 1759, five days after the defeat of the French under the chivalrous marquis of Montcalm on the Heights of Abraham, the 13th of that month, 1 mile from the city walls, where a small monument commemorates the death of his heroic rival. The fortress has played a remarkable part in the military annals of North America, both under its French and English masters. More than once under its frowning battlements some of the most warlike races of the Old World or proudest of the New have met in hostile array. The citadel, which occupies about 40 acres on the loftiest plateau of Cape Diamond, and its outlying fortifications, were originally designed by the famous French engineer Vauban, and several military strategists, De Levy, Levasseur, De Callières, etc., added much to them subsequently. The modern citadel and its surrounding walls, etc. are chiefly due to the imperial government of Britain, and are built on plans approved by the duke of Wellington in 1823. Quebec is one of the few walled cities on the continent; from its position, and especially since the erection of the new casemated forts at Levi in 1867–69, and its armament of rifled artillery, it is supposed to be the strongest fortress in North America. The place, though provided by nature with one of the finest harbors in the world, and enjoying rare facilities for a commercial emporium, was originally planned as a fortress and subsequently became a garrison-town: this character will always remain its distinctive feature. Dating long before the period when American cities were laid out with broad streets at right angles, squares, and boulevards, it had the circuitous paths of the forest for streets, the mountainous character of the lofty promontory on which it stands in some cases offering insurmountable obstacles to regularity of design and evenness of locomotion. Its founder and first governor, Champlain, built his "habitation," stores, and magazines at the foot of Mountain Hill, on a spot facing the river, where the present church of Notre Dame de la Victoire was erected 1691 in commemoration of the repulse of Admiral Sir William Phipps, who with a powerful fleet from the neighboring British provinces unsuccessfully bombarded the city, whilst a detachment under Maj. Walley was landed and defeated on the Beauport flats by Le Moine de St. Hélène, Duchesnay, and other colonists of note, and whilst De Marceaux pointed from the city walls the guns against Phipps's ships. More than once the solid walls of the city protected its inmates against the tomahawk of the savage Iroquois or the inroads of the neighboring English colonists.

Quebec is famous for the number of sieges it underwent, and more especially, for saving Canada to British rule when Montreal and other cities had accepted the yoke at the hands of Arnold and Montgomery in 1775. In its infancy in 1629 it was surprised and surrendered to Sir David Keith, who had anchored unannounced with a powerful fleet in the harbor; Champlain and all his colonists except five families returned to France; England held it three years, and returned it in 1632 by the Treaty of St. Germain-en-Laye, together with the Acadian peninsula and Cape Breton. In 1690 it stood a memorable siege on behalf of Sir William Phipps, governor of Massachusetts. In 1711 it had a providential deliverance from the armada of Sir Hovenden Walker, who had 8 transports, containing 881 officers and men, wrecked and lost on Egg Island in the lower St. Lawrence on Aug. 22, 1711. In 1759 the colony, deserted by France, and left to struggle against all the power of England, after successfully resisting Wolfe from June to September, succumbed, when the flag of St. George supplanted the Gallic lily on the ramparts of Quebec. In 1775 one of Wolfe's brothers-in-arms, Richard Montgomery, late captain in the 17th Foot, being well acquainted with the *locale*, seconded by a daring officer, the traitor Benedict Arnold, undertook to eject from British territory the British troops, whom, under Amherst, he had helped to lead. His devotion to his newly-adopted country brought him, at Près de Ville, beneath Cape Diamond, a soldier's grave at the early age of forty.

Quebec has ceased to be a garrison-town, and several portions of its works and defences have been handed over to the town council, which has already successfully obliterated a portion of its walls and gates and other landmarks of its warlike past, which by their memories were a source of so much interest to travellers. There are yet, however, beyond the city limits several interesting monuments, and picturesque scenery which is safe against municipal improvement and is well worthy of the attention of tourists.

Quebec, as a seat of learning, by its university, old foundations, religious as well as educational, deserves notice. The Laval University, founded in 1854, under an imperial charter, together with the Seminary of Quebec, founded in 1663, is a seat of learning and education of which the whole province feels proud. The Ursuline convent was founded in 1641; the Hôtel-Dieu in 1639; the General Hospital in 1690; the Jesuits' College, occupied since 1764 as a barrack for English troops, was founded by the marquis De Gamache in 1635; the Morrin College was

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* According to the Père Lacombe (1874), *Quebec* is derived from the native word *kepâk* or *kepek* ("it is closed"), because the river appears to be closed by Cape Diamond in ascending, and by Ile d'Orléans in descending.—EDS.

† According to Major Graham, U. S. A.

endowed by the late Dr. Joseph Morrin in 1860, and opened Nov. 6, 1862; the Literary and Historical Society was founded by the earl of Dalhousie, then governor-general of Canada, in 1824; there are also a number of educational or religious institutions of a later date. A number of manufactures have sprung up of late years in the suburbs of the city, but the chief industry from the beginning of the century has been shipbuilding—in the vicinity of Quebec from 20 to 30 large ships, of from 500 to 2000 tons, being sometimes built in one winter, many being beautiful models of naval architecture.

The lieutenant-governor of the province, Hon. R. E. Caron, occupies the beautiful domain of Spencer Wood. There are 19 churches in the city, and 1 synagogue. Of these churches, some own many valuable old paintings of great European masters, purchased about the era of the French Revolution. There are 7 Roman Catholic, 7 Church of England, 1 Church of Scotland, 1 Presbyterian, 1 Baptist, 1 Congregational, 1 Wesleyan. Quebec returns three members to the House of Commons at Ottawa, and three to the provincial legislature, sitting at Quebec. It is the seat of an archbishop of the Church of Rome, and of a lord bishop of the Church of England. P. in 1871, 59,699, 52,337 of whom are Roman Catholics, Irish and French Canadians. J. M. Le Moine.

Qued'linburg, town of Prussia, province of Saxony, at the foot of the Harz Mountains, on the Bode. It is an old town, founded by Henry the Fowler in 920, and surrounded with walls surmounted by towers, and has large manufactures of damask, linen, and woollen, besides breweries, distilleries, and sugar-refineries. It is the birthplace of the poet Klopstock. P. 16,402.

Quee'chee, p.-v., Hartford tp., Windsor co., Vt., on Vermont Central R. R.

Queen Anne, county of E. Maryland, bounded E. by Delaware and W. by Chesapeake Bay. Area, 400 sq. m. It has a rolling surface and a rich soil. The chief industries are agriculture and stock-raising; the principal productions, corn, wheat, wool, and swine. Cap. Centreville. P. 16,171.

Queen Anne, tp., Prince George co., Md. P. 2276.

Queen Anne's Bounty. Previous to the Reformation the profits of every spiritual benefice in England for the first year of its possession by a new incumbent were paid to the pope. (See Annates.) The right was transferred to the Crown at the Reformation, and was enjoyed by all the British sovereigns previous to Queen Anne, in whose second year (1704) an act of Parliament gave the first fruits and annates to a fund called Queen Anne's Bounty, for the benefit of the poorer clergymen.

Queen Charlotte's Islands, a small group of islands in the N. Pacific Ocean, about 80 miles from the coast of British Columbia. Only four are of any considerable size—namely, Graham, Moresby, Prevost, and North, of which the former is much the largest, having a length of 80 miles and an area of 3000 sq. m. They are little known to civilized man, being inhabited only by Indians of several tribes, supposed to number about 5000.

Queen Charlotte Sound. See Vancouver Island.

Queen City, tp., Adams co., Ia., on Burlington and Missouri River R. R. P. 398.

Queen's, an inland county of Ireland, province of Leinster, comprises an area of 664 sq. m., with a pop. of 153,792 in 1841, 111,623 in 1851, 90,650 in 1861, and 79,771 in 1871, of whom 27,461 are unable to read and write; from May 1, 1851, to Dec. 31, 1872, 31,786 persons emigrated. The surface is mostly flat, rising in the N. W. into the Sliebhloom Mountains, whose summit, Arderin, is 1734 feet high. The soil is fertile; agriculture and dairy husbandry are the principal occupations; in the southern portion are large beds of coal. The principal towns are Maryborough and Mount Mellick.

Queen's, county of New Brunswick, traversed by the navigable rivers St. John and Washademoak, and containing Grand Lake. The county contains beds of coal. Cap. Gagetown. P. 13,847.

Queen's, county in the S. of Nova Scotia, bounded S. E. by the Atlantic Ocean, which sends in numerous inlets which afford excellent anchorage. The interior is finely diversified. Cap. Liverpool. P. 10,554.

Queen's, the central county of Prince Edward Island, is an extremely fertile and well-cultivated region, traversed by Prince Edward Island Railway. Cap. Charlottetown. P. 42,651.

Queens, county of S. E. New York, comprising most of the western part of Long Island, and extending from Long Island Sound on the N. to the Atlantic Ocean on the S. Area, 410 sq. m. Its surface is much variegated, but usually somewhat hilly, has many bays and inlets on both shores, and is traversed by numerous lines of railroads. Agriculture, market-gardening, dairying, and stock-raising are extensively pursued, and important manufactures are springing up in the larger towns, favored by their proximity to Brooklyn and New York. The capital is to be Long Island City, where a new court-house is erecting. Meanwhile, the county offices are divided between North Hempstead and Jamaica. P. 73,803.

Queensbury, p.-v. and tp., Warren co., N. Y., on Hudson River, includes the village of Glen's Falls. P. 8387.

Queen's Counsel. See King's Counsel.

Queens'land, a large division of Australia, comprises the whole north-eastern part of the continent, bordering E. and N. on the Pacific Ocean and the Gulf of Carpentaria, and bounded S. by New South Wales and South Australia. Area, 678,000 sq. m. Cap. Brisbane. P. 146,690.

Queen's Metal, the trade-name for a sort of britannia or pewter used for making teapots and the like.

Queens'town, Ireland, formerly **Cove,** 9 miles S. W. of Cork and on N. side of Cork harbor, a seaport-town well known to Transatlantic travellers by steamer as the harbor touched by the Cunard and other Liverpool steamers. About 60 years ago Cove was a mere village; its rapid increase has proceeded principally from its convenient situation for the shipping in Cork harbor. There are no manufactures in Queenstown, the importance of the place being entirely dependent on the military and naval establishments in its vicinity, although the beauty of the place and its equable and delightful climate make it a resort for visitors and invalids. Until 1849 the place was known as *Cove,* when it received its present name in honor of the queen's visit in that year. P. 10,039.

Queenstown, p.-v. and tp., Queen Anne co., Md., on Chesapeake Bay. P. 1683.

Queenstown, b., Perry tp., Armstrong co., Pa. P. 201.

Quek'ett (John Thomas), M. D., F. R. S., b. at Langport, Somersetshire, England, in 1815; studied medicine at London Hospital; became a member of the Royal College of Surgeons, by which he was elected to a studentship of human and comparative anatomy; became assistant conservator of the Hunterian Museum 1843; gained a distinguished position as a microscopist by his *Practical Treatise on the Use of the Microscope* (1848); published *Lectures on Histology* (2 vols., 1852–54); became conservator of the museum and professor of histology 1856, and prepared an *Illustrated Catalogue of the Specimens in the College Museum in Lincoln's Inn Fields.* D. at Pangborne, Berkshire, Aug. 20, 1861.

Quemaho'ning, tp., Somerset co., Pa. P. 1213.

Quenemo, p.-v., Agency tp., Osage co., Kan.

Quérard' (Joseph Marie), b. at Rennes, France, Dec. 25, 1797; was for some time engaged in the publishing business in Vienna and Paris, and became widely known as a bibliographer. D. at Paris Dec. 3, 1865. His principal works are—*La France littéraire* (10 vols., 1827–42), *Les Auteurs déguisés de la Littérature contemporaine* (1845), and *Les Supercheries littéraires devoilées* (5 vols., 1845–60).

Quercitron. See Quercitron Bark.

Quer'citron Bark, or **Quercitron Tinctoria,** a valuable dyestuff obtained from the *Quercus nigra* (see Black Oak), containing a yellow crystallizable principle called *quercitrin,* scarcely soluble in water, but readily solved by weak alkalies. It yields a very durable yellow, much used in calico-printing.

Quere'taro, one of the smallest states of the Mexican confederation, between the states of Mexico, Vera Cruz, San Luis Potosi, and Guanajuato, comprises an area of 2444 sq. m., with 153,286 inhabitants, of whom a great number are Indians. The surface is an elevated plateau, the soil fertile; maize and cotton, besides all kinds of European grain and fruit, are produced; gold, silver, copper, and lead are mined; and some cotton manufactures are carried on.

Queretaro, town of Mexico, capital of the state of the same name, is beautifully situated on a fertile plain surrounded by forest-clad hills, at an elevation of 6365 feet. It is well built, contains several richly-decorated churches, and has a fine aqueduct, 2 miles long and resting on arches 90 feet high. Its manufactures of woollen and cotton goods are very important. In its cotton-spinning mills 3000 hands are employed. Its wood-carvings are celebrated. The peace between Mexico and the U. S. was ratified here by the Mexican congress in 1848. Here, also, the emperor Maximilian was besieged and captured, and June 19, 1867, was shot on the Cerro de las Campanas, overlooking the town. P. 48,237.

Quern [Ang.-Sax. *cweorn*], the old-fashioned hand-mill for grinding grain in use in Asia at the present day, as well as in the Hebrides, in Ireland, and in various remote places. The quern was made of two stones, after the manner of millstones, or it was a rude mortar of wood or stone. Examples of undoubtedly pre-historic origin are by no means uncommon.

Quesada. See Ximenes de Quesada.

Quesnay′ (François), b. at Mérey, department of Seine-et-Oise, France, June 4, 1694; studied medicine at Paris, and was appointed first physician to Louis XV. D. at Versailles Dec. 16, 1774. He is now chiefly known as the founder of the physiocratical school of political economy. He developed his views partly in articles in the *Encyclopédie*, partly in his *Tableau économique* (1758), and other writings, which were published in a collected edition in 1768 under the title of *La Physiocratie, ou Constitution naturelle du Gouvernement le plus avantageux au Peuple*.

Quesnel′ (Pasquier), b. at Paris July 14, 1634; studied theology at the Sorbonne; entered in 1657 the congregation of the Oratory; became director of the Paris house of the order in 1662; commenced in 1671 the publication of his famous *Réflexions morales sur le Nouveau Testament*, for the use of the young men under his charge; left the congregation in 1681; repaired to Brussels, where he joined Arnauld, and finished in 1694 the *Réflexions*, which were translated into both German and English. The book was at first considered harmless by the Roman Catholic authorities, but soon it was discovered that it really contained all the most obnoxious doctrines of the Jansenists. A hot controversy arose, and the author was denounced to the Spanish police in Brussels, and his book was condemned by the pope 1708. He fled to Amsterdam, where he afterward lived in retirement. D. Dec. 2, 1719. He was a very prolific writer both on moral and historical subjects.

Quetelet′ (Lambert Adolphe Jacques), b. at Ghent Feb. 22, 1796; was appointed a professor of mathematics in 1814 in his native city and in Brussels in 1819; superintended the erection of the observatory of that city in 1826, and was its director to his death, Feb. 17, 1874. His writings on physical science—*Positions de Physique* (1834), *Météorologie de la Belgique* (1864), *Sur la Physique du Globe* (1861), etc.—are valuable, but it is his statistical works—*Sur l'Homme, et le Développement de ses Facultés* (1835), *Sur la Théorie de la Probabilités* (1846), *Du Système social et des Lois qui le regissent* (1848)—which have procured for him a worldwide reputation.

Quetz′alcoatl [Aztec, "feathered serpent"], a mythical personage of great fame in the religious system of the ancient Mexicans, and also in that of the Mayas in Yucatan, where he is known as Cuculkan, a word having the same significance. The modern discovery of the family connection between the Mayas, Huaxtecos, and Natchez supplies illustration of the origin of this myth, which seems to have been foreign to the Mexicans proper. According to the legends, Quetzalcoatl appeared on the coast of the Gulf of Mexico, near the mouth of Pánuco River, dressed in a long white robe, adorned with feathers, accompanied by many followers, and assumed the religious and political leadership of the Huaxtecos, whom he guided first to the valley of Tula, and afterward to that of Cholula, where they erected the famous pyramid still existing there, and then disappeared to the S. W. to Huehue-Tollan or "ancient Tula," promising to return at a future day. When Cortes appeared on the coast in the same quarter in 1519, it is alleged that he was regarded by Montezuma and the Aztecs generally as Quetzalcoatl, and that this belief was the cause of their non-resistance to the strangers on their first advance to the Aztec capital. Be this as it may, the Spanish priests soon began to utilize the legend of Quetzalcoatl, building upon it a Christian superstructure, and so corrupting the primitive myth that it is difficult to restore its original form. According to the Christian theory, elaborately maintained by Siguenza y Gongora in the seventeenth century and by C. M. de Bustamante in the nineteenth, Quetzalcoatl was the apostle Thomas, and by him was introduced the use of the cross as a religious symbol, and many features of Aztec religion which bore a strange resemblance to Jewish and Christian rites. The probability is that the worship of Quetzalcoatl, admitted to be the tutelary divinity of a large ethnological family in Central America, was carried thence to the Huaxteca after the downfall of Palenque or some other of the now deserted cities of that region. This theory will also explain the origin of the Natchez, tracing them in a similar manner to a migration from Central America, and receives strong confirmation from the mythology of the Huaxtecos.

Porter C. Bliss.

Queve′do y Ville′gas, de (Francisco Gomez), b. at Madrid, Spain, Sept. 26, 1580; educated at the University of Alcalá de Henares; went to Naples in consequence of a duel; rose there to high civil and diplomatic posts; was concerned in the conspiracy of the marquis of Bedmar at Venice (1618), after which he returned to Spain; suffered two imprisonments for political causes; wrote several religious treatises and many satirical works in prose and verse, and edited the poems of Fray Luis de Leon (1631). D. at Villanueva de los Infantes Sept. 8, 1645. Quevedo is still the most prominent name in the annals of Spanish satirical literature, both prose and poetry, though the greater part of his works were never printed. Among his more popular works are the *History of the Great Sharper, Paul of Segovia* (1627), *The Letters of the Knight of the Forceps* (1635), and the *Visions* (1635). A partial collection of Quevedo's poetry appeared in 1648, and another in 1670, known as *The Spanish Parnassus*. A complete edition of his published works was issued by Sancho (11 vols., 1790–94), and a further collection was edited by Guerra y Orbe (1852). His *Visions* were translated into English by Sir Roger L'Estrange (1708), and a translation of the *Satires* was published at Edinburgh in 1798. Many of the writings of Quevedo are grossly indelicate, while others apparently reveal a highly cultivated and correct taste. He may be called the "Spanish Swift."

Quewhiffle, tp., Cumberland co., N. C. P. 954.

Quezaltenan′go, town of Central America, in Guatemala, on an elevated plateau in lat. 14° 51′ N., among beautiful, fertile, and well-cultivated surroundings, and enjoying a fine and healthy climate. It is well built, and contains, besides the fine cathedral, many handsome public and private buildings. It has some manufactures of woollen and cotton fabrics, and carries on a considerable trade. P. about 20,000, who are almost exclusively Indians.

Qui′che (or **Utlateca**) **Indians,** a race of American aborigines now found in Chiapas and Guatemala. Their language, still used, is related to the Maya, and by their traditions they are descendants of the old Toltecs. They fought the Spaniards desperately at the time of the Conquest, but were utterly overcome. They still retain much of their old semi-civilization, and are in every respect much superior to most of the tribes about them. The extensive ruins of the pueblo of Quiche attest their former prosperity.

Quichua (**Quichu, Qquichhua,** or **Quito**) **Indians,** one of the great Peruvian castes or races of the old civilization, the first in point of numbers and the second in social rank of the four families. Their ancient seat was more especially Cuzco, the capital. At present they are very numerous, and are found in Bolivia, Peru, and Ecuador, to the capital of which country, Quito, they give the name. Their language is very harsh. (See the grammars of Tomas (1560), of Holguin (1608), of Tschudi (1853), and of Markham (1864).)

Quicksilver. See Mercury, Compounds and Nature of, by Prof. Henry Wurtz, A. M.

Qui′etism, a peculiar movement within the Roman Catholic Church, originating from the celebrated devotional work of the Spanish priest Molino, *Guida Spirituale* (1675), and found its most conspicuous spokesman in Fénelon. In opposition to the worldly tendencies of the monkish orders, the Jesuits and Dominicans, and the mechanical character of the Roman Catholic worship, quietism presents a somewhat mystical appearance, and consists in concentration of the soul in quiet prayer and contemplation. It is a sentiment, not a doctrine. It founded no sect, though it was met with much sympathy outside of the Roman Catholic Church, especially among the Pietists. In spite of its peaceable character, it awakened, nevertheless, the enmity of other parties, and was even exposed to persecution. Some of its disciples—as, for instance, Madame Bouvier de la Mothe Guyon—described their devotional feelings and exercises in a peculiar manner, which could not fail to call forth severe censure, and even caused the police to interfere. Moreover, the emphasis which the Quietists laid on the inner state of the soul made the ceremonies and rules of the Roman Catholic worship seem somewhat superfluous, and provoked the rigid churchmen. Bossuet attacked Fénelon, who, however, immediately submitted to the decision of the pope. The movement died out in the middle of the eighteenth century.

Quilima′ne, town of the Portuguese territory of Mozambique, on the eastern coast of Africa, in a swampy and marshy district at the mouth of the river Quilimane, in lat. 17° 51′ S. It was formerly one of the largest slave-markets; it now exports some gold-dust, ivory, and gums. Its population consists of 6000 slaves and 130 freemen, of whom 12 are Portuguese. The population of the surround-

ing district is stated to be 15,000; the soil is very fertile, but the climate very unhealthy.

Quillo'ta, town of Chili, 22 miles N. E. of Valparaiso, with which it is connected by railway, in a fertile valley on the river Aconcagua, surrounded with orchards and vineyards. It is one of the oldest cities of the country, but it has grown very much since the opening of the railway to Valparaiso. P. about 10,000.

Quills, the shafts of the large wing-feathers of birds, were formerly the almost exclusive material from which pens were made, and even now there is considerable commerce in them. Quills are obtained chiefly from geese, but also from swans, turkeys, and other birds. Crow-quills are valuable in some kinds of drawing. The so-called quills (spines) of the European porcupine have considerable commercial value. Quills are also used for making toothpicks and for various other purposes.

Qui'loa, or **Kilwa,** town of Eastern Africa, belonging to the sultan of Zanzibar, and on an island off the coast of Zanguebar, in lat. 8° 57′ S., has become notorious as one of the principal ports from which slaves are exported. P. 7000.

Quilon', town of Hindostan, in the Travancore dominions, subsidiary to Great Britain, on the Malabar coast, in lat. 8° 53′ N., has a good harbor, large barracks, and exports coffee, cotton, pepper, cardamoms, and timber. P. about 20,000.

Quimper', town of France, cap. of the department of Finisterre, on the Odet, near its mouth in the Atlantic, has extensive fisheries, potteries, tanyards, and manufactures of hats and porcelain, and an active trade in wheat, wax, hemp, butter, and fish. P. 13,159.

Quimperlé', town of France, department of Finisterre, among high mountains at the confluence of the Insolle and the Ellé, has manufactures of vinegar and paper and a trade in wheat, honey, wax, and wood. P. 6686.

Quin (James), b. in London, England, Feb. 24, 1693; was educated at the University of Dublin; studied law in London, but soon devoted himself to the stage; obtained great success in the rôles of Falstaff and Cato, and was considered the head of his profession prior to the rise of Garrick. He retired from the stage 1748; was the instructor of George III. in elocution, and received a pension from that monarch. D. at Bath Jan. 21, 1766. A compilation entitled *Quin's Jests, or the Facetious Man's Pocket Companion,* appeared at London shortly after his death, but it is doubtful whether any portion of it was the work of Quin.

Quinault' (Philippe), b. at Paris June 3, 1635; studied law, and bought an office in the court of exchequer, but devoted himself mostly to dramatic authorship. In comedy and tragedy proper he was not very successful, and he was sharply criticised by Boileau, but his operas, for which Lully furnished the music, achieved great success. They are printed in his *Théâtre* (5 vols., 1739), and are still read with pleasure. D. Nov. 26, 1688.

Quin'by (Isaac F.), b. in New Jersey about 1823; graduated at the U. S. Military Academy July, 1843, when appointed brevet second lieutenant of artillery; served two years as assistant professor of mathematics and of natural and experimental philosophy at West Point; in the war against Mexico, and on duty with his regiment and as acting assistant adjutant-general until Mar., 1852, when he resigned to accept the chair of mathematics and of natural and experimental philosophy in the University of Rochester. On the outbreak of civil war he was appointed colonel of the 13th New York Vols., which he led at the first battle of Bull Run, resigning in August to resume his professorship at Rochester. In Mar., 1862, he was appointed brigadier-general U. S. volunteers, and served in the South-west, participating in the battle of Champion Hills and in the assault of Vicksburg, May, 1863, but ill-health again compelled him to resign, Dec., 1863, and return to his former duties at the University of Rochester.

Quince [Fr. *coing*], the fruit of *Cydonia vulgaris,* the quince-bush, a shrub originally from the Levant, belonging to the Rosaceæ. Its fragrant fruit is valued for making conserves and marmalades. A liqueur is made of the juice, and the mucilaginous seeds are employed in pharmacy and the toilet. There are several varieties of the fruit. The wood is hard and is used by turners. The Japan quince (*Cydonia Japonica*) is an ornamental dwarf species with profuse and beautiful blossoms. Its fruit is hard and austere, with a strong balsamic odor.

Quin'cy, p.-v. of Plumas tp., cap. of Plumas co., Cal., about 110 miles N. E. of Sacramento, has an academy, a fine court-house, jail, 1 newspaper, 2 good hotels, and several mercantile houses. P. 208.

William E. Ward, Ed. "Plumas National."

Quincy, p.-v., cap. of Gadsden co., Fla., 24 miles W. of Tallahassee, on Jacksonville Pensacola and Mobile R. R., has 1 high school, 1 colored school, 4 churches, 1 hotel and several boarding-houses, 1 newspaper, and the usual stores. P. 743. M. B. Owens, Ed. "Journal."

Quincy, city, cap. of Adams co., Ill., on E. bank of Mississippi River, 160 miles above St. Louis, and 263 miles S. W. of Chicago, the second city of the State in size, is picturesquely situated upon a limestone bluff 125 feet above the river, of which it commands a fine view; is regularly laid out and well built, paved, watered, and lighted; has an extensive river-traffic and a splendid railroad bridge across the Mississippi; is the point of junction of 8 railroads—namely, Chicago Burlington and Quincy, Toledo Wabash and Western, Hannibal and St. Joseph, Missouri Kansas and Texas, Quincy Carthage and Burlington, Quincy Missouri and Pacific, Quincy Alton and St. Louis, and St. Louis Keokuk and North-western; has 4 parks, a fine fair-ground, many elegant public and private edifices, numerous manufactories, employing 3500 operatives and producing annually $10,000,000 worth of goods; has 30 churches, 10 periodicals (3 daily), a medical college, several academies and seminaries, 9 public graded schools, a good city library, 2 hospitals, 3 asylums, 7 banks, a fine grain-elevator, and a large business in pork-packing and ice-collecting. Among the manufacturing establishments are 13 of carriages and wagons, 9 of spirits, 8 iron-foundries, 11 brickyards, and 11 flouring-mills. The first settlement was made here 1822, and became a city 1839. P. in 1860, 13,718; in 1870, 24,052; in 1876, estimated at 37,000.

Quincy, p.-v. and tp., Adams co., Ia., on Burlington and Missouri River R. R., has 1 newspaper and a thriving trade. P. 283.

Quincy, p.-tp. and seaport of Norfolk co., Mass., 8 miles S. of Boston, on Old Colony R. R., was settled in 1625, and is one of the oldest towns in New England, being formerly a part of Braintree, but in 1792 was set off and named in honor of Col. John Quincy. The first railway in the U. S. was built here in 1827 for moving granite, the cars being drawn by horses. Quincy has a public library, an academy, 1 high school, and 27 common schools, besides several private ones, 12 churches, 3 banks, a national and a State home for infirm sailors, 1 newspaper, and an iron-foundry and machine-shop. Shipbuilding has been carried on here for more than a century and a half, and some of the finest ships built in this country have been launched from Quincy Point. Granite is the staple production of the town, about 1200 persons being employed in its preparation for market. Quincy is the birthplace of John Adams, and of his son, John Quincy Adams, both former Presidents of the U. S. P. 7442. G. W. Prescott, Ed. "Patriot."

Quincy, p.-v. and tp. of Branch co., Mich., on Michigan Southern and Lake Shore R. R., about 55 miles S. W. of Lansing, has excellent schools, 5 churches, 1 bank, 2 newspapers, an iron-foundry, a flouring-mill, 2 carriage-factories, 1 planing, sash, door, and scroll factory, a stave, heading, and cooper establishment, 2 lumber-yards, and 2 hotels. There is an efficient fire department. P. of v. 1092; of tp. 2586. E. Mudge, Ed. "Times."

Quincy, tp., Houghton co., Mich. P. 1117.

Quincy, p.-v. and tp., Olmstead co., Minn. P. 807.

Quincy, p.-v., Montgomery tp., Hickory co., Mo. P. 80.

Quincy, v. (Ripley P. O.), Ripley tp., Chautauqua co., N. Y., on Lake Shore and Michigan Southern R. R. P. 350.

Quincy, p.-v., Miami tp., Logan co., O., on Miami River and Cleveland Columbus Cincinnati and Indianapolis R. R. P. 320.

Quincy, p.-v. and tp., Franklin co., Pa. P. 3127.

Quincy, p.-v. and tp., Adams co., Wis., on Wisconsin River. P. 272.

Quincy (Edmund), b. at Braintree (now Quincy), Mass., Oct. 24, 1681; graduated at Harvard 1699; became judge of the supreme court 1718; was long a member of the house of representatives and of the council; was lieutenant-colonel of a militia regiment, and went to England 1737 as agent of Massachusetts in the controversy with New Hampshire upon the boundary question. D. at London Feb. 23, 1738. The general court of Massachusetts caused a monument to be erected to his memory in the burial-ground of Bunhill Fields. He was ancestor of a distinguished line of Massachusetts statesmen.

Quincy (Edmund), son of Pres. Josiah, b. at Boston Feb. 1, 1808; graduated at Harvard 1827; was prominent as secretary of the American and the Massachusetts anti-slavery societies; contributed to magazines; was author

of *Wensley, a Story without a Moral* (1854), and of a *Life of Josiah Quincy* (1867), and editor of the *Speeches of Josiah Quincy* (1875). D. at Dedham, Mass., May 17, 1877.

Quincy (Eliza Susan), daughter of Pres. Josiah, b. about 1800, an accomplished student of the early history of Massachusetts; author of a *Memoir of Eliza Susan Morton Quincy* (privately printed 1861) and of *Memoirs of the Family of Edmund Quincy of Mount Wollaston, Mass.*, still in MS., the non-publication of which is (according to Allibone) much to be regretted.

Quincy (Josiah, Jr.), b. in Boston Feb. 23, 1744; graduated at Harvard University in 1763, and became an eminent lawyer. His father, Josiah (b. 1709), a merchant of Boston and a zealous patriot, d. at Braintree, Mass., in 1784; hence the term "Junior" was applied to the son to distinguish them. He had already by his writings and speeches obtained prominence as an ardent advocate of the cause of liberty when called upon, in conjunction with John Adams, to defend the soldiers implicated in the Boston Massacre. Although successful in securing the acquittal of their clients, popular feeling ran so high that, notwithstanding their established reputation for patriotism, they incurred much odium by their connection with the defence. In 1774 he went to England, where he was active in promoting the interests of his country. Embarking from London Mar. 16, 1775, upon his return trip, he declined rapidly during the voyage, and d., while in sight of the coast of Massachusetts, Apr. 26, 1775. In 1774 he published his *Observations on the Act of Parliament, commonly called the Port Bill.*

Quincy (Josiah), LL.D., son of the preceding, b. at Boston, Mass., Feb. 4, 1772; graduated at Harvard University 1790; studied law with Judge Tudor, and was admitted to the bar in 1793; member of the State senate in 1804, and member of Congress 1805–13, during which time he opposed the embargo law and the war with Great Britain; again State senator 1813–21; member of State legislature 1821–23, and Speaker of that body during his last term; appointed judge of the municipal court in 1822, but resigned the following year, having been elected mayor of Boston on the decease of the Hon. John Phillips, the first incumbent; continued in office until 1829, during which time many public improvements were inaugurated and completed under his auspices; in Jan., 1829, was elected president of Harvard University, and remained the efficient head of that institution until Aug., 1845; in 1840 published a *History of Harvard University;* in 1851 a *History of the Boston Athenæum*, of which he was president 1820–30; and in 1852 the *Municipal History of Boston, Life of John Quincy Adams* (1858); his *Speeches in Congress and Orations* have also been published, besides numerous *Memoirs*, including one of his father (1825). D. at Quincy, Mass., July 1, 1864.

Quincy (Josiah), son of Pres. Josiah, b. at Boston Jan. 17, 1802; graduated at Harvard 1821; became a lawyer at Boston; was a member of the city council 1833–37; president of that body 1834–37; president of the Massachusetts senate 1842; mayor of Boston 1845, and for many years treasurer of the Western R. R. and of the Boston Athenæum. During his mayoralty the Cochituate water was introduced into Boston, and he has been the originator of various other public improvements.

Quincy (Josiah Phillips), son of the preceding, b. at Boston in 1830; graduated at Harvard 1850; author of the dramatic poems *Lyteria* (1856) and *Charicles* (1856); edited *Manuscript Corrections from a Copy of the Fourth Folio of Shakespeare's Plays* (1854), and has contributed to magazines and literary periodicals.

Quincy (Samuel Miller), brother of J. P. Quincy, b. at Boston in 1833; graduated at Harvard 1852; became a member of the Boston bar; was for several years one of the editors of the *Monthly Law Reporter;* entered the volunteer service as captain of the 2d Massachusetts regiment May 24, 1861; became lieutenant-colonel of the 72d U. S. regiment (colored) Oct. 20, 1863, colonel May 24, 1864, and was subsequently brevetted brigadier-general. In 1865 he edited the *Reports of Cases* of his great-grandfather, Josiah Quincy.

Quincy, de (Quatremère). See Quatremère de Quincy.

Quincy College and Seminary, Quincy, Ill., established in 1856 under Rev. J. F. Jaquess, D. D., and Prof. C. W. Bowen, A. M. (partners); in 1862 under the charge of Rev. G. Andrews, A. M.; in 1867, E. W. Gray, A. M.; in 1873, again by Prof. Bowen. The two departments of instruction, with a graduating course of three years each, are open to women as well as to men, but the seminary course is designed more especially for women and the college for men. It is a Methodist institution, in healthy condition; with buildings and lot valued at $85,000. C. W. Bowen.

Quincy Point, p.-v., Quincy tp., Norfolk co., Mass., on Massachusetts Bay at the confluence of Weymouth and Town rivers.

Quindaro, p.-v. and tp., Wyandotte co., Kan., on Missouri River. P. 2139.

Quinet′ (Edgar), b. at Bourg, department of Ain, France, Feb. 17, 1803; studied at Paris, Geneva, and Heidelberg; resided in the Morea 1828–30; was appointed professor of foreign literature at Lyons in 1839, and at the Collége de France in 1842, but was dismissed in 1846, because his opposition to the political and religious reaction of the age assumed too direct a form in his lectures; travelled in Spain; fought in the Revolution of 1848, and was reinstated in his chair as professor; was banished in 1852; lived in Holland and Switzerland, and did not return to France until after the fall of the Empire. D. at Paris Mar. 27, 1875. His *Œuvres complètes* (10 vols.) contain, besides several poetical or semi-poetical productions (*Ahasvérus, Merlin, Les Esclaves*, a drama, *Napoleon*, an epic, etc.), works on a great variety of subjects—literature and philosophy, history and politics—always interesting and suggestive, though often eccentric in their ideas; always striking and brilliant, though often somewhat profuse in their style. The most remarkable are—*Allemagne et Italie* (1839), *Le Christianisme et la Révolution française* (1846), *La Révolution* (1865), *De la Grèce moderne et de ses Rapports avec l'Antiquité* (1830), etc.

Quinia, or Quinine (which see).

Qui′nine [Fr., from *quina*, "Peruvian bark"], the most important medicinal ingredient of cinchona or Peruvian bark. It was discovered in yellow or calisaya bark in 1820 by Pelletier and Caventou. It exists in all the officinal barks, but is most abundant in the calisaya. To obtain it, it is first extracted from the bark as a sulphate by means of quite a complex process. By treating this salt with the solution of an alkali, the quinine is precipitated, and is then washed, dried, dissolved in alcohol, and reobtained by slow evaporation. As usually prepared, it is amorphous, but with care it can be obtained in silky crystals. Quinine is an alkaloid with strong basic properties, and forms with acids crystallizable salts. Its formula is $C_{20}H_{24}N_2O_2$. Quinine is without smell, but has an intensely bitter taste; is very insoluble in water, but dissolves freely in alcohol and moderately in ether. Solutions of the alkaloid or its salts, treated first with chlorine water and then ammonia, strike a brilliant green color. This test is very delicate, and distinguishes quinine from all other vegetable alkalies except quinidia. Quinine is used in medicine principally in the form of sulphate or hydrochlorate, the latter salt having the advantage of being more soluble. Quinine salts are locally irritant, and internally in small dose are stomachic; in large, powerfully disturbing to the nervous system, while also tending to nauseate and vomit. In medicinal doses the most prominent symptoms of "cinchonism" are headache and deafness, with buzzing or roaring in the ears, muscular debility, some reduction of the force and frequency of the pulse and of the body-heat. In poisonous dose the individual may become completely blind, deaf, and paralyzed, but death is rare. Quinine salts are powerfully antiseptic, a small percentage preventing or arresting putrefactive and fermentative processes. They also, in small percentage, arrest protoplasmatic movement, as in white blood-corpuscles, bacteria, etc., and even destroy permanently the vitality of the organisms. These salts are used in medicine in small dose as stomachic tonics, and in large to control the inflammatory process and help reduce the exalted body-heat in febrile and inflammatory diseases, and especially to cure malarial affections of all kinds, over which they have a well-known, unequalled, but wholly unexplained special power. The three other alkaloids of cinchona bark—namely, cinchonia, quinidia, and cinchonidia—have the same physiological properties as quinine, and the last two also equal quinine in power. Edward Curtis.

Quin′isext Council [Lat. *quinque*, "five," *sextus*, "sixth"], the Oriental Church council which was convened in 698 A. D. to supplement the acts of the fifth and sixth œcumenical councils. It is called also the Second Council *in Trullo*, because it was held in the imperial palace called Trullus at Constantinople. The Greeks consider it the seventh œcumenical council, but the Latins do not recognize it. It was convened by Justinian II., and gave 102 stringent canons on clerical discipline.

Quinisextum. See Quinisext Council.

Quinoa, the *Chenopodium quinoa*, a woody herb, which, with other nearly-related species, is cultivated in the high-

lands of Spanish America for its nutritious seeds. Its leaves are used as a potherb.

Quin'sy, acute suppurative tonsilitis, or inflammation of the tonsil, terminating in abscess. The term "quinsy" is a popular perversion of Lat. *cynanche*, the technical designation of a sore throat. It attacks adults, less often children; the two extremes of life, infancy and old age, being quite exempt from it. One attack usually leaves subacute or chronic disease of the tonsil, which predisposes the person to repeated attacks in subsequent seasons. Quinsy is most often unilateral, less frequently attacking the two tonsils successively, and rarely coincident upon both sides. It occurs in persons of full habit, often the plethoric, and especially when the diet has been excessive and luxurious. With such predisposing conditions must be superadded, as an immediate or exciting cause, some exposure of the body to wet or cold. Quinsy may follow checked perspiration, chilling the extremities, or wet feet. The attack is manifested by soreness of the throat, increased by swallowing and talking, soon actual pain, rigidity of the jaw, hypersecretion of saliva, coated tongue, labored breathing, and sense of obstruction, tension, and tumefaction in the throat. With the first development of pus, intense throbbing pain exists. The disturbance of the general system is variable. In mild cases only impaired appetite and sense of lassitude exist; in graver attacks there may be a slight or marked chill at the onset, and a succession of light chills; the temperature elevated to 102° or 104° F.; the pulse full and bounding; the mind delirious at night, and by day the face expressive of great fatigue from loss of sleep, of suffering, and of alarm and apprehension of impending suffocation. Internal examination discloses the tonsil symmetrically enlarged, extending to the median line of the throat and obstructing it. Palpation by the finger may detect the softness and fluctuation of pus. In from five to eight days the suppurated tonsil bursts, all the symptoms vanish, and recovery is speedy. In its formative or first stage quinsy may sometimes be aborted by scarification, by ice in the mouth, cold gargles or spray, and astringent gargles or applications, as of alum or tannin, and by internal administration of saline cathartics and arterial sedatives. Quinine boldly administered may abort it. When developed, the inhalation of steam, warm anodyne gargles, soothing poultices or fomentations externally, anodynes to secure rest, tonics and diet to sustain the strength, and early evacuation of pus with the knife, are the essentials of treatment.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Quint, in large organs, a stop or set of pipes tuned a perfect fifth above the diapasons, or an octave below the twelfth.

Quint (Alonzo Hall), D. D., b. at Barnstead, N. H., Mar. 22, 1828; graduated at Dartmouth College 1846, at Andover 1852; was pastor of the Mather church at Roxbury 1853–63; member of Massachusetts board of education 1855–61; chaplain of the 2d Massachusetts Vols. 1861–64, and became pastor of the North Congregational church, New Bedford, July 21, 1864. Author of *Army Notes* (1864) and *A History of the Second Massachusetts Regiment* (1867); is one of the proprietors and editors of the *Congregational Quarterly*, and has contributed to the *New England Genealogical Register*.

Quin'tain, an object, often in the form of a man, designed to be tilted at with a lance. It was sometimes placed at the end of a crosspiece so balanced upon a pivot that if the rider were not very quick a bag of sand at the other end of the crosspiece would strike him in the back.

Quin'tal [Fr., remotely from Lat. *centum*, a "hundred"], a hundredweight, chiefly used in weighing fish, and usually pronounced *kentle*.

Quinta'na (Manuel José), b. at Madrid, Spain, Apr. 11, 1772; educated at the University of Salamanca; became a lawyer at Madrid; published a volume of poems 1802; produced in 1805 his tragedy of *Pelayo*, intended to stimulate the Spaniards to resist the encroachments of Napoleon; edited a selection of Spanish poetry with the same object (3 vols., 1808); published his *Odas á España Libre* (1808); was secretary to the Cortes and to the regency during the early part of the war of liberation; was imprisoned in the castle of Pamplona from 1814 to 1820, when he was released by the revolution; lived in retirement in Estremadura 1823–33; was then made preceptor of the infant queen, Isabella; was created a senator 1835, and received from the queen the honor of a laurel crown in 1855. D. at Madrid Mar. 11, 1857. His *Complete Works* appeared in 1852 in the *Biblioteca de Autores Españoles* of Rivadaneyra, the most important being his *Lives of Celebrated Spaniards* (3 vols., 1807–34), which are reputed among the modern Spanish classics.

Quintanar' de la Or'den, town of Spain, province of Toledo, at an elevation of 2106 feet above the sea, manufactures blankets and other woollen fabrics. P. 6842.

Quin'tard (Charles Todd), M. D., D. D., LL.D., b. at Stamford, Conn., Dec. 22, 1824; graduated in medicine at the University of New York 1846; became a physician to the New York City Dispensary 1847; professor of physiology in the Memphis Medical College 1851; contributed to medical periodicals; took orders in the Protestant Episcopal Church 1855; was successively rector of churches at Memphis and Nashville; was a chaplain in the Confederate army, and was chosen bishop of Tennessee 1865.

Quintet' [It. *quintetto*], in music, a composition written for five instruments or voices.

Quintil'ian (Marcus Fabius), b. at Calagurris, Spain, about 35 A. D.; educated at Rome, and gained there afterward the highest reputation as a teacher of eloquence; received a regular salary from the imperial treasury by order of Vespasian, and was loaded with the highest civil honors and titles by Domitian. D. under the reign of Hadrian. In 95 A. D. he published his *Institutio Oratoria*, a work in 12 books on the art of oratory, which, besides its great historical interest (bk. x.), may still be read for practical purposes. Best edition by Bonnell (Leipsic, 1854); of the 10th book, separately, by Krüger (Leipsic, 1861); English translations by Guthrie (1756), Patsall (1774), and Watson (1856).

Quin'tus Cur'tius Ru'fus, the author of an historical work in ten books on Alexander the Great, *De Rebus Gestis Alexandri Magni*, which was much read and much admired during the Middle Ages. Of the author nothing is known; some critics fix the date of his life in the age of Augustus, others much later. Of the work, the first two books have been lost, and some of the others considerably damaged. The narrative is very pleasant, but by no means accurate, and is full of fables. Best edition by Zumpt (Brunswick, 1864).

Quin'tus Smyrnæ'us, or **Quin'tus Cal'aber,** a Greek poet of uncertain age, though he is generally considered to have been a native of Smyrna and to have flourished in the fifth century A. D. His writings had long been lost, when in the fifteenth century they were discovered by Cardinal Bessarion in the church of St. Nicholas, near Otranto, Calabria, whence the name Calaber, incorrectly given to the author. His poem purports to be a supplement to or continuation of Homer's *Iliad*, and possesses no intrinsic merit, but is interesting as the only extant specimen of the so-called "cyclic poems," and as preserving a considerable number of mythological traditions from writers whose works are wholly lost.

Quir'inal, a celebrated hill at Rome, N. of the Palatine, and connected with the Esquiline and Viminal, was so named from its temple to the god Quirinus. According to Mommsen, it was the seat of an early commonwealth independent of the original Rome, which was confined to the Palatine, the inhabitants of the former town being distinguished as "hill-men" (*collini*) from the Romans proper, "mount-men" (*montani*). The origin of this early settlement is one of the most interesting but obscure problems of early Roman history (see Quirites), but there seems no reason to believe in a diversity of race or to accept the Sabine hypothesis. It is certain that there was on the summit of the Quirinal a "Capitolium" earlier than that which subsequently gave name to the Capitoline Hill; that it contained a joint sanctuary of Jupiter (Vejovis), Juno, and Minerva, temples of Sol, Salus, Flora, Semo Sancus or Dius Fidius, and of the goddess of Fidelity, in which latter building the Roman treaties were deposited. There were also guilds of the Salii and Luperci priesthoods, the latter being probably hereditary in the Fabian gens. The Tities, one of the three original branches of the Roman people, at whose head was the Valerian gens, seem to have had their original seat on the Quirinal, and were not improbably derived from the Faliscan city of Falerii, whence probably a confusion with the neighboring race of the Sabines. Titus Tatius, Numa Pompilius, and his son-in-law, Ancus Martius, mythical kings of Rome, usually assigned to the Sabine stock, had the chief seats of their power on the Quirinal, but the derivation of their origin from the so-called Sabine city of Cures seems to rest upon no better authority than an etymological hypothesis of the Sabine Varro, reproduced by Livy and most subsequent historians. It is probable that at that period the Sabines had not left the mountain-valleys around Reate and Amiternum, and it is certain that the towns on the Tiber and Anio N. W. of Rome for many miles were then peopled not by Sabines, but by Latins. The Roman institution of the Curies and the legends of the brothers Curiatii (etymologically connected with the Quirinus) point rather to the

Alban Mount and the primitive Latin confederacy, than to the city of Cures, which had no demonstrable connection with Rome for several centuries after its foundation.

In modern times the hill has been crowned by the Palazzo Quirinale, which was begun by Pope Gregory XIII., continued under Sixtus V. and Clement VIII. by Fontana, and finished under Paul V. by Maderno. It has often been occupied by the popes as a summer residence, was the seat of the last papal conclaves, and since the annexation of Rome to the kingdom of Italy has been the residence of Victor Emmanuel. PORTER C. BLISS.

Quiri'tes [early Lat. *quiris* or *curis*, "a spear"], the collective name of the early Romans, considered in their capacity as warriors, and consequently as citizens entitled to vote in the *curies* or assemblies of armed men. The name was closely connected with that of the Latin spear-bearing divinity Quirinus, a synonym of Mavors, Mamers, or Mars, who was the patron of the armed host, and had his temple on the hill which from him took the name QUIRINAL (which see). To a late period of the Empire the name Quirites enjoyed precedence as a synonym of the patrician order (*populus Romanus Quiritium*), and as a title of honor over the geographical name Romans, the senators being called *patres conscripti Quirites*. The identification of Romulus with Quirinus was merely a guess of the rationalizing writers of the declining Republic.

Quiros', de (PEDRO **Fernandez**), b. in Spain about 1550; accompanied Admiral Mendana on his second voyage of discovery in the Pacific Ocean 1595, and was himself entrusted with the command of an exploring expedition which sailed Dec., 1605; discovered the New Hebrides group of islands Apr., 1606, and explored many other islands subsequently visited by Capt. Cook. D. at Panamá in 1614.

Quit-Claim, a word often employed in deeds in which the grantor or seller undertakes no responsibility in regard to the validity of his own assumed right to the property in question, but merely conveys to the grantee or buyer his own interest, whether valid or the reverse.

Quit'man, county of S. W. Georgia, bordering on Alabama, from which it is separated by Chattahoochee River. Area, 190 sq. m. The surface is rolling, and the soil fertile, cotton and corn being the chief productions. It is crossed by a branch of South-western R. R. Cap. Georgetown. P. 4150.

Quitman, p.-v., cap. of Brooks co., Ga., on Atlantic and Gulf R. R., 174 miles W. of Savannah, has good schools, a large cotton and woollen factory, spinning, weaving, and dyeing, 2 steam sash and blind factories, a cigar manufactory, several wagon and carriage factories, 2 weekly newspapers, 1 bank, and an extensive warehouse. Pop. 784. J. C. GALLAHER, ED. "INDEPENDENT."

Quitman, p.-v., cap. of Wood co., Tex., near Lake Fork of Sabine River, has 1 newspaper. P. 320.

Quitman (JOHN ANTHONY), LL.D., b. at Rhinebeck, N. Y., Sept. 1, 1799; received a liberal education; became a lawyer, and was professor at the Mount Airy College, Pa., 1819; practised law at Chillicothe, O., 1820–23; removed to Natchez, Miss., where he became a successful planter and rose to distinction in his profession and in the politics of the State; was chancellor of the superior court 1828–31 and 1832–34; member of the State legislature 1828–32; president of the senate in 1835 and governor *pro tem.*; judge of the high court of errors and appeals 1839; distinguished in the Texan struggle for independence, he was on the outbreak of the war with Mexico appointed brigadier-general of volunteers; promoted to be major-general Apr., 1847; was distinguished at Monterey, Chapultepec, and assault and capture of the City of Mexico; for his services at Monterey, Congress presented him with a sword, and Gen. Scott appointed him governor of the City of Mexico. Returning home at the close of the war, he was elected governor of Mississippi in 1850, and from 1855 to 1858 was a member of Congress and chairman of the committee on military affairs. D. at Natchez July 17, 1858. His *Life and Correspondence* (2 vols.), by F. H. Claiborne, appeared in 1860.

Qui'to, city, cap. of the republic of Ecuador and of the province of Pichincha, in the district of Quito, in a valley between two parallel ranges of the Andes, is built on the declivities of several small hills on the E. flank of the volcano of Pichincha, at an altitude of 10,000 feet above the level of the sea, in lat. 0° 13′ S., lon. 78° 43′ W. from Greenwich, and was, during the colonial government, capital of the kingdom of Quito, which embraced most of the present republic of Ecuador. Picturesquely located between vast mountain-barriers on the E. and W., it can be approached only from the N. and W., and owing to topographical features is laid out with little regularity, most of the streets being narrow, uneven, and ill-paved. The city is traversed by two deep and precipitous ravines, which annually carry off abundant floods of melted snow from the slopes of the volcano, and which are crossed by several lofty arches covered with substantial edifices. Owing to the frequency of earthquakes, most of the houses are of a single story, but are solidly built around spacious courtyards adorned with rich tropical plants and flowers, and often display considerable taste in decoration. The healthful and equable climate, ranging from 45° to 75° F., at an average of 60°, is justly characterized as a perpetual spring. The view from the heights of Quito embraces a panorama of eight Andean summits covered with perpetual snow, among them the famous peaks of Cayambi (19,813 feet), Cotopaxi (19,500), Antisana (19,200), Iliniza (17,380), and Pichincha (15,960), and a beautiful view of the cultivated valley of Chillo, abounding in sugar-cane, cotton, maize, and fruits of many kinds. The public edifices of Quito are built of stone, and comprise the palace of government, the archbishopric, cathedral, and city hall, grouped around the handsome Plaza Mayor, 3 hospitals, 2 asylums, 2 colleges, a university, a mint, and many churches, usually with convents attached. The public (formerly the Jesuits') library contains 20,000 volumes, and there are several smaller collections. Education has of late years been under the control of the Jesuits, who have exercised a strict supervision over religious doctrine, but have given instruction in mathematics, astronomy, and some branches of natural science, in addition to the routine studies of former times. A polytechnic school was established in 1872. Quito has several times been nearly laid in ruins by earthquakes, the most destructive having been those of Feb. 4, 1797, and Mar. 22, 1859; on which latter occasion the government buildings and most of the churches, as well as many private residences, were nearly ruined, involving a loss of $3,000,000 and of many lives. Water is copiously supplied through pipes to the principal houses and to several handsome stone fountains in the public squares; the quality of the water is, however, far from satisfactory, it being impregnated with mineral elements which give rise to elephantiasis to such an extent that a special hospital is devoted to that disease. The only good road in the republic is that leading from Quito northward to Bogotá, but a carriage-road to Guayaquil is now (1876) under construction. Commerce is languid, owing to the difficulty of communication with seaports by mule-paths. The chief articles of exportation are the precious metals, indigo, and liquors. Coarse cotton and woollen cloths are manufactured by hand, also fine articles of jewelry, and the women are skilful in embroidery, needlework, and gold-lace. The cultivation of silkworms and manufacture of silk are of recent introduction. A telegraph-line to Guayaquil has been recently opened. Considerable talent in painting, the fine arts, and literature is ascribed to the Quiteños, and the women enjoy a high reputation for beauty. The city was from remote antiquity the capital of the Quitus, a semi-civilized race, kindred to the Quichuas or Incas of Peru, and the valley of Quito, next to the valleys of Mexico and Cuzco, was the seat of the earliest American civilization. The mass of the inhabitants are still of the same race, though they have adopted Christianity and the Spanish language. The modern city of Quito was founded by Sebastian Benalcazar in 1534; the history of the old and the new capitals is incidentally given in the article ECUADOR. P. about 75,000. PORTER C. BLISS.

Quit'tor, or **Quiltor,** a fistulous abscess in the foot of the horse, is best treated by cutting away enough of the hoof to give free vent to the fetid pus which burrows there. The discharge may be facilitated for a day or so by poultices, and then the sore should be washed out with a solution of sulphate of zinc, two or three grains to the ounce.

Qui'ver, tp., Mason co., Ill. P. 893.

Quogue, p.-v., Southampton tp., on Shinnecock Bay, near Sag Harbor branch of Long Island R. R. P. 137.

Quoits [W. *coitan*, "quoit"], a game of strength and skill, in which the player strives to pitch a flattened ring of steel (called a quoit) in such a way as to land it as near as may be to a peg or hob of iron stuck upright in the ground, or, if possible, to make it ring the hob. The game is played by two parties, each striving to excel the other. This game differs from the discus-play of the ancients, in which the player threw a disk of metal or stone as far as he could, the longest thrower winning the prize.

Quo Warranto [Low Lat., "by what authority?"], in law, the name of a writ served upon a person by the attorney of the State or nation, requiring him to show by what title he holds a specified property, office, or privilege. Owing to the cumbrousness of the proceedings under the writ, it has been superseded in England by an "information in the nature of a *quo warranto*."

R.

R, a consonant of the liquid class, approaching the character of a vowel. Its sound is to some extent interchangeable with that of *l*, and even in some languages with *d* and *s*. It is often treated by the vulgar as a silent letter or a vowel, but it is never silent, and always has a consonantal character more or less marked. In Greek, Latin, and in most modern languages it is distinctly trilled. *R.* (*rex, regina*) stands for king or queen.

Raab, town of Hungary, at the influx of the Raab into a branch of the Danube, was formerly fortified, and has a fine old cathedral. Its manufactures of tobacco and its transit-trade are extensive. P. 20,035.

Raal'te, town of the Netherlands, province of Overyssel, has a large trade in horses and cattle. P. 5570.

Raba'nus Magnentius Maurus, descended from an ancient Roman family, and pronounced by Kurtz "the most learned man of his age," was b. at Mentz about 776; was teacher at the monastery of Fulda from 817; was made abbot in 822, archbishop of Mentz 847. D. at Winkel Feb. 4, 856. The name of MAURUS was given to him by his teacher, Alcuin, in remembrance of St. Maur, the disciple of St. Benedict. He opposed the doctrine of transubstantiation, first distinctly set forth by Paschasius Radbert in 831 (expanded in 844). His works fill 6 vols. of Migne's *Library*. (See Bach's *Rabanus Maurus, der Schöpfer des deutschen Schulwesens* (1835), and Kunstmann's *Rabanus Magnentius Maurus* (1841).) R. D. HITCHCOCK.

Rabat', town of Morocco, Northern Africa, at the mouth of the Bu-Regreb in the Atlantic, is well built and strongly fortified. It has manufactures of fine carpets, burnouses, woollen and linen fabrics, and an active trade with Genoa and Marseilles in wool, wax, almonds, and olive oil. P. 25,000.

Rab'ba, town of Central Africa, kingdom of Gando, on the Niger, in a highly-cultivated region among beautiful surroundings, in lat. 9° 15′ N. and lon. 5° 26′ E. It is a large and populous town, carrying on an extensive trade with Tripoli, Fezzan, etc. It was at one time the most important slave-market in this part of Africa. Its horses are celebrated. It is said to have suffered much during the last ten years from internal wars. P. about 40,000.

Rab'bah, the same as AMMAN (which see).

Rab'bi [Heb., "my master"], a title of honor anciently employed by the Jews to designate those learned in the law, in which sense it is frequently found in the Gospels, being sometimes used in addressing Christ. At the present time the term *rab* is applied by Oriental Jews in a manner similar to the American use of "esquire."

Rab'bit [O. D., *robbe*], the English name conferred on many species of the family LEPORIDÆ (which see), but more especially applicable to the *Lepus cuniculus*, or common rabbit of Europe. The species is too well known to need description; it is found generally distributed throughout Europe (except in its more northern portions), as well as the contiguous portions of Asia and Northern Africa, and is familiar as a semi-domesticated animal. Its habits are characteristic in that it lives in communities, burrows in the ground, and brings forth its young in a blind and naked condition. It is very prolific, commencing to breed at the age of about six months, and having several litters in the course of a year, and in each litter some four to eight young ones. The name "rabbit" is also generally given indiscriminately to American species, the best known of which is the common small rabbit of the Eastern and Middle States (*Lepus sylvaticus*); this species, however, as well as all the other species of the family, agrees with the hare in making forms, instead of burrowing, and in bringing forth its young provided with hair and able to see. THEODORE GILL.

Rabelais' (FRANÇOIS), b. in 1483, or perhaps in 1495, in Chinon, Touraine, where his father had a farm and kept an inn and a drug-store. The widespread idea of Rabelais as an unruly, grotesque, half-dissipated jester is a coarse confusion of the author and his creations, and is contradicted by those facts of his life which are well ascertained. He was educated first in the convent of Senillé, then in the monastery of La Baumette, and, although he showed no taste for studies or devotional exercises, he was destined to enter some monastic order. After becoming a brother of the order of St. Francis, however, in 1511 or 1519, his talent and passion for studies and literary occupation awoke, and when he left Fontenay-le-Comte in 1524 he was a man of learning. His fellow-monks disliked and suspected his studious life. They ransacked his cell and confiscated his books, and such an ill feeling upsprang between him and them that the pope, Clement VII., found it advisable to remove Rabelais to Maillezais, and allow him to change the Franciscan order for that of the Benedictines. At Maillezais, however, he did not feel better satisfied, and in 1530 left the monastery without the permission of his superiors, not on account of any persecution, but from sheer dissatisfaction, as it would seem. He settled first at Montpellier, at that time the seat of the most celebrated school of medicine in France, but in 1532 he went to Lyons as a hospital physician. While in Lyons he published revised and annotated editions of the works of Hippocrates and Galen, and of Marliani's *Antiquitates Romæ*. He also published miscellaneous treatises on archæology, jurisprudence, and medicine, and the first two books (1533 and 1535) of his great satirical work, *Les Faits et Dicts du Géant Gargantua et de son Fils Pantagruel*. In 1536 he accompanied Cardinal du Bellay, an old schoolmate and friend of his, and now bishop of Paris, and by his influence he obtained from Pope Paul III. a release from the penalties which he had incurred by abandoning his order. In 1538 he entered the abbey of St. Maur des Fossés in the diocese of Du Bellay, and in 1551 he obtained the curacy of Meudon. D. in Paris in 1553. Rabelais was a man of great erudition. He understood Latin, Greek, Hebrew, Arabic, Italian, Spanish, English, and German. His knowledge in medicine, law, theology, history, philosophy, and art was comprehensive and exact. His scientific writings attracted much attention in his time, and commanded respect. But his fame was founded by, and rests now on, his satirical romance of *Gargantua and Pantagruel*. It consists of five books, of which he published the first two in Lyons, and the next two in Paris (1546 and 1552); the fifth was found unfinished after his death, and was printed in 1564. The subject-matter of this romance is often coarse and indecorous, but on these points the author differs only from our taste, not from that of his age, and the treatment, the form, show everywhere that ease, clearness, simplicity, and grace which cannot be obtained without great natural talent and consummate education. The sâtire of the book is now often obscure, or even irrecognizable, but its humor is still living, brilliant, and irresistible. Besides the fun which every reader can draw from it, it gives a picture of French civilization in the sixteenth century, of the strife between inherited dogmas and acquired views, which is most attractive and instructive to the student of history. There exist about 60 editions of the book, besides English, German, and Italian translations. CLEMENS PETERSEN.

Rabies. See HYDROPHOBIA, by CHARLES P. RUSSEL, M. D.

Ra'bun, county in N. E. Georgia, between Chattooga River on the E. and the Blue Ridge on the W., traversed by Tallulah (or Terrora) River. The surface is extremely mountainous, and abounds in picturesque scenery, including the celebrated Tallulah Falls and the Eastatoia or Rabun Falls, a succession of cascades in Rabun Gap, an important highway through which Knoxville and Charleston R. R. is to pass. The head-waters of Tennessee River are in the same vicinity. Agriculture and stock-raising are the only industries. Cap. Clayton. Area, 320 sq. m. P. 3256.

Ra'burn (WILLIAM), b. in Halifax co., N. C., Apr. 8, 1771; went to Georgia in childhood; received but a limited education, but became a judge, a leading member of both houses of the legislature, and governor of the State 1817–19. D. in Hancock co., Ga., Oct. 23, 1819.

Racahout, or **Racahout des Arabes,** is a starchy food prepared in Barbary from the acorns of *Quercus ilex* and *Q. ballota*, oaks of that region. It is flavored with herbs, and is sometimes prescribed for invalids' use. But the racahout of the confectioners' shops is a compound of starch with chocolate, vanilla, etc., sold as a sweetmeat.

Racalmu'to, town of Sicily, province of Girgenti, on the left bank of an affluent of the Platani, about 15 miles N. E. of the town of Girgenti. The neighboring country is very rich in grain, vines, olives, and fruits, and also abounds in sulphur, saltpetre, and gypsum. Racalmuto is

an old town, the name being of Arabic derivation, and it was long under the lordship of the Chiaramonti, whose family castle still stands on a rock about 2½ miles distant. The town was almost utterly depopulated by the plague in the thirteenth century, and its present site is not precisely the same as then. The inhabitants now carry on an active trade in the rich products of the district. P. in 1874, 12,250.

Racconi′gi, town of Northern Italy, province of Cuneo, on the right bank of the Maira, S. of Turin about 19 miles by rail. It is a walled town, and the three interesting old castles of Migliabruna, of Carpanetto, and of Bonavalle are in its remote neighborhood, but it is now chiefly known for the royal castle and park in its immediate vicinity. This castle was originally a fortress, was converted into something like a villa by E. Filiberto in 1681, and has been improved by successive princes until it is now one of the most sumptuous of the Italian royal palaces. The park, which is walled in, is 1¼ miles in length and ¾ of a mile in width, abounds in game, and is adorned with artificial lakelets, grottoes, hermitages, etc., and with much statuary. Racconigi is a favorite resort of King Victor Emmanuel during the hunting-season, and a large herd of chamois, kept here, is an object of interest to every visitor. P. 10,000.

Raccoon′ [Fr. *raton*], the vernacular name of species of the genus *Procyon* and family Procyonidæ. These all agree in having a rather stout body; the snout pointed, and the tail rather long and bushy, and annulated with dark-colored rings; their feet are provided with long and slender digits, and with the fore ones the animal is able to grasp its food and other objects. They are fond of playing in the water, and of soaking therein their food, and to this peculiarity the common American species (*Procyon lotor*) owes its specific name *lotor—i. e.* "washer." Two well-defined species are known—(1) *Procyon lotor*, found throughout almost all North America, and *P. cancrivorus*, characteristic of South America. THEODORE GILL.

The Raccoon.

Raccoon′, p.-v. and tp., Marion co., Ill. P. 1139.

Raccoon, tp., Parke co., Ind. P. 1327.

Raccoon, tp., Beaver co., Pa. P. 1012.

Race-Horse. See HORSE.

Race′land, p.-v., La Fourche parish, La., on Morgan's Louisiana and Texas R. R.

Race′mic Acid [Lat. *racemus*, a "bunch" of grapes or fruit]; also called **Paratartaric Acid** and **Uvic Acid** [Ger. *Traubensäure*], ($C_4H_6O_6$), found with tartaric acid in grape-juice, and identical with it in composition. It differs from it, however, in its action on polarized light and in some other characters. It was discovered by Kestner in wines of certain vintages. It may also be formed artificially by several methods. Racemic acid itself has no action on polarized light, but by certain treatment may be separated into two isomeric constituents, one of which is ordinary dextro-rotatory tartaric acid, and the other is lævo-rotatory, the two being called *dextro-tartaric* and *lævo-tartaric* acid. Racemic acid itself has, according to Buignet, a density of 1.69, while Pasteur found for the dextro- and lævo-tartaric acids obtained from it the densities 1.7496 and 1.75, practically identical. While, therefore, these two substances, of different optical properties, have the same molecular volume, their compound, racemic acid, in which they optically neutralize each other, has a much larger volume. No relation, therefore, is apparent between these optical characters and the volumes of the molecules. Pasteur found, nevertheless, certain relations between the modifications of the crystals of the two acids and the action on polarized light, for which the reader must be referred to the textbooks. H. WURTZ.

Ra′chel [Heb. *rahel*, "ewe"], of Northern Mesopotamia, younger daughter of Laban, favorite wife of Jacob, and mother of Joseph and Benjamin. Her tomb, about 4 miles from Jerusalem on the road to Bethlehem, though of modern construction, undoubtedly marks the very site of her burial as described in Gen. xxxv. 19, 20.

R. D. HITCHCOCK.

Rachel′ (ELISA RACHEL **Felix**), b. at Mumpf, Switzerland, Feb. 28, 1820, daughter of a wandering Jewish peddler. In Lyons, Paris, and other cities she, with her sister Sarah, helped the family income as a vagabond singer at the cafés and on the boulevards. Coron, of the Royal Institution, attracted by their voices, took them from the streets. Elisa, showing more dramatic talent than musical, was put in charge of M. St. Aulaire. In 1836 she was admitted to the Conservatoire; in 1837 made her first appearance at the Gymnase in *La Vendienne*, an unsuccessful play; went back to her studies under Samson, and in 1838 astonished and captivated Paris by her performance at the Théâtre Française of Camille in *Les Horaces*. Her fame and fortune were made. The classic tragedies of Racine, Corneille, and Voltaire were revived; her intensity, originality, naturalness, the singular expressiveness of her face, the skill of her declamation, made a new era in dramatic art. Her earliest and some of her latest triumphs were in Phèdre, Camille, Roxana, Hermione, Electra, and other parts in the older drama. Her fame being secure, she enlarged her repertoire, and played with great power Jeanne Darc, Marie Stuart, Adrienne Lecouvreur, and other characters by modern writers; the last mentioned was one of her famous personations. In 1855, in company with her brother, Raphael Felix, and her sisters, Sarah, Lia, and Dinah, with a complete theatrical troupe, she came to America; played in New York and Boston, but once only in Philadelphia, and once in Charleston; failing health compelled her then to desist. A visit to Havana brought no relief; she returned to France, spent a winter in Egypt, but gradually succumbed to pulmonary disease, and d. at Cannes, France, Jan. 3, 1858. Rachel was slender, graceful, not beautiful, of pale complexion, expressive features, brilliant eyes, and singularly fascinating presence. Margaret Fuller said of her: "Her range, even in high tragedy, is limited; she can only express the darker passions and grief in its most desolate aspects. Nature has not gifted her with those softer and more flowery attributes that lend to pathos its utmost tenderness. She does not melt to tears or calm or elevate the heart by the presence of that tragic beauty that needs all the assaults of Fate to make it show its immortal sweetness. On the dark side she is very great in hatred and revenge." Rachel was never married, but she left two sons—one, a son by M. Walewski, was made count of Etiolles by Napoleon III.—RAPHAEL FELIX, the brother, became in 1868 director of the Théâtre Porte Saint-Martin; SARAH was connected with the Gymnase, the Français, the Odéon, and was favorably known in the provinces; LIA, devoted to high tragedy, distinguished herself most at the Porte Saint-Martin; REBECCA d. in 1854, having been five years at the Comédie Française; DINAH found her place in vaudeville. All, though meritorious artists, have owed much to the fame of their sister, who made a name in her special order of genius along with which no other is mentioned. Her fame is purely dramatic, her personal qualities winning for her neither respect nor love. O. B. FROTHINGHAM.

Racine′, county in S. E. Wisconsin, on Lake Michigan, is level and fertile, with abundance of limestone, is watered by Fox, Des Plaines, and Root rivers, and traversed by Chicago Milwaukee and St. Paul, Chicago and Northwestern, and Western Union R. Rs. Wheat, corn, oats, potatoes, hay, wool, and butter are the principal products. There are 12 manufactories of agricultural implements, 13

of carriages and wagons, 22 of clothing, and several tanneries, breweries, and flouring-mills. Cap. Racine. Area, 325 sq. m. P. 26,740.

Racine, tp., Mower co., Minn. P. 813.

Racine, p.-v., Sutton tp., Meigs co., O., on Ohio River. P. 560.

Racine, city and tp., cap. of Racine co., Wis., on Lake Michigan at the mouth of Root River, and on Milwaukee division of Chicago and North-western and Western Union R. Rs. It was incorporated in 1848, ranks fourth among the cities of the State, and contains 24 churches, 2 banks, 1 college, an orphan asylum, a city hospital, 4 newspapers, with manufactories of threshing-machines, wagons, fanning-mills, sash, doors, and blinds, trunks, silver-ware, leather, baskets, boots and shoes, pumps, and other commodities. Racine College is situated in Main street, in grounds of 10 acres in extent, was established in 1852, comprises a collegiate department and a grammar school, and in 1874–75 had 18 instructors, 180 students, and a library of 3000 vols. P. of city, 9880.
CHARLES JONAS, ED. "SLAVIC."

Racine (JEAN BAPTISTE), b. Dec. 21, 1639, at Ferté-Milon in Picardy; lost both his parents when four years old; was educated first by his grandfather at Beauvais, then by his grandmother and aunt in the monastery of Port Royal; in this celebrated institution and among its quiet almost solitary surroundings the fine, tender, and sensitive nature of the young poet developed with great rapidity and astonishing brilliancy. He was loved, admired, and watched over by all. When he was twenty years old he left the monastery to see the world, and an ode he wrote at the marriage of Louis XIV., *La Nymphe de la Seine*, brought him a little name and a little reward. In Paris, however, his friendships and habits soon became somewhat irregular, and his relatives began to feel great anxiety about him. As he was still, to some extent, under their control, he retired to one of his uncles, a priest, at Uzès in Languedoc, and began to study theology. But neither the study nor the life satisfied him. He returned to Paris, and, a friend of Molière and Boileau, he became a dramatic author. His first tragedies, *La Thébaïde* (1664), *Alexandre* (1665), and his comedy, *Les Plaideurs* (1668), had only a moderate success, but his following tragedies, *Andromaque, Britannicus, Iphigénie* (1669), *Bérénice* (1670), *Bajazet* (1672), and *Mithridate* (1673), won a great name for him; and when he brought his *Phèdre* on the stage in 1677 he was generally acknowledged to be the first tragic poet of France. The intrigues of a literary cabal succeeded, however, in slurring the success of the piece, and this circumstance hurt the pride and sensitiveness of Racine so deeply that he gave up writing for the stage. The religious influence of his education in Port Royal began also to become uppermost in his mind; he spoke of becoming a Carthusian monk. This idea he gave up, but, having married a very devout lady, he retired into private life as royal historiographer, and divided his time between his family, his labors in the service of the king, and religious exercises. At the solicitation of Madame de Maintenon he wrote *Esther* (1689) and his masterpiece *Athalie* (1691) for the pupils of St. Cyr, but neither of them made any great impression on the public. At her solicitation he also wrote a memoir to the king on the state of France, and this memoir offended Louis XIV. very much. The loss of the favor of the monarch Racine could not bear; he actually pined away, and d. Apr. 22, 1699, in Paris. In reading Racine it must be remembered that he wrote under the influence of certain views, or rather under the sway of certain rules whose authority no Frenchman at that time could dream of doubting. These rules did not concern merely the theatrical arrangement and external dramatic form; they exercised an influence on the poetical conception itself. French tragedy in its classic period was not allowed to paint men; it had to paint only educated men; and in the educated man it aimed less at his passions than at his ideas. Thus, in classic French tragedy we must not seek for human nature idealized only by being represented through an artistic form. Before human nature could become a fit subject for artistic treatment it had to undergo a sort of social idealization. But the reader who can familiarize himself with these peculiarities will in Racine find a most charming poet—passionate yet pure, tender yet never sentimental. He knew not all that can go through a human heart, but that which he did know he knew in all the depths of its sorrow and in all the freshness of its joy, in all its anguish and in all its sweetness; and he pours it forth in expressions which are models of precision and gracefulness. CLEMENS PETERSEN.

Racing. See HORSE-RACING.

Rack [Ang.-Sax. *ræcan*, to "stretch"], an engine of judicial torture formerly much employed in Europe to compel accused persons to plead their own guilt or to obtain satisfactory testimony from recusant witnesses. It was introduced into England in 1447 by the duke of Exeter as constable of the Tower of London. In 1628 it was pronounced illegal by the courts. It has been since disused there, and is now everywhere obsolete. The victim was stretched upon a platform of wood; cords were attached to his limbs, and then strained by pulleys until the sufferer yielded or had his joints dislocated.

Rack'et, or **Racquets** [Fr. *raquette*], a game played with ball and racket-bat in a closed or an open court, popular in England and Ireland, and lately introduced into the U. S., which though confounded with tennis is quite dissimilar. The closed court is usually adopted, and the front wall has two lines marked on it, the first two feet two inches from the floor (below which the ball must not strike), and the second seven feet nine inches from the floor. Partners being chosen, the second party, standing on the right side of the court about halfway, serves the ball so that it shall strike above the second line and rebound to the left side, when the first party is obliged to return the ball at its first bound off the floor, and so continue. An elaborate code of rules has been adopted by the Prince's Racquet Club of London, which is generally observed wherever the game is played. Several racket clubs have been organized in New York City, one of which has erected a fine court on Sixth avenue.

Racoon', tp., Gallia co., O. P. 1700.

Racoon (P. O. name of INDEPENDENCE), Preston co., West Va., on Baltimore and Ohio R. R.

Rad'cliffe (Mrs. ANN **Ward**), b. in London, England, July 9, 1764; married in 1786 William Radcliffe, subsequently editor of the *English Chronicle;* published several romances notable for their wild and fantastic plots, of which *The Mysteries of Udolpho* (1794) is the only one now remembered, and some poems. D. in London Feb. 7, 1823. Her writings had considerable influence upon the literature of the time, and even Byron was among her imitators. A *Memoir* by Talfourd appeared in 1826.

Radcliffe (JOHN), M. D., b. at Wakefield, Yorkshire, England, in 1650; graduated at University College, Oxford, 1669; studied medicine, which he practised at Oxford, and subsequently at London; acquired wealth and popularity; was noted for wit and plainness of speech; was appointed physician to the princess Anne 1683; attended Queen Mary in her last illness, and entered Parliament 1713. D. at Carshalton, near London, Nov. 1, 1714. By will he left a large sum to University College, Oxford, and also founded the Radcliffe Library in that city, devoted to medical literature. (See his *Life and Letters* (1736), by W. Pittis.)

Radcliffe Library, an institution at Oxford, England, connected with the university, founded by a bequest of £40,000 left by Dr. John Radcliffe. The building, which is circular in form, standing upon arcades and with a spacious dome, stands in the centre of Radcliffe Square, and was completed in 1747 by James Gibbs, the architect, who bequeathed to the library his collection of books. Intended originally for medical literature, it has received large bequests of legal, theological, and Oriental works, and since 1861 has been reorganized in combination with the Bodleian Library, the vast central room of the Radcliffe being transformed into a reading-room.

Ra'dersburg, p.-v., cap. of Jefferson co., Mon., near Missouri River, in the vicinity of gold-mines. P. 311.

Radet'zky (JOSEPH WENZEL), COUNT, b. at Trzebnitz, in Bohemia, Nov. 2, 1766; entered the Austrian army in 1784; fought with distinction at Aspern and Wagram in 1809, and at Kulm and Leipsic in 1815; was made commander-in-chief of the Austrian troops in Italy in 1831, and field-marshal in 1836; put down with uncommon energy the revolution in Milan and Venice in 1848, though now a man of eighty years; won the victories at Custozza and Novara over the Piedmontese, and governed the Austrian possessions in Italy to Feb. 28, 1857, when he resigned. D. at Milan Jan. 5, 1858.

Rad'ford (WILLIAM), b. Mar. 1, 1808, in Virginia; entered the navy as a midshipman Mar. 1, 1825; became a passed midshipman in 1831, a lieutenant in 1837, a commander in 1855, a captain in 1862, a commodore in 1863, a rear-admiral in 1866; retired in 1870; served on the W. coast of Mexico during our war with that country, and commanded the iron-clad division in both the Fort Fisher fights. In his commendatory report of Jan. 28, 1865, Rear-Admiral Porter writes: "Com. Radford has shown ability of a very high order, not only in fighting and manœuvring his vessel, but in taking care of his division. His vessel did more execution than any other in the fleet, and I had so much confidence in the accuracy of his fire that even

when our troops were on the parapet he was directed to clear the traverses in advance of them of the enemy. This he did most effectually, and but for this, victory might not have been ours." FOXHALL A. PARKER.

Radia'ta [Lat. *radiatus*, "rayed"], a name proposed by Cuvier for the last or lowest of the four primary groups or branches (*embranchens*) into which he divided the animal kingdom, and owing its name to the radiate plan or symmetry manifested in many of its representatives. (I.) By Cuvier the group was constituted to "include a number of beings whose organization, always evidently more simple than that of the three preceding divisions, also presents a greater variety of degrees than is observed in either of them, and seems to agree in but one point—viz. their parts are arranged round an axis and on one or several radii, or on one or several lines extending from one pole to the other." To this group were referred five classes: (1) echinoderms (including gephyrean worms), (2) entozoans, (3) acalephs, (4) polyps (including Polyzoa), and (5) infusorians. This system was adopted by many. The incongruity of the infusorians with the other classes of radiates, and subsequently that of the polyzoans and gephyreans, was in time appreciated, and the group was limited (by H. Milne-Edwards) to the classes echinoderms, acalephs, and polyps, which were themselves purified of the heterogeneous elements confounded under them by Cuvier. With these limits the branch or sub-kingdom has been accepted by a large body of naturalists, and especially the French and American ones. (II.) Special investigators of the several classes (*e. g.* Frey and Leuckart) had convinced themselves that even those thus retained together had no common bonds of agreement, and differentiated them into two branches: (1) Echinodermata, limited to the echinoderms (which have been by some distributed among several classes), and (2) Cœlenterata, proposed for the reception of the acalephs and polyps. The last view has been strongly opposed by American naturalists (*e. g.* L. Agassiz, A. Agassiz, H. J. Clark, A. E. Verrill), who have contended for the retention of the branch Radiata as limited by Edwards; but has received the approbation of most European naturalists, and appears to be gaining ground among the Americans. While a number of naturalists regard the Echinodermata and Cœlenterata as entitled to rank as primary divisions (sub-kingdoms or branches), others entertain different views. Thus, by Huxley and his followers the echinoderms and the scolecids (intestinal worms and allied forms) have been associated together in a sub-kingdom Annuloidea, and by Häckel the sponges have been united with the acalephs, ctenophores, and polyps under the name Zoophyta. As more or less exact synonyms of Radiata may be noted the names Radiaria (Lamarck), Actinomorpha or Actinozoaria (De Blainville), Racemifera (Ehrenberg), regular animals (Burmeister), and Zoophyta (H. Milne-Edwards, Von Siebold, and Stanius, etc.). THEODORE GILL.

Radiation. See HEAT.

Rad'ical [Lat. *radix*], an indicated root of a quantity; thus, $\sqrt{3}$, $\sqrt[4]{16}$ are radicals. If the quantity under the radical sign is a perfect power of the indicated degree, the quantity represented is essentially rational, though under a radical form; if the quantity under the radical sign is not a perfect power of the degree indicated, the quantity is called a *surd*; thus, $\sqrt[4]{16}$ is a radical form of the rational quantity 2, but $\sqrt{3}$ is a surd, and its value can only be expressed by approximation. A radical may be written in either of two ways: it may be expressed by means of the radical sign $\sqrt{\ }$, in which case the degree of the radical is indicated by a number written over the sign and called an *index*; or it may be written by the aid of a fractional exponent, in which case the denominator indicates the degree of the radical. Thus, the cube root of a may be written $\sqrt[3]{a}$, or $a^{\frac{1}{3}}$. The methods of transforming radicals depend on two fundamental principles: (1) the product of the nth roots of two quantities is equal to the nth root of their product, and the reverse; (2) the quotient of the nth roots of two quantities is equal to the nth roots of their quotient, and the reverse. By the aid of these principles operations on radicals are readily reduced to corresponding operations on rational quantities. W. G. PECK.

Rad'ical Ax'is. If the equation (in rectangular or Cartesian co-ordinates), reduced to its simplest form of one circle, be subtracted from that of another, the remainder, an equation of the first degree, will, *if the circles intersect*, be the equation of a right line passing through the points of intersection. But it is remarkable that, whether the circles meet in real or *imaginary* points (*i. e.* whether they really intersect or not), the equation obtained as above always represents a real line having important geometric properties in relation to the two circles. This is in conformity to a general principle (that of "continuity;" see PROJECTION, METHOD OF, in APPENDIX) that the line joining two points may preserve its existence and its properties when those points have become imaginary.

Whether or not there be real intersection of the circles, the real line of which the equation is obtained as above is called the *radical axis* of the two circles. In the latter case the position of this axis is determined geometrically by cutting the line joining these centres so that the difference of squares of the parts = difference of squares of the radii, and erecting a perpendicular at this point.

If from any point of the radical axis tangents to the two circles be drawn, those tangents will be equal. Given any three circles, if the radical axis of each pair be taken, these three lines will meet in a point called the *radical centre*. From these two relations many other important geometric properties are deduced. The two points of intersection of the two *pairs* of common tangents to two circles are called *centres of similitude*; and if three circles be given, the six centres of similitude will be so disposed that three of them will lie on the same straight line, called the *axis of similitude*, of which there are four. By the use of these axes and their *poles* (see POLE AND POLAR), and the *radical centre* of three circles, the famous problem of "tangencies" of Apollonius, which attracted the attention of Descartes, and even Newton,* of drawing a fourth circle touching the other three, is geometrically solved with a facility which proves that the progress of modern geometry has been commensurate with that of analysis. (See TANGENCIES.) J. G. BARNARD.

Radicals, in chemistry, sometimes called **Radicles.** This term was first introduced by Guyton de Morveau, and adopted by Lavoisier, at the time when the foundation of our present chemical nomenclature was laid in 1787. It was, however, applied then in a much narrower sense than it has since acquired. Guyton used it as synonymous with *acidifiable base*, whether simple or compound; that is, to designate a substance which would unite with oxygen to form an *acid*. It is now, in its broadest sense, applied to all substances, simple or compound, which combine with any of the more electro-negative elements to form compounds either acid, neutral, or basic; but, more generally and narrowly, it is now used to designate only "compound radicals" like *ammonium* and *cyanogen*, compounds of elements which have themselves an elementoid nature and perform elemental functions. One class of such radicals which has played a great part in the history of chemistry is that known as the "alcohol radicals," invented by Berzelius and Liebig. The alcohols and ethers and other important classes of organic compounds were during a considerable period almost universally regarded as containing certain compound elementoid groups of carbon and hydrogen atoms called *methyl*, *ethyl*, *propyl*, *butyl*, etc. At present, another radical is supposed by many to be contained in the alcohols, called *hydroxyl* (HO), and many do not regard the existence of the former series as essential. A recent distinguished chemical writer has defined a *radical* as "a group of elements which is common to a more or less numerous series of allied compounds, and remains unaffected by the processes whereby these compounds are transformed one into another." (*George C. Foster.*) (See SALT-RADICALS and VOLUMES, MOLECULAR.) HENRY WURTZ.

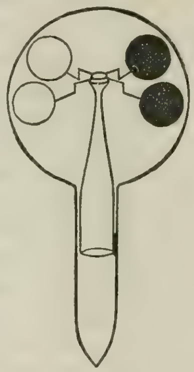
Radical Sign, the ordinary sign used for indicating a radical, $\sqrt[3]{\ }$, is a modified form of the letter *r*, with the addition of a number placed above it to indicate the degree of the radical.

Radiom'eter [Lat. *radius*, "ray;" Gr. *μέτρον*, "measure"], the name given to an instrument (Fig. 1) invented by Prof. William Crookes of London. It is formed of four or more delicate arms supported at their intersection by a needle-point, and carrying at their extremities thin disks of pith or of mica blackened on one side, the lamp-blackened surfaces all facing the same way. When the radiations from a luminous or a heated body fall upon this instrument, the vanes rotate, their blackened surfaces moving away from the source of radiation. Prof. Crookes was led to the discovery of this remarkable phenomenon by the minute study of the anomalous behavior of heated bodies when weighed in a vacuum. It is well known that a body when hot weighs less in air than when it is cold, the explanation usually given being that the ascending currents of hot air buoy up the body. To get rid of this action during a research on the atomic weight of thallium, Prof. Crookes used a balance enclosed in a case exhausted of air. He found that even in these conditions the

* The analytical solution was first successfully accomplished by Gergonne, *Annales des Mathématiques* (1820). B. Alvord (now paymaster-general U. S. A.) first gave elegant geometrical solutions of this and cognate problems. (*Smithsonian Contributions*, 1855, "Tangencies of Circles and Spheres.")

body appeared to weigh less when hot than when cold. He now suspended in an exhausted vessel a bar of pith, and in a similar vessel containing air he suspended another pith-bar, and found that a hot body repelled the pith-bar in the exhausted vessel, while it attracted the bar in the vessel holding air. To reach quantitative results, he constructed the apparatus shown in Fig. 2. It consists of a delicate horizontal rod suspended by a fine fibre of glass, and having disks of pith at each end coated with lampblack. The whole is enclosed in a glass case made of tubes blown together, and by means of a Sprengel pump the air is removed. In the centre of the horizontal rod is a mirror which reflects a beam of light on to a distant horizontal scale. The motions of this beam of light show the direction and amount of motion of the horizontal rod.

FIG. 1.



From the more interesting experiments made with this torsion-balance we select the following: A heliostat reflected a beam of sunlight in a constant direction, and it was received on an arrangement of slit, lenses, and prisms for projecting a pure spectrum. Equal areas of light from different parts of this spectrum were projected on to one of the blackened pith-disks of the torsion-balance. Experiments were made in the months of July, August, and September, and the results are given graphically in Fig. 3. The maximum effect is shown in the ultra red, and the minimum in the violet. Taking the maximum at 100, the following are the

FIG. 2.

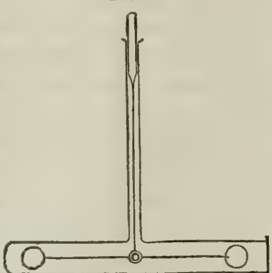
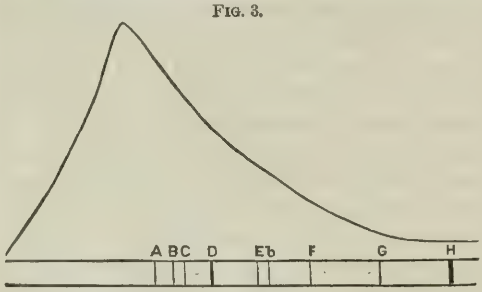


FIG. 3.



repelling actions on the disk of equal areas of the different colors of the spectrum:

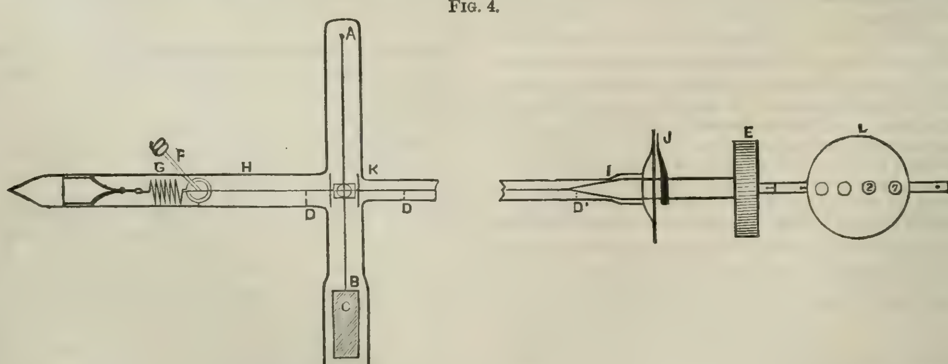
Ultra red	100°	Green	41°
Extreme red	85	Blue	22
Red	73	Indigo	$8\frac{1}{4}$
Orange	66	Violet	6
Yellow	57	Ultra violet	5

If Prof. Crookes had reduced these values to equal areas of the diffraction spectrum (see SPECTRUM and DIFFRACTION), his numbers would have approached equality, and his results would be similar to those obtained by Dr. J. W. Draper in his research on the distribution of heat in the solar spectrum. In subsequent experiments Crookes found that when a suspended bar of pith, having one half black and the other half plain, was exposed to the radiations from a candle, the blackened half of the bar was repelled five and a half times more than was the plain half of the bar. Prof. Crookes found that the action of the radiation on the torsion-balance (Fig. 2) diminished inversely as the squares of the distances of the source of radiation from the disk of the balance.

In the instrument described above the radiation acts on a pith-bar, one end of which is blackened on each side. But suppose the bar blackened on alternate halves, and a candle placed so near it that it drives the bar half round. The light will now have presented to it another black surface in the same position as the first, and the bar will be again driven in the same direction half round. This action will be repeated again and again, and the result will be *rotation*. If we now replace the suspended pith-bar by one supported on a point, we have a radiometer; which can be improved by substituting for the pith-bar several arms, each carrying a blackened disk of pith, and then we have the radiometer shown in Fig. 1. Prof. Crookes called this instrument a radiometer, because it can measure the intensity of the radiation falling on it by counting the number of its revolutions in a given time; the law being that the rapidity of revolution is inversely as the square of the distance between the source of radiation and the instrument. Prof. Crookes has constructed a radiometer with an attached electro-magnetic apparatus which registers the number of revolutions of the "light-mill," as some call it; and he proposes this instrument as a photometer, and as a meteorological instrument to measure the amounts of solar radiation received at different points of the earth.

Measure of the Pressure which Radiation exerts on a Blackened Surface.—In a lecture delivered by Prof. Crookes *On the Mechanical Action of Light*, before the Royal Institution on Feb. 11, 1876, and published in the April number of the *Quarterly Journal of Science*, the reader will find described many interesting experiments with this instrument. We here give an extract from this lecture: "I want to ascertain the amount of pressure which radiation exerts on a blackened surface. . . . The principle of the instrument is that of W. Ritchie's torsion-balance, described by him in the *Philosophical Transactions* for 1830. The construction is somewhat complicated, but can be made out on reference to the diagram (Fig. 4). A light-beam A B, having 2 square inches of pith C at one end, is balanced on a

FIG. 4.



very fine fibre of glass D D′ stretched horizontally in a tube, one end of the fibre being connected with a torsion-handle E passing through the tube, and indicating angular movements on a graduated circle. The beam is cemented to the torsion-fibre, and the whole is enclosed in glass and connected with the mercury pump by the spiral tube F, and exhausted as perfectly as possible. G is a spiral spring to keep the fibre in a uniform state of tension; H is a piece of cocoon-silk; I is a glass stopper, which is ground into the tube as perfectly as possible, and then highly polished and lubricated with melted india-rubber, which is the only substance I know that allows perfect lubrication and will still hold a vacuum. The pith C represents the scale-pan of the balance. The cross-beam A B which carries it is cemented firmly to the thin glass fibre D, and in the centre is a piece of mirror K. Now, the cross-beam A B and the fibre D being rigidly connected together, any twist which I give to the torsion-handle E will throw the beam out of adjustment. If, on the other hand, I place a weight on the piece of pith C, that end of the beam will fall down, and I shall have to turn the handle E round and round a certain number of times until I have put sufficient torsion on the fibre

D to lift up the beam. Now, according to the law of torsion, the force with which a perfectly elastic body like glass tends to untwist itself is directly proportional to the number of degrees through which it has been twisted; therefore, knowing how many degrees of torsion I must put on the fibre to lift up the $\frac{1}{100}$th of a grain weight, I can tell how many degrees of torsion are required to lift up any other weight; and conversely, putting an unknown weight or pressure on the pith, I can find its equivalent in grains by seeing how much torsion it is equal to. Thus, if $\frac{1}{100}$th of a grain requires 10,000 degrees of torsion, $\frac{1}{50}$th of a grain would require 20,000 degrees; and conversely, a weight which required 5000 degrees torsion would weigh $\frac{1}{200}$th of a grain. Once knowing the torsion equivalent to $\frac{1}{100}$th of a grain, the ratio of the known to the unknown weights is given by the degrees of torsion.

"Having thus explained the working of the torsion-balance, I will proceed to the actual experiment. On the central mirror I throw a ray from the electric light, and the beam reflected on a particular spot of the ceiling will represent zero, and the counter which I fasten on at the end L stands at zero. I lift up my little iron weight by means of a magnet (for, working in a vacuum, I am restricted in the means of manipulating), and drop it in the centre of the pith; it knocks the scale-pan down, as if I had placed a pound weight on an ordinary balance, and the index-ray of light has flown far from the zero-point on the ceiling. I now put torsion on the fibre to bring the beam again into equilibrium. The index-ray is moving slowly back again. At last it is at zero, and on looking at the circle and counter I see that I have had to make 27 complete revolutions and 301 degrees, or $27 \times 360° + 301 = 10{,}021°$, before the force of torsion would balance the $\frac{1}{100}$th of a grain. I now remove the weight from the pith-pan of my balance, and liberate the glass thread from torsion by twisting it back again. Now the spot of light on the ceiling is at zero, and the counter and index are again at zero.

"Having thus obtained the value to the $\frac{1}{100}$th of a grain in torsion degrees, I will get the same for the radiation from a candle. I place a lighted candle exactly 6 inches from the blackened surface, and on removing the screen the pith scale-pan falls down and the index-ray again flies across the ceiling. I now turn the torsion-handle, and in much less time than in the former case the ray is brought back to zero. On looking at the counter, I find it registers 4 revolutions and the index points to 188 degrees, making altogether $360° \times 4 + 188 = 1628°$, through which the torsion-fibre has to be twisted to balance the light of the candle. It is an easy calculation to convert this into parts of a grain weight; 10,021 torsion degrees representing 0.01 grain, 1628 torsion degrees represent 0.001624 grain—$10021° : 0.01$ grain $: : 1628° : 0.001624$ grain.

"The radiation of a candle 6 inches off, therefore, weighs or presses the two square inches of blackened pith with a weight of 0.001624 grain. In my own laboratory, working with this torsion-balance, I found that a candle 6 inches off gave a pressure of 0.001772 grain. But this balance is capable of weighing to a far greater accuracy than that. You have seen that a torsion of 10,021° balanced the $\frac{1}{100}$th of a grain. If I give the fibre 1 degree more twist, the weight is overbalanced, as shown by the movement of the index-ray on the ceiling. Now, 1 degree of torsion is about the $\frac{1}{10000}$th part of the whole torsion required by the $\frac{1}{100}$th of a grain. It represents, therefore, the $\frac{1}{10000}$th part of the $\frac{1}{100}$th grain, or the millionth part of a grain. Divide a grain weight into a million parts, place one of them on the pan of the balance, and the beam will be instantly depressed!

"Weighed in this balance, the mechanical force of a candle 12 inches off was found to be 0.000444 grain; of a candle 6 inches off, 0.001772 grain. At half the distance, the weight of radiation would be four times, or 0.001776 grain. The difference between theory and experiment being only four-millionths of a grain, is a sufficient proof that the indications of this instrument, like those of the apparatus previously described, follow the law of inverse squares. An examination of the differences between the separate observations and the mean shows that my estimate of the sensitiveness of this balance is not excessive, and that in practice it will safely indicate the millionth of a grain. . . . But however fair an equivalent ten candles may be for a London sun in December, a midsummer sun in a cloudless sky has a very different value. Authorities differ as to its exact equivalent, but I under-estimate it at 1000 candles 12 inches off. Let us see what pressure this will give: A candle 12 inches off, acting on 2 square inches of surface, was found equal to 0.000444 grain; the sun, equalling 1000 candles, therefore gives a pressure of 0.444 grain—that is, equal to about 32 grains per square foot, to 2 cwt. per acre, 57 tons per square mile, or nearly 3,000,000,000 tons on the exposed surface of the globe—sufficient to knock the earth out of its orbit if it came upon it suddenly. . . . Whilst showing this experiment, I wish to have it distinctly understood that I do not attach the least importance to the actual numerical results. I simply wish to show you the marvellous sensitiveness of the apparatus with which I am accustomed to work. I may, indeed, say that I know these rough estimates to be incorrect. It must be remembered that our earth is not a lamp-blackened body enclosed in a glass case, nor is its shape such as to give the maximum of surface with the minimum of weight."

We here give an abstract from a paper on Crookes's radiometer by Dr. Arthur Schuster, published in the *Proceedings of the Royal Society* for Mar. 23, 1876. This paper, with the preceding facts, will give the reader all of the knowledge necessary to the understanding of the best explanation yet given of the phenomena presented by the radiometer: "Whenever we observe a force tending to drive a body in a certain direction, we are sure to find a force equal in amount acting in the opposite direction on the body from which the force emanates. It was with the view of finding the seat of this reaction that I made a few experiments. If the force is directly due to radiation, the reaction will be on the radiating body: if, on the other hand, it is due to any exterior action, the reaction will be on the enclosure of the moving bodies. I have been able to test this by experiment, and I have found that the action and reaction is entirely between the light bodies suspended *in vacuo* and the exhausted vessel. The radiometer was suspended by means of two cocoon-fibres, forming a bifilar suspension, from the top of a vessel which could be exhausted. A slight movement of the enclosure could be easily detected by means of a concave mirror attached to it. A beam of the oxyhydrogen lamp was concentrated on the light-mill, which then revolved about 200 times a minute. The light was cut off at the beginning of the experiment by means of a screen, and the position of rest of the glass vessel was read off by means of the dot of light on the scale. The screen was then suddenly removed, and in every case a large deflection of the glass vessel was observed. The vessel was deflected in the opposite direction to that in which the mill turned. When the velocity of the mill had become constant, the vessel returned to its original position. On suddenly cutting off the light, the vessel was again deflected, but in the opposite direction to that on starting the experiment. The vessel, therefore, now turned in the same direction in which the mill turned.

"These experiments are easily explained on the assumption that the force acting on the vessel enclosing the light-mill is exactly equal and opposite to that acting on the mill itself. While the velocity of the mill in one direction is increasing, a force acts in the opposite direction on the vessel. When the velocity has become constant, the force which tends to drive the mill around is exactly counterbalanced by the resistance which opposes the motion of the mill; the two forces acting on the vessel will therefore counterbalance, and the vessel will return to its original position of rest. When the light is cut off, the resistance will stop the motion of the mill. The reaction of the resistance will act on the enclosure, and the enclosure will turn in the same direction as the mill.

"By means of the reaction on the enclosure I have been able to calculate the strength of the force, and I have found that the pressure on a surface on which light of equal intensity to that used in my experiments falls is equal to that produced by the weight of a film of water on a horizontal surface equal in thickness to the length of a wave of violet light."

Explanation of the Motions of the Radiometer.—The most favorably-received explanation of the actions observed in the radiometer is that recently given by Prof. G. J. Stoney in the *Philosophical Magazine*, Mar., 1876. He bases his reasoning on the kinetic hypothesis of the constitution of a gas, according to which the molecules of a gas are in a constant state of vibration. The intensity of the vibratory motions is dependent on the temperature of the gas, and the degree of pressure which a gas exerts is due to the amount of these molecular motions. Prof. Stoney assumes that the pressure of the gas in a Crookes radiometer is about one-tenth of a millimètre of mercury; and he states that according to his own calculations and those of Sir W. Thomson and of Loschmidt, the number of molecules remaining in this so-called vacuum must be somewhere about one hundred millions of millions in every cubic millimètre. He then shows that to the peculiar character of the molecular motions in this rarefied gas is due the observed phenomena. He reasons thus: "Upon the blackened surface of the disks fall those radiations from the candle which are capable of passing through the glass. These will heat the blackened disk to a considerable degree, but not the transparent glass. I shall assume that the disk is heated one-tenth of a degree Centigrade more than the

glass. The disk in turn will warm a layer of air in contact with it. Throughout the thickness of a layer of this kind, if not interfered with, the temperature varies gradually, having on one side the temperature of the surrounding air, and on the other the temperature of the disk. If the chamber enclosing the apparatus contained air at atmospheric pressure and temperature, this layer would be thin. It would consist of air which has been expanded by the warmth of the disk, while the air in the rest of the chamber would by this expansion be in a trifling degree compressed. In other words, the molecules whose activity has been increased by contact with the heated disk would, in their encounters with other molecules, keep back some of them, and in this way reduce the number of molecules striking the heated disk, while this process would slightly crowd molecules into the rest of the chamber, and thus increase the number coming into collision with unheated surfaces. In this way the pressure everywhere is in a small degree raised, but everything is adjusted so that there is no excess of pressure anywhere; and this adjustment takes place in an exceedingly short period of time—so short that no sensible motion of the disk can establish itself while it is being effected. In fact, the number of molecules in a cubic millimètre of atmospheric air is known to be about a million of millions of millions; the molecules are dashing about with velocities of which the average is about 500 mètres per second; each meets with about a thousand millions of encounters with others in every second; and the adjustment accordingly takes place with what is promptitude as compared with visible motions.

"It is necessary for our purpose to form some estimate of the thickness of the layer of warmed air. In the absence of direct experiments, I assume that this layer of graduated temperature would in ordinary air be about as thick as a sheet of paper if the disk were 20° C. hotter than the air. This seems a very moderate estimate, judging from the copiousness of the convection currents which would quickly establish themselves if there were such a difference of temperature. And from this assumption it follows that if the temperature of the disk had been raised one-tenth of a degree before the chamber was exhausted—which I have assumed to be about the elevation of temperature that actually takes place in the radiometer—the thickness of the warmed layer of air would be about the wave-length of light of mean refrangibility, and about one-sixteenth the diameter of the disks which float in human blood. Let us suppose, then, that a layer of this thickness is heated, irrespective of convection, when ordinary air is inside the apparatus. On the foregoing assumptions we can compute what the state of things will be when the chamber is exhausted. When the pressure is made to vary, it appears from the doctrine of probabilities that the value of λ (using λ to designate the length of the average excursion of a molecule—*i. e.* the distance a molecule on the average travels in the intervals between two of its encounters with other molecules) will vary inversely as $\delta^{\frac{3}{2}}$, δ being the density. Now, the thickness of the layer of graduated temperature depends on λ, and will vary in the same ratio as it. We have supposed the density in our vacuum-chamber to be $\frac{1}{10000}$th of an atmosphere; it will follow that the thickness of the heated layer in this attenuated medium would be $10{,}000^{\frac{3}{2}}$ times what it is in ordinary air, and would therefore become half a sixth-mètre $\times 10{,}000^{\frac{3}{2}}$, which is more than a decimètre. It therefore reaches quite to the walls of our little vacuum-chamber; and this very materially alters the state of affairs. In fact, we have on one side glass at a temperature of, suppose, 15°, on the other a disk at a temperature of 15.1°, and between them a space which is only a part of what would be required to establish a complete gradient of temperature in the intervening air. This is equivalent to saying that some of the additional momentum communicated to molecules of air by the heated disk, instead of expending itself in interaërial collisions, and thus increasing the general temperature and pressure of the air, makes its way across the intervening stratum to the opposite walls of glass, where it occasions an increased pressure against them, of which the resultant is directed perpendicularly from the disk. The momentum of the accelerated molecules which reach the glass falls after the contact of the molecules with the glass to the feebler type corresponding to its lower temperature; and it is chiefly momentum of this feebler type which makes its way to regions behind the disk. An excess of force equal and opposite to that on the glass acts against the front of the disk, and is sufficient to account for the phenomena which Mr. Crookes has investigated. For its amount may be approximated to as follows: Instead of the actual condition of the molecules which come into collision with the heated disk, we may substitute one more convenient for calculation. The resulting pressure will be the same as if some moderate portion of the molecules, say one-third of them, had reached it with velocities corresponding to the temperature 15.1°, while the remaining two-thirds reached it with velocities corresponding to 15°. We may further regard the increased pressure on the disk caused by the former class of molecules as equal in amount to the portion which is compensated by the slight reductions of density in the neighborhood of the disk, and by the slightly-increased temperature and density elsewhere, which are due to the existence of a portion of the gradient. Under this hypothesis the effect of these molecules may be left out of account. There would, however, remain the augmented pressure arising from the other two-thirds of the molecules, uncompensated so far as regions behind the disk are concerned; and it is the amount of this pressure which we have now to estimate. The molecules in question reach the disk, according to the hypothesis, with velocities corresponding to 15°, and are thrown off from it with velocities corresponding to 15.1°. It is easy to see that the augmentation of pressure which they will produce upon the disk will be half what would arise if they had reached the disk as well as left it with velocities corresponding to the higher temperatures. This latter can be calculated by Boyle and Mariotte's law. It is two-thirds of a decigramme $\times \frac{0.1}{273 + 15}$, or 0.000023 of a gramme per square centimètre. The uncompensated excess of pressure on the disk will, upon the assumption we have made, be half of this, or 0.0000115 of a gramme per square centimètre, the amount as determined experimentally by Mr. Crookes being 0.00001. Accordingly, an elevation of the temperature of the blackened face of the disk to the extent of about one-tenth of a degree above the temperature of the glass and of the back of the disk is enough to account for the observed pressure."

Quite recently the writer of this article has discovered that a pressure, somewhat analogous to the above, exists between the front of a sounding organ-pipe and the interior of a neighboring resonator, so that the latter, when suspended from an arm of a torsion-balance, will be repelled from the sounding-pipe. ALFRED M. MAYER.

Rad′ish [Ang.-Sax. *rädic*], the *Raphanus sativus*, a cruciferous plant, a native of Asia, cultivated for its root, employed as a table relish. The root is stimulant, diuretic, and antiscorbutic. The seeds of some varieties yield an oil almost identical with rape and colza oil.

Ra′dius [Lat., "spoke"], the outer bone of the fore arm, on the same side with the thumb. It is parallel with the ulna, which is larger than the radius, and enters much more closely into the formation of the elbow-joint, while the radius forms the joint with wrist-bones. Thus the hand of man acquires its susceptibility of rotation.

Radius. The radius of a circle is the distance from the centre to any point of the circumference. The radius of a sphere is the distance from the centre to any point of the surface.

Radius of Curvature, the radius of an osculatory circle—that is, the radius of a circle passing through three consecutive points of a curve. (See OSCULATION.)

Radius Vector. In a system of polar co-ordinates the radius vector is the distance from the pole of the system to any point of a line or of a surface.

Rad′nor, tp., Peoria co., Ill. P. 948.

Radnor, p.-v. and tp., Delaware co., O. P. 1255.

Radnor, p.-v. and tp., Delaware co., Pa., on Pennsylvania R. R. P. 1431.

Rad′norshire, an inland county of South Wales, comprises an area of 425 sq. m., with 25,428 inhabitants. The surface is irregular and mountainous; more than one-half of the soil is bog and moorland. Barley, oats, and potatoes are grown; cattle and sheep are reared. Principal towns, Presteign and New Radnor.

Rad′noth, town of Transylvania, on the Maros, is noted for the splendid palace which Prince George Rakoczy I. had built here by the Venetian architect Augustino Serana. P. about 1200.

Ra′doboj, town of Austria, in Croatia, is noted for its sulphur-mines, which annually yield about 2500 cwts. of sulphur. P. about 1100.

Ra′dolfzell, town of Germany, in the southern part of the grand duchy of Baden, at the confluence of the Radolfzeller Ach with the Untersee, is noted for its fine Gothic church of the eleventh century, and for its cultivation of wine, fruit, and vegetables. P. about 2000.

Ra′dom, government of Poland, European Russia, bounded N. by the government of Warsaw, comprises an area of 4768 sq. m., with 532,466 inhabitants. It is the most elevated portion of the Polish plain, being traversed by the Sandomir Mountains, which rise to a height of

about 2000 feet. Forests abound; agriculture and breeding of horses and cattle are the principal occupations.

Radom, town of Poland, European Russia, the capital of the government of Radom, is situated on the Radomsk, and has some trade and manufactures. P. 10,944.

Ra'dowitz, von (Joseph Maria), b. at Blankenburg, grand duchy of Brunswick, Germany, Feb. 6, 1797; received his military education at Paris and Cassel; fought in the campaigns of 1813 and 1815; was subsequently appointed teacher of mathematics at the military school of Cassel; removed in 1823 to Prussia, and held various high military and diplomatic positions, for a short time in 1850 that of minister of foreign affairs. D. at Berlin Dec. 25, 1853. His influence, although very widely spread, was nevertheless small, and even his ideas, such as they appear in his *Gespräche aus der Gegenwart über Staat und Kirche* (i. 1846; ii. 1851), and *Gesammelte Schriften* (5 vols., 1852–53), derive their principal interest from the very intimate friendship, and, so to speak, community of ideas, between the author and Frederick William IV.

Rad'stadt, town of Austria, near Salzburg, on the road which crosses the Noric Alps through the depression called Radstädler Tauern, is encircled with walls surmounted with towers, and contains a convent and several old buildings of interest. P. about 3000.

Radu the Black, the first native prince of Wallachia (about 1280), celebrated for the negotiations which he carried on with the papal see for the introduction in his country of the Roman Catholic conception of Christianity. The Wallachians received Christianity very early, and were under the metropolitan of Ochrida in Macedonia. In 861 they adopted the alphabet introduced by Cyrillus among the Bulgarians, and the Slavonian language became their church language. When the schism took place between the Eastern and Western churches, they followed unhesitatingly the former, and the pope of Rome was to them an abomination. Radu nevertheless received some monks of the mendicant orders in the country, and it seemed as if a reconciliation were about to be accomplished, but under his successor the negotiations were again broken off, and the monks were partly expelled, partly put to death.

Rae (John), M. D., LL.D., b. in the Orkney Islands early in the nineteenth century; studied medicine at Edinburgh; entered the service of the Hudson's Bay Company as a surgeon 1833; made several explorations through British America; visited the shores of the Arctic Sea 1846–47; was a member of Sir John Richardson's expedition in search of Sir John Franklin 1848; conducted a similar expedition 1850; reached Repulse Bay; discovered a large river flowing into Chesterfield Inlet, and found the first traces of Franklin's fate. Author of *A Narrative of an Expedition to the Shores of the Arctic Sea* (1850) and other works.

Rae'burn (Henry), R. A., b. at Stockbridge, near Edinburgh, Mar. 4, 1756; educated in Heriot's Hospital; was apprenticed to a goldsmith; displayed such genius for miniature-painting that in his leisure hours he earned enough money to buy up his indenture; afterward devoted himself to oil-painting; studied some months under Sir Joshua Reynolds; spent two years in Italy; established himself as a portrait-painter in Edinburgh 1787; soon became the most eminent artist of Scotland; became president of the Society of Artists, Edinburgh, 1812, and was knighted 1822. D. at Edinburgh July 8, 1823. He has left portraits of nearly all the eminent Scotchmen of his time, and his pictures are now much valued. His style was formed upon that of Reynolds, and has been compared to that of Velasquez.

Raffadali, town of Sicily, province of Girgenti, situated on a hill about 8 miles from the town of Girgenti. This place, of Saracenic origin, exports grain, olive oil, and cheese in considerable quantities. P. 6700.

Raffaelle. See Raphael.

Raf'fles (Thomas), D. D., LL.D., b. in London May 17, 1788; educated at Homerton College; settled at Hammersmith in 1809, and in 1812 succeeded Thomas Spencer (who was drowned in the Mersey) as pastor of the Great George street chapel, Liverpool. D. Aug. 18, 1863. Some of his hymns have been very popular. He published *The Life and Ministry of the Late Thomas Spencer* (1813), *A Tour on the Continent* (1817), *Lectures on Christian Faith and Practice* (1820).—His son, Thomas Stamford Raffles, of the Inner Temple, published an admirable biography of his father in 1864. R. D. Hitchcock.

Raffles (Thomas Stamford), cousin of the preceding, b. at sea off Point Morant, Jamaica, July 5, 1781, son of a sea-captain in the West India trade; obtained at the age of fifteen an assistant clerkship in the East India House, where his talents procured him rapid advancement. In 1805, on the formation of a government at Pulo-Penang (or Prince of Wales Island), the court of directors gave him the appointment of assistant secretary, and in 1807 he was made principal secretary. By assiduous study of the Malay language, and careful researches among the numerous races of the Indian Archipelago, aided by a visit to Malacca in 1808, Raffles soon became a leading authority upon the ethnology of that little-known region; was secretary to the governor-general of India, Lord Minto, during the expedition against Java 1811; was made lieutenant-governor of the newly-acquired colony, and administered that important island and its dependencies with great judgment for five years, effecting the abolition of slavery and acquiring the good-will of the native princes. Returning to England on account of ill-health, he was knighted in 1817, and published his *History of Java* (2 vols. 4to, 1817), which is still the best English account of that island. Java having been restored to the Dutch, Raffles was in 1818 made lieutenant-governor of the settlement at Fort Marlborough, Bencoolen, on the coast of Sumatra, where he formed a fine collection of natural history, which was unfortunately lost by the burning of a ship in which he, with his family, had taken passage for England, Feb., 1824. While in Sumatra he emancipated the slaves, formed the new British settlement of Singapore (1819), endowed there a college for the study of Malay and Chinese literature, and published two vols. of *Malayan Miscellanies* (Bencoolen, 1820–22). On his arrival in England, Sir Stamford founded the Zoological Society of London, of which he was the first president, and devoted himself chiefly to its interests. D. at London July 4, 1826. A *Memoir* was published by his widow (4to, 1830).

Raffle'sia [named in honor of Sir T. Stamford Raffles (1781–1826)], a genus of remarkable rhizogenous plants of the order Rafflesiaceæ. (See Rhizogens.) The Rafflesias are natives of Sumatra and Java, parasitic upon stems and roots of *Cissus*. They are all stemless, rootless, and leafless, mere flowers, with a few scales for leaves; the seeds are of a rudimentary character, and once regarded as spore-like. The plant has a fungus-like, fleshy appearance, and an intolerable odor of carrion. *R. Arnoldi* is considered the largest flower in the world. It is some three feet in diameter, and has been known to weigh fifteen pounds. It is worshipped by the Javanese. *R. patma* has strong styptic power. *R. Horsfieldii* is but three inches across.

Rafinesque' (Constantine Smaltz), b. of French parents at Galata, a suburb of Constantinople, in 1784; was sent to the U. S. 1802, landing at Philadelphia; he soon developed a fondness for natural history; made many excursions for collecting botanical specimens; went to Leghorn 1805, and thence to Sicily, where he resided ten years, and published (in French) several scientific works; sailed for New York 1815; lost by shipwreck on the coast of Long Island all his effects, including valuable books, manuscripts, and collections; went to the West in 1818; was for some years professor of botany in Transylvania University, Lexington, Ky.; travelled and lectured in other States; settled finally at Philadelphia; wrote many monographs in various branches of natural history; published *Annals of Kentucky* (1824), *The American Florist* (1832), *Atlantic Journal and Friend of Knowledge* (8 numbers, 1832–33), *The American Nations* (2 vols., 1836), *Medical Flora of the U. S.* (2 vols., 1828–30), *A Life of Travels and Researches* (1836), and other works. D. at Philadelphia Sept. 18, 1842. The *Writings of C. S. Rafinesque on Recent and Fossil Conchology* have been edited by W. G. Binney and G. W. Tryon, Jr. (Philadelphia, 1864).

Rafn (Karl Christian), b. at Brahesborg, island of Fünen, Denmark, Jan. 16, 1795; studied at the University of Copenhagen; was appointed librarian of the university in 1821, and founded in 1825 the Society for Northern Antiquities. D. at Copenhagen Oct. 20, 1864. Besides a number of critical editions (*Krákumál* (1826), *Fornaldar Sögur* (3 vols., 1829), *Färeyinga Saga* (1832), and parts of *Fornmanna Sögur* (12 vols., 1828, *seq.*)) and minor essays, he wrote *Antiquitates Americanæ* (1837), *Grönlands historiske Mindesmærker* (3 vols., 1838–45), and *Antiquités russes et oriéntales* (3 vols., 1850–54). In his *Antiquitates Americanæ* he proved from geographical, astronomical, and nautical dates contained in the Scandinavian sagas that the Scandinavians discovered America in the tenth century, and between the eleventh and fourteenth centuries occupied parts of the coast of Rhode Island and Massachusetts —an hypothesis which local researches have since confirmed.

Raft'ing Creek, tp., Sumter co., S. C. P. 1585.

Rag'lan, tp., Harrison co., Ia. P. 334.

Raglan (Fitzroy James Henry **Somerset**), Baron, son of the fifth duke of Beaufort, b. in England Sept. 30,

1788; educated at Westminster School; entered the army as ensign 1804; attended Sir A. Paget to Constantinople 1807; accompanied the duke of Wellington in the Peninsula as a member of his staff, rising to the position of aide-de-camp and military secretary 1807; was wounded at Busaco 1810; distinguished at Badajoz 1812; lost his right arm at Waterloo; was knighted and made colonel; was secretary of embassy at Paris 1816–19; entered Parliament as a Conservative 1818 and 1826; was again military secretary to Wellington thirty-three years, from 1819 to the death of the latter; was appointed master-general of the ordnance Sept., 1852; made Baron Raglan Oct., 1852; commanded the British expedition to the Crimea with the rank of general Mar., 1854; defeated the Russians at the battle of the Alma, Sept. 20; fought the battles of Balaklava, Oct. 25, and Inkermann, Nov. 5, and was made field-marshal Nov., 1854. D. of cholera in the camp before Sebastopol June 28, 1855. His military papers formed the principal material for Kinglake's *History of the Crimean War.*

Rag'lesville, p.-v., Van Buren tp., Daviess co., Ind. P. 53.

Rag'stone, or **Rag,** a silicious limestone with a rough fracture, used for whetstones and for building material. The term is, however, quite loosely applied.

Raguet' (Condy), LL.D., b. in Philadelphia, Pa., Jan. 28, 1784; was educated at the University of Pennsylvania, and studied law; engaged in commercial pursuits; went to St. Domingo as supercargo of a vessel 1804; returned there 1805; published two small books giving an account of the state of that island and a history of the massacre of the planters; went into business on his own account 1806; accumulated a fortune; took an active part in several useful corporations and mercantile associations, and in taking measures for the defence of the city against an expected attack by a British fleet 1812; served in both branches of the legislature; became in 1822 consul at Rio de Janeiro, Brazil; negotiated a commercial treaty with that country, to which in 1825 he was appointed the first chargé d'affaires; returned in 1827, and wrote much in periodicals, especially in the *Portfolio,* in favor of free trade. D. at Philadelphia Mar. 22, 1842. Author of *Principles of Free Trade* (1835), *On Currency and Banking* (1839), and other works; editor of *Free Trade Advocate* (2 vols., 1829), *Examiner* (2 vols., 1834–35), and *Financial Register* (2 vols., 1837–39).

Ragu'sa, town of Austria, in Dalmatia, on a peninsula of the Adriatic, and built in terraces on the side of Mount Sergio, the upper streets communicating with the lower by flights of steps. It is strongly fortified with citadels and walls surmounted by towers. Of its two harbors, Porto Casson admits only small vessels, but Gravoso, on the N. side of the peninsula, 2 miles from the city, can accommodate the largest men-of-war. Ragusa was formerly one of the commercial centres of the Adriatic, and formed an independent republic; its fortifications and palaces bear witness to its past splendor. But in the last 100 years it has greatly declined. Soap, liquors, silk, and leather are manufactured, and a lively transit-trade is carried on. It suffers often from earthquakes. P. 8678.

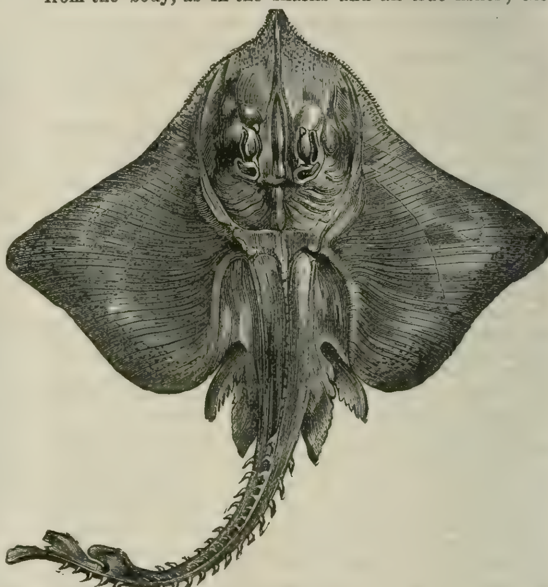
Ragusa, town of Sicily, province of Syracuse, about 9 miles N. N. W. of Modica. This city is now divided into Upper and Lower Ragusa, each having its own proper municipal organization. In the upper town, Ragusa Superiore, some interesting old churches escaped destruction in the earthquake of 1693, but they have been greatly injured by modern injudicious restorations, especially Santa Maria della Scala. The remains of mediæval buildings overthrown by earthquakes may still be seen in various parts of the city, near which are also the ruins of a large fortress in a strong position and provided with subterranean vaults. Many old cisterns exist outside the walls, and about a mile to the W. of the double town there is an ancient cemetery containing tombs, and by the side of this another in the form of a labyrinth. Ragusa is of very ancient origin, took part with Syracuse against the Romans, and was by the latter reduced to a colony. In 844 A. D. it was taken and sacked by the Saracens. It is now a place of considerable industry and commerce, the near landing of Mazzarelli serving as its port. P. of Ragusa Inferiore, 6800; of Ragusa Superiore, 21,550.

Rahdunpoor', town of Western Hindostan, in lat. 23° 52′ N. and lon. 71° 38′ E., the capital of a small state of the same name dependent on Great Britain. The whole dominion has an area of 850 sq. m., with 45,000 inhabitants, of whom about 15,000 live in the capital, chiefly employed in the manufacture of coarse cotton fabrics.

Rahn, tp., Schuylkill co., Pa. P. 1227.

Rah'way, city, Union co., N. J., on the river of the same name, navigable for boats of from 4 to 8 feet draught, about 20 miles S. W. of New York City. It contains 17 churches, 1 public and 1 circulating library, an opera-house, 2 public halls, 1 high school, and 5 public schools, with several private seminaries, 2 national and 2 savings banks, 2 weekly newspapers, 1 street railway, 2 insurance companies, 2 woollen mills, 1 hub and 2 spoke factories, a printing-press manufactory, 30 carriage-factories, and several other manufacturing interests. The city is supplied with water and gas, and has 2 cemeteries handsomely laid out. P. 6258. Ed. "Advertiser and Times."

Rai'æ [Lat. *raia,* "ray" or "skate"], according to some authors an order, and to others a sub-order, of the class of Elasmobranchiates, including the rays, torpedoes, and related types. The pectoral fins are much developed, and produced from the anterior margins forward, and connected with the rostral cartilages, thereby constituting an integral part of the form, and not abruptly differentiated from the body, as in the sharks and all true fishes; the



The Bordered Ray.

branchial openings are in two converging rows of five each on the inferior surface of the body; spiracles are well developed behind the eyes. In other respects the order essentially agrees with the Squali, and the two form a common super-order or sub-class—the Plagiostomi. The form varies considerably in the several members of the order; on the one hand, the sawfishes have an outline much like that of the sharks, and with a long caudal portion; and on the other hand, the eagle rays and certain stingrays have a disk extremely wide—much wider than long—and the caudal portion is reduced to a whip-like appendage. These two forms exemplify the extremes of the characteristics according to which the order is divided into two sub-orders—viz. (1) Pachyura (including the Raiidæ, Rhinobatidæ, Pristidæ, and Torpedinidæ); and (2) Masticura, including the eagle rays (Myliobatidæ), devil-fishes (Cephalopteridæ), and stingrays (Trygonidæ). Theodore Gill.

Rai'idæ [Lat. *raia,* "ray"], a family of the order Raiæ, including the common skates or rays. In all these the disk is broad and more or less sub-rhomboid, and the tail slender, but fleshy, and rather longer than the disk; the skin covered with radiated spines or asperities; the head well defined, and with a more or less pointed snout; the internasal region furnished with a broad velum; the mouth transverse; the teeth small, generally varying according to the sex; the dorsals two in number, small and situated on the terminal half of the tail; the caudal reduced to a narrow seam. The female is oviparous, laying eggs provided with parchment-like cases furnished at each angle with a filamentous extension; these cases are known popularly as "sailors' purses," and are rather common on the sea-shore. Between thirty and forty species are known, some or other of which are found in all seas, but are more numerous in the northern than the southern hemisphere. Five species are known from the eastern coast of the U. S. (*Raia erinacea, R. ocellata, R. radiata, R. eglanteria,* and *R. lævis*), and two from the western coast (*R. Cooperi* and *R. binoculata*). Theodore Gill.

Raikes (Robert), b. at Gloucester, England, in 1735, became editor and publisher of the Gloucester *Journal;* founded a system of Sunday schools for poor children in 1781, and witnessed its extension to most of the towns of England. D. Apr. 5, 1811.

Rail [Fr. *râle*], the English name for various species of the family Rallidæ, but especially applied to species of the genus *Rallus* and *Porzana* in the U. S. The former has the bill comparatively slender and longer than the head; it embraces (1) the common or marsh rail (*Rallus elegans*), the largest species found in the U. S., whose total length is about seventeen inches; and (2) the clapper-rail or mud-hen (*R. crepitans*), whose length is about fourteen inches. The species of the latter genus have a comparatively thick bill, which is not longer, and even shorter, than the head; to it belong (1) the common rail or sora (*Porzana Carolina*), whose length is between eight and nine inches; (2) the little black rail (*P. Jamaicensis*), about five inches in length; and (3) the little yellow rail (*P. noveboracensis*), whose length is about six inches. These frequent salt-water marshes, and are all sought after by the sportsman as game-birds. Theodore Gill.

Rail Road, tp., Chicot co., Ark. P. 1008.

Rail Road, tp., Starke co., Ind. P. 532.

Railroad, tp., Elko co., Nev. P. 110.

Railroad Equipment. See Railroads, by Col. Julius W. Adams, C. E.

Railroad Junction, tp., Carlton co., Minn. P. 27.

Railroad Laws. See Appendix.

Rail′roads, roads with parallel tracks of iron rails upon which the carriages run. The term is used as a synonym for "railway." The latter term is exclusively used in England, and is gaining ground in this country, but it would appear to be incorrect, from the fact that *way* may be regarded as the generic term for the path which a person chooses at pleasure for himself, while *road* specifies the kind of way: "Instead of keeping the high *road* to town, you may go a shorter *way* across the fields."

History.—The plan of facilitating the draught of carriages by forming a hard continuous surface for the wheels to run upon is old and simple, and the successive adaptation of flag-stones, pieces of timber, and finally strips of iron fastened to the top of the timbers, are the several improvements it has undergone. The use of iron was found to reduce the friction very sensibly, and to increase more than fourfold the amount which the horses could draw from the mines, where such tracks were mostly in use; a ledge or flange on the outer edge of the plate of iron forming the rail enabled the ordinary wagon to keep on the rails without difficulty. This kind of track was long in use, and was known as a tramway. The next improvement, growing out of the necessity for increased strength in the rails, was the introduction of the edge rail, formed by setting up a bar of cast or rolled iron in the form of a ⊤. This required special supports called "chairs," spiked to the timber rails or to cross-supports of timber called "ties," or at intervals to stone blocks. To produce uniform strength between the points of support, the iron rail was made of an elliptical profile—that is, the upper part of the ⊤ upon which the wheels rolled was a straight line, while the stem of the ⊤ varied in depth, being thinnest at the points of support and deeper intermediately. These constituted the "fish-bellied rail," for a long time considered the proper form for iron rails. In this rail the flange, which in the tramway was necessary to prevent the wheels from leaving the track, was removed, and in lieu of it a flange was cast on the inner edge of the wheel-tires. Railroads constructed upon this principle were in operation in the principal collieries in England and Germany toward the close of the last century, used for the transportation of coal or ores from the pit to the port of shipment, sometimes by the force of gravity; and where the acclivity had sufficient steepness the loaded wagons in descending drew up the empty wagons by means of an endless rope passing around a pulley at the summit of the incline; in others, horse or steam power was used.

In 1802, Trevithick took out the first patent for adapting a steam-engine to move upon a road, although Watt is said to have invented one previously. As early as 1804 steam was used as a means of propulsion on some of these roads, but the speed was not greater than that of horses, owing to the imperfect construction of the boilers of the engines; and on grades as low as 18 feet per mile they required to be assisted by auxiliary power of some sort; and, what is very remarkable, the progress of improvement in the engine used for roads was much retarded for many years by an imaginary difficulty which it would seem a single experiment would have sufficed to remove. This was in the opinion that the friction, or the adhesion of the driving-wheels of an engine to the rails, did not offer sufficient resistance to slipping to allow of the power of the engine being applied to the axles so as to produce locomotion. As late as 1811, Blinkinsop obtained a patent for the application of a rack-rail, laid on one side of the railway, into which a cog-wheel on the axles of the driving-wheels worked. Other patents are on record as late as

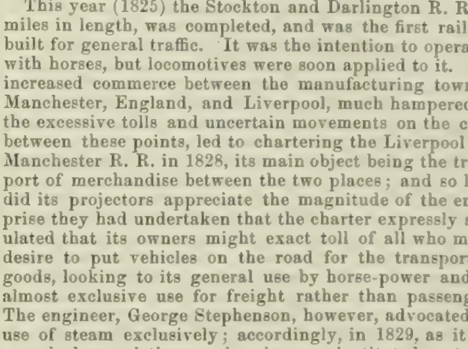
Fig. 1.

South Hetton Collieries Railway.

1815, looking to overcoming this fictitious difficulty—some by means of chains extending the whole length of the road between the rails, and others by means of jointed levers worked by steam. It was at about this date that the important discovery was made that the adhesion of the wheels of the engine to the rails furnished a sufficient fulcrum for the action of the propelling power, thus dispensing with all the cumbersome contrivances of racks, chains, etc.; and yet as late as 1825 we find the record of a patent for a locomotive requiring for its action a racked rail lying midway between the bearing-rails of the track.

This year (1825) the Stockton and Darlington R. R., 37 miles in length, was completed, and was the first railroad built for general traffic. It was the intention to operate it with horses, but locomotives were soon applied to it. The increased commerce between the manufacturing town of Manchester, England, and Liverpool, much hampered by the excessive tolls and uncertain movements on the canal between these points, led to chartering the Liverpool and Manchester R. R. in 1828, its main object being the transport of merchandise between the two places; and so little did its projectors appreciate the magnitude of the enterprise they had undertaken that the charter expressly stipulated that its owners might exact toll of all who might desire to put vehicles on the road for the transport of goods, looking to its general use by horse-power and its almost exclusive use for freight rather than passengers. The engineer, George Stephenson, however, advocated the use of steam exclusively; accordingly, in 1829, as it approached completion, an inquiry was instituted as to the respective merits of stationary and locomotive steam-power, and two of the four commissioners appointed for the purpose reported in favor of working the road by stationary engines, and two, including the engineer, were decidedly in favor of the use of locomotive engines; and the directors of the road were induced to offer a reward for a locomotive engine which should be able to take *three times* its own weight on a level road at a speed of *ten miles per hour*—such performance being then unknown—the price of the

Fig. 2.



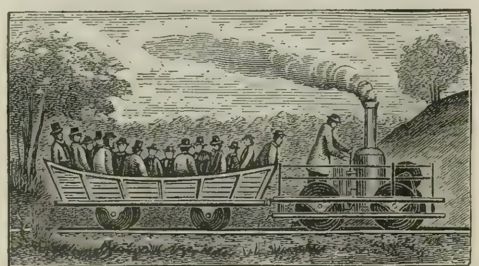
The Rocket—the first successful English Locomotive.

engine to be restricted to £550. In October of the same year the trial was had, and an engine built by Robert Stephenson, Jr., more than performed all the stipulated

requirements; weighing but $7\frac{1}{2}$ tons, it drew 44 tons at the rate of 14 miles an hour.

But this success was not decisive as to the applicability of the locomotive to our American roads. An English road was virtually a straight road; an American road had curves sometimes of as small a radius as 200 feet. It was thought that this might debar the use of locomotives. To Peter Cooper, now justly venerated for so many other benefits to his countrymen, is due the construction of the *first American locomotive,* built for the Baltimore and Ohio road, to show that steam might be adapted to curved roads. A trip made to Ellicott's Mills, drawing a car filled with the directors and others, was the first *land-journey by steam* in America. (See Stuart's *Lives of American Engineers.*)

Fig. 3.



First American Locomotive.

Construction.—The principles of the construction of the accessory works of a railroad, such as embankments, bridges, tunnels, etc., differ in no essential save dimensions from those required for first-class turnpike-roads; but the location of the *curves,* or horizontal deviations from a right line; the *grades,* by which we understand the rise or fall in the direction of the length of the road; and the *gauge,* or width between the rails of the track, are the elements which determine the capacity or classification of a railroad as a machine for transport, and are matters requiring careful study. The first two are more or less dependent upon the nature of the country traversed by the road, which, of course, should be made to deviate as little from a straight line and level as the configuration of the ground and the means at command of the builders will permit. The perfection of a railroad would seem to be a straight line and a level; and yet there may be controlling circumstances which would render a level road not desirable, such as a heavy trade of coal, lumber, ores, etc. in one direction: in fact, the trade may be such as to render the weight of the empty return wagons alone the data for limiting the steepness of the grade. In general, however, let what will be the best grade in view of the weight of traffic or other circumstances, it is rarely that these conditions can be rigorously obtained, save at a cost which will defeat its own object; for it is undeniable that even a good road *may* cost too much. These considerations, as also the necessity of embracing, with a view to revenue, lateral points near the line not situated directly between the termini, render the proper location of a railroad a matter for the exercise of the greatest skill and judgment on the part of the engineer.

Curves.—The precise amount of resistance to locomotion occasioned by curves in a road has never yet been accurately determined. It is partly due to the effect of centrifugal force, causing the flange of the outer wheel of the cars to press against the rail; partly to the dragging of the wheels, which, being necessarily fixed on the axle, are obliged to perform an equal number of revolutions whether on the inner and shorter or outer and longer rail of the track; and partly to the axles being *fixed* parallel. In practice, curves of a mile radius offer but little impediment to rapid motion. In fact, the unavoidable irregularities in the line and levels of the respective rails of a straight track *may* produce an oscillating motion in the cars of a train productive of greater resistance to motion than would the continued pressure of the flanges of the wheels on a curved track of a radius of a mile, or even less, in length. The necessities of the locality very frequently call for curves of much less radius than this, and the expense of maintenance of both road and machinery is thereby much enhanced unless the curves be traversed at a reduced speed.

It is customary to reduce the rate of inclination on the inclined portions of such parts of the road as are curved at the rate of .025 feet per 100 for every degree of curvature, as also to raise the outer rail of the track a height proportioned to the speed of the trains; and it has also been customary to make the tread of the wheels a conic surface, that in traversing a curve the wheel on the outer rail may run on a longer diameter, and so cover a greater length of the track, than those on the inner rail, and thus assist the movement around the curve; but this latter method has been found to produce much oscillation and concussion on the straight portion of the track, and has in a great measure been discontinued, although a coning of the wheels to the extent of $\frac{1}{16}''$ is still practised.

The velocity of the train being an element in the calculation for the super-elevation of the outer rail of the track, what would be suitable for one speed of train would be unsuitable for another; hence a compromise has to be made, and the average speed of passenger-trains is usually taken from which to calculate this super-elevation:

If v = speed of train in miles per hour,
r = radius of curve, in feet,
g = gauge of track;

then $g \times \dfrac{v^2}{15r}$ = elevation to be given to the outer rail of the track.

In practice it is customary to disregard the speed, and elevate the rail $\frac{1}{2}$ inch per degree of curvature for ordinary-gauge tracks, and $\frac{6}{10}$ inch per degree for 6-foot track. When the term "degree of curvature" is mentioned in speaking of curves, it is not to be understood as degrees of arc, but the degrees at the centre of a circle subtended by a given chord. Thus, a $\frac{1}{2}°$ curve is one of about 2 miles radius with a 100-foot chord; a 1° curve is of about a mile radius; a 2° is a half mile, or, more accurately—

Radius, feet.	Curvature, degrees.	Radius, feet.	Curvature, degrees.
22,918	$\frac{1}{4}°$	2,292	$2\frac{1}{2}°$
11,459	$\frac{1}{2}$	1,910	3
7,639	$\frac{3}{4}$	1,433	4
5,730	1	1,146	5
3,820	$1\frac{1}{2}$	955	6
2,865	2		

hence, the super-elevation to be given to the outer rail would be, in inches, for a 1° curve, $\frac{1}{2}$; for a 2°, 1; for a 3°, $1\frac{1}{2}$; for a 4°, 2; for a 5°, $2\frac{1}{2}$ inches, and so on.

Grades.—The additional resistance to motion occasioned by the various grades or inclinations in a road is susceptible of precise calculation, and is a constant quantity for the same inclination, let the state of the road or the machinery be what it may, and is as the sine of the angle of inclination; or, virtually, it is that fraction of the weight which is represented by dividing the height of a given inclination by its length. For instance, in a rise of 22 feet per mile it would be represented by $\frac{22}{5280} = .004$, which is 8 pounds for a ton of 2000 pounds, or $\frac{1}{250}$th of the weight. The relative capacity of roads for traffic is therefore limited by their grades; that is to say, only a certain number of trains can pass over the road yearly, and if the grades are such as to limit the load of the engine to a certain amount, the yearly tonnage, which is the total number of trains multiplied by the load of each, is limited in the same proportion. This constitutes the capacity of the road, and is a subject of but little popular appreciation, but one of great importance in projecting new lines of roads.

The principle which obtains in calculating the effect of grades on the movement and weight of trains is briefly illustrated as follows: If a locomotive engine be prevented from advancing on the track, and at the same time the proportions of the machinery be such that upon the application of the power to the wheels the latter will revolve by slipping on the rails (as is usually the case), the engine is said to work up to its adhesion, and the latter becomes the limit of its traction force. This adhesion varies, in different states of the rail-surface, from one-third to one-tenth of the weight on the driving-wheels, and may be taken ordinarily at one-fifth of the insisting weight. If, then, we know the resistance to motion occasioned by the friction at the axles of the wheels of the engine and train, as also of the rolling of their surfaces on the rails, by dividing the adhesion by this amount we shall have the weight which the engine will draw on a level under the assumed condition of the rails and the machinery. Thus, if it be found that 8 pounds per ton of the weight of the engine and train represents the resistance to motion on a level occasioned by all impediments to motion of whatever kind, as it does very nearly, then by dividing the adhesion expressed in pounds by 8, we obtain the gross weight in tons which the engine will draw upon a level; but where the train ascends a grade there will be, in addition to the resistance of friction on the level, the resistance arising from the gravity of the engine and its load, or its tendency if unresisted to move down the slope, explained above.

The resistance of gravity is the same on a given plane at all speeds, but is overcome twice as fast at 20 miles per hour as at 10 miles, and hence is said to vary with the speed. Friction is the same at all velocities, but varies with the load of the train; concussion, or resistance of the curves, varies both with the weight and speed of the train.

Atmospheric resistance varies with the speed and bulk of the train. If we disregard for the present the various resistances in detail occasioned by curves, concussions, and that of the atmosphere, and consider them as included in a single factor per ton of train, the formula expressive of the performance of an engine on different grades is very simple, and sufficiently accurate for relative comparison. Let E represent the weight on the driving-wheels of an engine in pounds; R represent the rise in feet per mile of a given grade; than the gross load, including engine and tender, in tons of 2000 pounds, which the engine will take up that grade will be represented by $\frac{.2\ E}{.3787\ R + 8}$, the adhesion being $\frac{1}{5}$ of the weight of the engine on the drivers. The following table shows the gross load which a first-class freight-engine weighing 66,000 pounds, 40,000 pounds on the driving-wheels, may be estimated to move on different grades in a good condition of the rails, by the above formula, in tons of 2000 pounds:

On a level.	20 feet per mile.	30 feet.	40 feet.	50 feet.	60 feet.	80 feet.	100 feet.	150 feet.	200 feet.	250 feet.
1000	513.8	413.2	345.6	290.3	260.4	208.9	174.4	123.4	95.5	78.

Inclined Planes.—Before the locomotive had been perfected, and before even the question of locomotive *vs. stationary*-engine power had been settled, it is not surprising that recourse was had to inclined planes (which were in fact the *first* form the railway assumed) for overcoming abrupt changes of level. Hence we find several examples, as that on the Mohawk and Hudson (Albany and Schenectady) road; the Columbia road (Philadelphia to the Susquehanna) had one at each end. The Alleghany Portage road, connecting two sections of the Pennsylvania Canal, had a number. The South Carolina road (Charleston to Augusta) had one near the latter place, and the Baltimore and Ohio had one at Parr's Ridge, Md. On the Liverpool and Manchester road there were two; on the railway near Liege, Belgium, was one; and others existed elsewhere in Europe. But the necessity was speedily felt for admitting much higher grades than had been supposed admissible, and of overcoming them by locomotive power. The Baltimore and Ohio road was constructed to admit grades of 116 feet, and even heavier grades, though unadvisable, are yet to be found. Mr. Ross Winans, as a constructor of engines for these steep grades on the Baltimore and Ohio road, did much to develop the American locomotive.

By experiments on a broad-gauge road the resistance at different speeds on a *level*, attributable to friction, concussion, and atmospheric resistance, which are the same at the same speed on levels or grades, was found to be:

20 miles per hour	14.5	pounds per ton.
30 " " "	19.3	" " "
40 " " "	25.	" " "
50 " " "	35.4	" " "
60 " " "	39.	" " "
100 " " "	76.5	" " "

A formula expressing all the resistance to motion of an engine and train is a desideratum; perhaps the one conforming most nearly to experience, deduced from experiments on the broad gauge, but applicable to the prevailing gauge in this country, is as follows:

V = velocity of train in miles per hour;
E = weight of engine in tons;
T = weight of train, including tender, in tons;
B = bulk of tender and cars in cubic feet (180 cubic feet per ton);
$E(.5V + 5 + .00004TV^2)$ = resistance of engine in pounds;
$BV^2.00002$ = atmospheric resistance of train in pounds;
$\frac{VT}{15}$ = oscillating resistance on straight line or friction on curves;
$6T$ = frictional resistance of train and tender.

Then the total resistance to engine and train in pounds per ton will be—

$$\frac{E(.5V + 5 + .00004T.V^2) + BV^2.00002 + \frac{VT}{15} + 6T}{E + T}$$

Gauge.—It is not known what, if any, principle governed the determination in the first instance of the gauge between the rails of 4.8½ inches. It was adopted in the roads from the collieries in the N. of England, believed to have arisen from the colliery-wagons in use on common roads having an outside width of axle of 5 feet, and the tram-roads having the flange on the outer edge of the rail admitted of their use also on the railroads; and when the tramway was replaced by an edge-rail the same width of track was continued, but, measured from the inner edge of the rail, resulted in the 4.8½-inch gauge. Be this as it may, Mr. Stephenson, engaged in these collieries, was selected to build the Liverpool and Manchester road, and seeing no reason to change the gauge with which he was familiar, it was adopted there. When once established on a line of road looking to future extension, it was apparent that unless some special advantage called for a change there was a manifest propriety in continuing its use; accordingly, the success of the Liverpool and Manchester road led to the general adoption of this gauge. As the weight of traffic increased, and a corresponding increase of power was called for in the locomotive-engine, the impression prevailed that this could be best arrived at by increasing the space within which the machinery was placed, and an increase in the width of track on many roads was the consequence. In 1846 the inconvenience resulting from this lack of uniformity in the width of the railroads in England led to the matter being brought before Parliament, and an inquiry was instituted as to the respective merits of the various proposed widths of tracks. The commotion which followed, known as the "battle of the gauges," led to experiments, investigations, and reports by a committee of Parliament, and every effort possible was made to arrive at a just conclusion in the premises, and the subject was exhaustively considered. The result was, that while Parliament declined to enact a law compelling all roads to adopt the narrow gauge, yet the evidence went to show that while for main-trunk lines of great traffic a wider gauge than the prevailing one of 4.8½ inches would probably prove advantageous, yet the advantages were not then so apparent as were the disadvantages resulting from a lack of uniformity with the prevailing gauge of the country; and the public mind settled generally to this belief, although the fact that the interest involved in 4000 miles of narrow track failed to secure their claim against 300 miles of broad-gauge is very significant to one acquainted with the spirit of legislation in that country. We have five different widths of track in this country—from 4′ 8½″ to 6 feet—and the advantages of uniformity of track is again forcing itself upon the attention of railroad proprietors, and the "battle of the gauges," fought and supposed to have been settled in England in 1846, will again be gone through with here, and with a like result—viz. the triumph of the 4.8½; and for the same reasons as formerly—not its mechanical superiority to any other, but the expediency of its adoption in view of the extent of roads in operation of that width of gauge, losing sight of the fact that the circumstances of the two cases are altogether dissimilar. In the present case the capacity of our grand trunk-lines crossing a continent, and aiming to transport the commerce not merely of a hemisphere, but of a world, should not be determined by the same standard of expediency which would be applicable to an isolated state of limited extent. But, further than this, it has been found that a gauge of 3½ feet, or even 3 feet or less, is amply sufficient for short branches to mines or factories, or to centres of trade of limited extension and in sections difficult of access, and where rapidity of transit is of secondary importance and the work to be done limited; and the economy of construction resulting therefrom has been so magnified, through interested motives or the ignorance of advocates, that this extremely narrow gauge is strenuously maintained as the true key for opening up our waste territory, on the ground of its greatly superior economy both in construction and management; and roads are now constructing on the broad plains of the West of this exceptionally narrow width of track. There cannot be a greater fallacy than to suppose that because the adoption of the broader gauge *permits* a greater cost and increase in non-paying load, it thereby renders such increase absolutely *necessary*. That lighter engines and cars can be profitably worked on the wider gauges, if the general wants of the traffic warrant their use, is shown by the experience of all railroads in use fifteen or twenty years since. The gross receipts on the Liverpool and Manchester R. R. the first six months after its opening, a length of 35 miles, were $328,465, the expenses of the same period having been $176,895, and in the succeeding 6 months showed an increase of over 30 per cent., the engines used weighing, as we have seen, but 7½ tons, whilst a palace-car of the present day weighs 10 tons, and the engine and tender frequently 50 tons. As before remarked, the grades, curves, and gauge of a railroad are the elements of its capacity for transport. The relative effects of the first two are well understood, but the precise effect of variations in the latter still remains to be investigated under the light of modern improvements.

The form, strength, and weight of rails; the mode of fixing them in the track; the weight, power, and proportions of the engines; the form, strength, and weight of cars; the magnitude of train, and the speed in use for freight and for passengers; the fixtures for watering the engines, for reversing them, shifting them from track to

track,—all these and many other items have been the subject of study and experimental development from the date of the opening of the Liverpool and Manchester road to the present time, and each of them would furnish material for a volume. Space will only permit a further notice of such points in the construction of railroads as are universal in their application and important in their economical bearing; and first is—

Drainage.—The history of all failures in earthwork shows that in almost all cases it arises from unskilful or inadequate drainage; and the expense of the maintenance on any line will, other things being equal, vary very nearly in the proportion in which its drainage is good or otherwise. Water lying or running on the surface soaks and softens the road-bed, washes away the earth, and chokes the ditches. When saturated with water the road-bed loses its firmness, and the bottom sinks and deranges the tracks, thus adding to the shocks of the train and to the wear and tear of both the machinery and the track. The surface-drainage of the slopes of excavations is equally important, to prevent the velocity of running water from tearing up the soil and choking the ditches, which should be kept open and of a sufficient depth to drain the bottom of the ballast. Of scarcely less importance to a railroad, and closely connected with a proper system of drainage, and equally neglected in road-building in this country, are the proper principles to be observed in the quality and application of—

Ballast, which should consist of porous material, on which the cross-ties rest, and in which they should be bedded. The cross-ties, of oak, chestnut, or other hard and durable wood, from 6 to 8 inches in depth, from 8 to 10 wide, and 8 feet in length, are laid usually upon the road-bed at intervals of about 2 feet between centres, upon which the iron rails are secured by brad-headed spikes ⅝ inch square and 6 inches in length. The material upon which the ties rest should be broken stone or gravel mixed with coarse sand free from loam or clay, and to a depth of at least 18 inches below the bottom of the ties, and the space between the latter should be filled in nearly to the level of the bottom of the rail. The effect of this, besides securing the cross-ties and rails in their places, permits by its porosity the thorough drainage of the track, resists the sinking of the ties, and enables them to be readily packed up, while it gives a proper amount of elasticity to the track, more conducive to durability than the plasticity of earth or the rigidity of rock, and secures them against the heaving action of the frost.

The expense of maintenance, growing out of imperfect or defective drainage and ballasting, is at least *four* times as great on roads in this country as on the roads in Europe, where, as a general thing, the roads are completed before being opened for use, which is not the case in this country, where nearly all our early roads, and many of our present new ones, are first built without ballast.

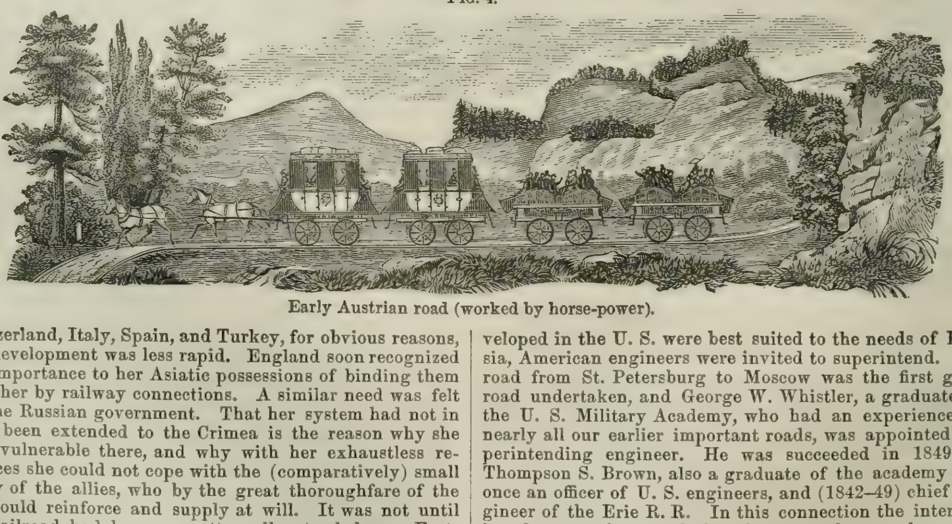
Rails.—In the early railroads much attention was paid to the quality of the iron of which the rails were composed, the weight of the rail then being light, but subsequently, when heavier rails were adopted, very inferior iron was worked into rails; recently, however, more attention has been paid to this matter. The use of the cheaper forms of steel has stimulated the iron manufacturers somewhat, but the enormous increase in the endurance of the steel rails—the latter lasting under the heaviest traffic "five or ten times as long as really good iron rails, fifteen or twenty times as long as those that pass for good rails, thirty or forty times as long as the common iron, and fifty or a hundred times as long as many rails made ten years ago or since imported from the cinder-heaps of Great Britain"—and the fact that the steel rail costs but about one-half more, will ultimately lead to their universal adoption on leading lines of road.

The form and proportion of the rail are found to be of more consequence than its weight. The heavy 80-pound iron rail wears out much faster than a properly-proportioned 60-pound rail, and the proper weight of a steel rail is about 53 pounds to the yard. In England and in Europe generally it is customary to make the rail double-headed, and when worn on one edge to reverse it, and thus double its duration; but this method, besides rendering an expensive cast-iron chair necessary, with its complication of fastenings (this item alone being estimated in England as amounting to over 1,000,000 tons), is of doubtful expediency, as the effect of the chair is in many cases to indent the lower face of the rail, which is subsequently liable to fracture. The system universally pursued in this country of dispensing entirely with a chair, and making the base of the rail some four inches in width, resting on the timber cross-ties without other support, and secured to the latter by two brad-headed spikes, is gradually gaining ground elsewhere as the most simple and efficient method of securing the rail.

The rails are rolled in lengths of thirty feet, and the joints secured by fish-plates of a length of 28 inches placed on each side of the joint under the head, and fastened by four screw-bolts, with slightly elongated bolt-holes to allow of the expansion of the rail by heat. Under no circumstances can it be economy to use a heavy iron rail of 80 pounds to the yard, for a lighter steel rail (say 53 pounds) will cost less and last longer, and it makes little difference whether a steel rail will last a half century or for ever, the present value of renewals every fifty years being less than 2 per cent. on the cost of the rails.

In France, the earliest railway was the Chemin de Fer de St. Étienne à Lyon, 34 miles in length, double track, commenced in 1826, finished in 1831. This was for a local freight purpose, St. Étienne being one of the principal sources of coal-supply to France. From St. Étienne to Givors it was worked by gravity, 23 miles of which on a down grade of 76 feet per mile. The roads connecting Paris with Lyons, Orléans, and Havre soon followed. In Austria, one of the earliest roads connected Budweis and Linz, and another Linz and Gmunden. These were single-track roads, worked by horse-power, with wooden rails covered with iron plates—the first giving access to the Danube, the interior of Bohemia, and the second to carry to the Danube the salt of the mines of Gmunden. The sketch shows a train on one of these roads (Fig. 4). In

Fig. 4.



Early Austrian road (worked by horse-power).

Switzerland, Italy, Spain, and Turkey, for obvious reasons, the development was less rapid. England soon recognized the importance to her Asiatic possessions of binding them together by railway connections. A similar need was felt by the Russian government. That her system had not in 1855 been extended to the Crimea is the reason why she was vulnerable there, and why with her exhaustless resources she could not cope with the (comparatively) small army of the allies, who by the great thoroughfare of the sea could reinforce and supply at will. It was not until the railroad had become pretty well extended over Eastern Europe and the U. S. that a real beginning to the great system of Russian roads was inaugurated; and then, owing probably to a belief that the peculiar methods developed in the U. S. were best suited to the needs of Russia, American engineers were invited to superintend. The road from St. Petersburg to Moscow was the first great road undertaken, and George W. Whistler, a graduate of the U. S. Military Academy, who had an experience on nearly all our earlier important roads, was appointed superintending engineer. He was succeeded in 1849 by Thompson S. Brown, also a graduate of the academy and once an officer of U. S. engineers, and (1842–49) chief engineer of the Erie R. R. In this connection the interesting fact may be stated that three months ago the semi-centennial anniversary of the first introduction of railroads into England was celebrated at Darlington; and the chairman announced that the second half century was

inaugurated by the rolling of rails for a railroad *in China;* and it is now stated that the *first railroad in China* (from Shanghai to Woosung, 20 miles distant) is opened to traffic.

Gridley Bryant, the inventor of the eight-wheeled car, the turn-table, and the switch (see Stuart's *Lives*), was the projector, builder, and engineer of the first railroad in America—the Quincy, in 1826. It is a matter of interest that it was built to supply the Quincy granite for the Bunker Hill Monument. It was 4 miles in length; near the quarry was an inclined plane of 315 feet length, rising 84 feet, worked by gravity. The Quincy was followed in 1827 by the Mauch Chunk road, 9 miles in length, a *coal* road, and so graded that gravity should do the work of bearing away the coal, horses being used to return the cars. This principle was subsequently applied to the Reading road, built for the carrying of coal from the mines to the place of shipment at Philadelphia. The New Orleans and Lake Ponchartrain R. R., the first in the U. S. laid with T rail, was built in 1830–31, under supervision of the *first graduate* of the U. S. Military Academy, the late Gen. J. G. Swift. It was a work of sheer necessity. An *impassable* swamp (a tedious navigation through Bayou St. John only qualifying the term) separated New Orleans from a lake from whence there was easy steam-navigation to Mobile and the Gulf coast and the routes which led northward. Until this barrier was broken New Orleans had no inland communication but by the tedious navigation of the Mississippi, from which there was no access to the Atlantic slopes.

Between the years 1828 and 1833 our actual system of railway communication may be said to have been inaugurated by the commencement of the Baltimore and Ohio, the Baltimore and Susquehanna, the Camden and Amboy, the New Castle and Frenchtown, the Hudson and Mohawk, the Charleston and Augusta, the Boston and Providence, the Boston and Lowell, and other roads. If we except the Baltimore and Ohio, it will be seen that there was little foresight of a future great connecting system; they were generally projected to supply an *immediate* necessity—to fill up a gap in an otherwise easily-available line of transit. And even now it may be said that in general our present great lines of communication with the Mississippi Valley and the West are made up of parts originally having little reference to each other. Indeed, the American roads, especially in the West, have been gradually called into existence to supply a need they themselves have created, and which did not in the beginning exist. The Baltimore and Ohio and (at a later date) the Pennsylvania roads, connecting the Ohio with Baltimore and Philadelphia, the Mobile and Ohio, connecting that river with the Gulf, may be called the first through lines. The imperious necessity of connecting our newly-developed Pacific States with the older body gave rise to the most extended system of reconnaissance and survey through a vast expanse of mountain-chain and desert for the determination of practicable routes, and finally to the rapid construction of the most remarkable *through line* of railway in the world.

The following table exhibits the lengths of railroads in operation in the U. S. at the dates named, in miles (see Poor's *Manual*):

Years.	Miles.	Years.	Miles.
1830	23	1855	18,374
1835	1,098	1860	30,635
1840	2,818	1865	35,827
1845	4,633	1870	47,254
1850	9,021	1874	69,273

The length and cost of the railroads of the world were estimated in 1871 as follows:

	Miles.	Cost.
Europe	61,110	$8,252,400,000
America	56,314	2,432,850,000
Asia	4,480	414,763,000
Africa	583	54,937,000
Australia and Islands	1,974	100,201,000
	124,461	$11,255,151,000

A general comparison for the last three years will show as follows for the U. S.:

	1872.	1873.	1874.
Length reported	57,323	66,237	72,623
Aggregate cost	$3,159,423,057	$3,784,543,034	
Capital stock	1,647,844,113	1,947,638,584	$1,990,997,486
Debt, chiefly funded	1,511,578,944	1,836,904,450	2,230,766,108
Percentage of debt to total capital	47.85	48.50	
Average cost per mile	55,116	57,134	60,425
Gross earnings	468,241,055	526,419,635	520,466,016
Gross earnings per mile	8,256	7,948	
Freight earnings	335,931,785	389,035,508	379,466,935
Passenger earnings	132,209,370	137,384,427	140,999,081
Working expenses	307,486,682	342,609,373	330,895,058
Proportion of working expenses to receipts	65.0	65.1	63.6
Net earnings	160,754,373	183,810,262	189,570,958
Proportion of gross receipts to cost	15.00	13.91	12.3
Proportion of net earnings to cost	5.20	4.85	4.5
Average dividend on stock	3.91	3.45	
Amounts divided	64,418,151	67,120,709	67,042,942

The mileage and average cost and earnings per mile in different sections of the country are, for the last year, as follows:

	Mileage.	Cost per mile.	Receipts per mile.
New England States	5,509	$42,862	$8,915
Middle States	14,291	47,356	14,486
Western States	34,482	54,329	6,103
Southern States	15,602	38,764	3,869
Pacific States	2,239	89,981	10,234

In this division of States, Maryland, the District of Columbia, and West Virginia are included with the four others more commonly called Middle States; the Western States begin with Ohio, and extend so as to include all the Territories having railroads except Washington, and as far S. as the Ohio River, and to include Missouri and Kansas. The Pacific States are those reaching the Pacific, together with Nevada, and the others are the Southern States.

Statement showing the Mileage, Cost, Earnings, Earnings per Mile and per Head of Population, etc. of the Railroads of the U. S., and of the different Sections of the U. S., compared with those of the Railroads of Great Britain and France, in 1872.

Groups for comparison.	Railroad mileage.	Cost of roads.	Cost per mile.	Earnings.	Earnings per mile.	Percentage of earnings to cost.	Percentage of net to cost.	Earnings per head of population.
New England States	4,574	$230,609,794	$50,418	$48,519,835	$10,636	21.10	6.26	$13.53
Middle States	11,617	922,700,774	79,427	169,205,702	14,565	18.30	6.40	15.86
Western States	28,778	1,472,625,232	50,550	193,826,252	6,735	13.10	4.57	13.76
Southern States	10,986	401,913,267	36,575	47,788,539	4,350	11.80	4.09	4.31
Pacific States	1,368	131,573,990	98,300	13,900,727	10,161	10.50	6.00	17.00
United States	57,323	3,159,423,057	55,116	473,241,055	8,256	15.00	5.20	11.76
Great Britain	15,376	2,763,400,535	178,720	244,463,900	15,900	8.49	4.65	7.70
France	11,061	1,327,320,000	120,000	149,322,500	13,500	8.81	4.40	4.31

The earnings for Great Britain are for 1871.

It has been computed that, notwithstanding the limited return in most cases to stockholders of railroads, the actual addition to the world's wealth yearly is not less than 10 per cent. upon the outlay for the construction of railroads.

We have in what precedes very roughly sketched the origin, development, and progress of that wonderful achievement in the art of overland transport which is so remarkable a feature of the present century, and which has extended its influence over all those portions of the habitable globe where civilization exists. Since the opening of the Liverpool and Manchester Railway (1831) there have been built over 160,000 miles of railroad, at an estimated cost of $16,000,000,000! The railroad may, therefore, justly claim to be one of the most—perhaps *the* most—signal instruments of civilization which the history of the world has yet developed. Mighty as has been its direct influence, its *indirect* has been scarcely less so. Such enormous application of the money capital of the world cannot be made without powerfully moving the minds of men. The influence exerted on the sciences—and especially on that practical application of the sciences to the development, working, and manufacture of the world's civilizer, *iron*, to investigating and applying the world's motive-power, *steam*—has been manifest. No less so the expansion given to the spheres of the civil, mechanical, and mining engineer. Indeed, nearly all the great engineer works of the present day, the great bridges, the tunnels, etc., owe their existence—nay, even the art by which they are created—to railroads. The oft-quoted words of the prophet, "Many shall run to and fro, and knowledge shall be increased," would almost seem to have been spoken in reference to *this* agent, by which the words seem to be accomplished.

J. W. Adams.

Railway, Atmospheric. See Pneumatic Transmission, by William E. A. Axon.

Railways. See Railroads, by Col. Julius W. Adams, C. E.

Raimon'di (Marco Antonio), b. at Bologna about 1480; was first apprenticed to a goldsmith; received afterward the instruction of Francesco Francia in drawing and engraving; made his first engravings after Albert Dürer at Venice; repaired to Rome, where he resided till 1527, and became very celebrated for his engravings of the works of Raphael. After the capture of Rome by the constable de Bourbon he returned to Bologna. The date of his death is unknown, but an engraving by him of a picture by Giulio Romano is dated 1539.

Raimundus Lullius. See Lull (Ramon).

Rain. See Rains, by Prof. Arnold Guyot, Ph. D., LL.D., M. N. A. S.

Rain'bow [Ang.-Sax. *rênboga*], an arch of concentric colored bands arranged in the prismatic order, violet being innermost. It is sometimes simple, and sometimes accompanied by an outer, secondary bow, which is broader and fainter than the primary, and has its colors in the reverse order. A rainbow occurs when the sun or moon, not far above the horizon, throws its beams upon a sheet of falling drops on the opposite side of the heavens. A beam of light from the sun S falls upon a raindrop obliquely at R; a portion is reflected; the remainder, passing into a denser medium, is refracted toward the normal $n\,c$ (see Refraction) and converged to a point; at A the portion not transmitted is reflected and diverges; at R' the beam is again refracted *from* the normal $n'\,c$, and reaches the eye at E. The rays of light emerging are usually so greatly dispersed as to be practically invisible. Calculation, however, proves that for certain angles of incidence the emergent rays form a beam of rays distinctly visible; such rays are called effective rays. These rays emerge, not as white light, but they are spread out by the drop into their component colored rays. (See Undulatory Theory of Light.) The angle of incidence and emergence varies for each color; the angle of incidence for violet is 58° 40'. After one internal reflection and two refractions the deviation of the ray forms an angle of 40° 17'. The deviation of the red from the same cause is 42° 2'. After two internal reflections and two refractions the deviation of violet is 54° 9', and of red 50° 59'.

Draw a line E D parallel to the sun's rays S a, S b, etc. (they being practically parallel with each other). Let the eye E take such a position that the angle a E D shall equal 40° 17'—the angle of deviation of the violet ray after two refractions and one internal reflection. S a E equals a E D, being alternate angles. The eye E therefore receives from the drop a a violet ray, while the other colors of the same dispersed ray fall below it. The angle of deviation of red is 42° 2'—1° 45' greater than violet. A drop b, 1° 45' above a, sends to E a red ray; all the effective intermediate rays produce the intermediate colors in their order. Every other drop in the sheet of falling water which has the same obliquity to the eye E as the drop a will also send to it a violet ray. The only drops which fulfil this condition are those which would define the base of a right cone whose apex is the eye, and the centre of whose base is in a right line passing through the sun and the spectator's eye. The violet rays, then, and all the other colors in their order concentrically arranged, form, when the sun is at the horizon, a semicircle, and when he is higher a proportionally smaller segment of a circle. The whole circle could only be visible to a spectator on the top of a very high and narrow peak, which elevated him while it did not obstruct the light. At a definite distance above the drop a and its series is another at such an angle to the eye E that a red ray, after two refractions and two reflections, is sent to E, and in the same way the other colors of the secondary bow. The angle of deviation of red, after two refractions and two reflections, is smaller than violet; red, therefore, is the innermost color of the secondary bow; the difference between the angles of the deviation of the extreme colors in this bow is 3° 10', while in the primary it is 1° 45'; it is therefore broader. The rays have been reflected one more time; it is therefore fainter. If the sun were a mere point, the primary bow would be 1° 45' wide from violet to red. The angular diameter of the sun is, however, 30', and each ray of light proceeding from it forms a separate bow, which partially overlaps, the violet apparently projecting 15' beyond the inner, and the red 15' beyond the outer edge; the primary bow is therefore 2° 15', and the secondary 3° 40' wide. The colors, being intermingled in the myriads of superimposed bows, are much modified. Between the primary and secondary bows are sometimes seen concentric bands of red, growing fainter and narrower as they approach the secondary; this phenomenon is explained by interference. (See Interference.) The lunar bow is like the solar except that the colors are less distinct—sometimes not at all distinguishable, when it appears as an arch of white light. S. B. Herrick.

Fig. 1.

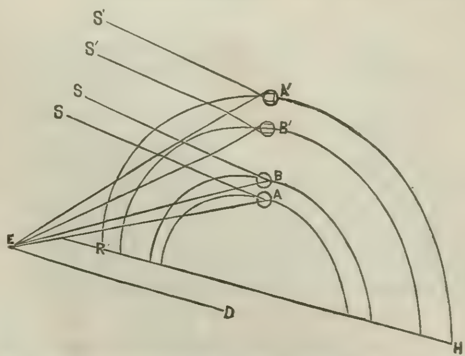
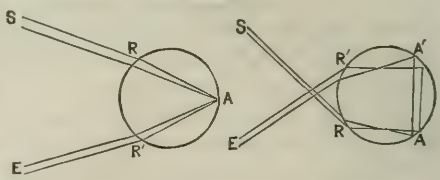


Fig. 2.



Rain-Gauge, the apparatus by means of which the rainfall is collected and measured. The exhaustive researches carried on under the direction of Mr. Symons of London during the past fifteen years have shown that for a standard gauge the collector may have any diameter from three inches up to three feet (eight inches is preferred); it must be of thin sheet metal, of cylindrical form, and have its axis truly vertical. The mouth of the collector should be horizontal, and not less than one foot nor more than three feet above the ground (a uniform height of one foot is preferred). The collected rain should flow at once, with the least possible loss, into a receiver or holder, where it will be kept safe from evaporation or other chance of loss, and the quantity should be measured as soon as possible, although some gauges placed in positions difficult of access have been so constructed as to allow of measurements once a month; while in others the rain runs directly into a graduated glass tube, where the rate of fall may be observed from minute to minute. Either the weight, the volume, or the depth of the collected water may be measured, according to convenience, the usual method of measurement being to give only the depth in inches to which the ground is covered by the rain which fell thereon. When snow falls it is considered best not only to melt and measure that which fell into the collector, but also to dip the inverted collecting cylinder into those spots where the snow has fallen evenly, and thus take up sections representing the average snowfall. By melting these, and taking the average resulting quantity of water, we deduce a better result than could have been given by a single gauging. The depth in inches of the unmelted snow as it lies fresh on the ground should also be noted. Rain-gauges should be as far as possible from trees, fences, buildings, etc.; and when the rainfall must be measured in a disadvantageous locality, it is necessary to establish numerous gauges in diverse positions, so as to study and perfectly estimate the local disturbing influences. C. Abbe.

Rains [Ang.-Sax. *regen*]. The distribution of rain is full of apparent anomalies. Here it is superabundant, and a luxuriant vegetation is the consequence. There it fails entirely, and the barrenness of the desert follows. In one place it falls at regular periods, in another at any time, without apparent rule. Now it is accompanied by terrific thunder and lightning, now it falls drizzling in gentle drops. The annual quantity of rain at a given place, again, is far from being the same; one year it may be double what it is another. To account for these phenomena, the law which governs the condensation of vapor into clouds and rain must be understood.

A column of air—a cubic foot, for example—at a given temperature can receive a definite amount of vapor, or humidity, as we call it, and no more. When it is thus filled with all the amount it can contain, evaporation ceases, and


Nº VIII
JOHNSON'S
WORLD
SHOWING THE DISTRIBUTION OF THE
RAIN
OVER THE GLOBE
BY
PROF. A. GUYOT
ARCTIC OCEAN
POLAR ZONE
GREENLAND
Spitzbergen
Region of Low Clouds, drizzling Rains and prevailing fogs, with dry Winter.
Siberia
Summer Rains - Dry Winter
NORTH
AMERICA
REGION OF PERENNIAL RAINS
in all Months with maximum in the Summer
EUROPE
ASIA
ATLANTIC
REGION OF SEMI PERIODICAL RAINS
In the South Winter Rains and dry Summers; in the North Spring & Autumn Rains prevailing
PACIFIC
OCEAN
SAHARA
Rainless or dry Central Zone of Asia
Tropic of Cancer
NORTH REGION OF PERIODICAL RAINS
In Rainy Season, heavy Showers with thunder and lightning
Dry Season rainless
MONSOON
EQUATORIAL REGION OF ALMOST DAILY SHOWERS AND AFTERNOON THUNDERSTORMS
NO DRY SEASON
EQUATOR
SOUTH AMERICA
INDIAN OCEAN
SOUTH REGION OF PERIODICAL RAINS
In Rainy Season, heavy Showers with thunder and lightning
Dry Season rainless
Tropic of Capricorn
AUSTRALIA
REGION OF SEMI-PERIODICAL RAINS
In the North, Winter-Rains and dry Summers, in the South Spring & Autumn-Rains prevailing
Melbourne
Probable Equatorial limit of the fall of Snow at the level of the Sea
REGION OF PERENNIAL RAINS
C. Horn
ANTARCTIC OCEAN
Approximate yearly amount of Rain in various Latitudes
Inches
Arctic Circle
North Pole
Dry Winter
Position of the Sun December 21st
Explanation
Dry Winter
South Pole
DIAGRAM SHOWING THE DISTRIBUTION AND NORMAL ZONES OF RAIN
Explanation
Great amount of Rain
Lesser amount of Rain
Rainless Districts
Polar limits of the various Regions of Rain
Explanation
The Figures near the names like New York 42 indicate the amount of Rain in English inches
Direction of the Winds bringing Rains
North Pole
Equator
Equator
Cloudiness to Clear Sky
Explanation
South Pole
RELATIVE AMOUNT OF CLOUDINESS & SUNSHINE IN VARIOUS LATITUDES
0 Longitude
East 40 from
Greenwich 80
West
Longitude
East 77 from
Washington 117
West

the air is said to be saturated or perfectly moist. Increase, however, its temperature, it will be able to hold more; evaporation begins again, and the air has a certain degree of dryness. We must, therefore, distinguish the *absolute humidity*, or the actual amount of vapor present in the air, and the *relative* humidity, or the degree of dryness, which is simply the relation of that real amount to the quantity which would be necessary to saturate the air at the same temperature. This is made clear by the following table:

Quantity of Vapor in a Cubic Foot of Saturated Air at Different Temperatures.

Temp. of air.	Weight of vapor in saturated air, in grains troy.	Temp. of air.	Weight of vapor in saturated air, in grains troy.
20° F.	1.30	70° F.	7.99
32° "	2.13	80° "	10.95
50° "	4.09	90° "	14.81
62° "	6.15	100° "	19.79

If we call saturation 100, every other degree of humidity will be only a fraction of 100, or a fraction of saturation. Suppose the air has a temperature of 50° F., and contains only 2 grains of vapor, while it can contain 4, as shown by the table—there is room for 2 more; the fraction of saturation, therefore, will be $\frac{50}{100}$, and 50 per cent. will express the degree of moisture of the air. Two grains per cubic foot is the *absolute*, 50 per cent. the *relative*, moisture. Again, if the temperature is 70°, and the air only contains 4 grains per cubic foot, the temperature has to be reduced to 50° before the air is saturated, and condensation into dew, cloud, or rain begins. That temperature (in this case 50° F.) at which that process begins is called the temperature of the *dew-point*. When the air is saturated the temperature of the dew-point is that of the air, but when it is not saturated the temperature of the dew-point is lower than that of the air, and it is evident the greater the difference between the two the dryer the air is, and the less the chance for rain. The comparison of these two temperatures, therefore, gives the degree of the relative moisture of the atmosphere. Thus, condensation, fogs, clouds, and rains are mostly due to the cooling of a moist air.

The application of these principles in meteorology is easy to understand. A warm wind setting from the tropics clear and dry toward the temperate regions comes into cooler places, and losing at every step its capacity for holding vapors, soon becomes moist, cloudy, and, farther on, rainy. A cold wind moving from the poles toward warmer climes may start full of clouds, but its capacity for holding vapors increasing with the heat, it becomes gradually dryer, and its clouds dissolve in a clear, transparent sky. Warm winds blowing toward cold quarters bring rain; cold winds blowing toward warm quarters bring fair weather. When both meet and struggle together, as in our storms, the average temperature being lower, clouds and rain are the usual consequence. The same phenomena occur with vertical currents of wind. When the ground is powerfully heated, ascending currents carry the warm air into the cooler layers of the upper atmosphere, where its vapors are condensed and accumulate into clouds, soon to fall back in pouring rains. Such are the rains of the tropics and of our thunderstorms. When a mountain-chain opposes a horizontal wind, the air is forced up along the slopes, its vapors are condensed, and from the beclouded mountain-summits torrents of rain water the side exposed to the wind, while on the opposite slope the same wind descends dry and cloudless from the lofty mountain-crests. These principles prepare us to understand the following general facts. The greatest average quantity of rain falls in the tropical or warm regions of the globe, because of the increased amount of evaporation and a greater capacity of the air for holding vapor; and gradually decreases toward the cold regions, as shown in the following table:

Average Annual Fall of Rain in Various Latitudes.

Latitude.		Rain in Eng. inches.	Latitude.		Rain in Eng. inches.
0°	Equator	100	50°	Equator	30
20°	"	80	60°	"	20
30°	"	60	70°	"	10
40°	"	40	80°	"	5

It is the reverse with the amount of cloudiness and the number of rainy days. Both increase from the warm latitudes toward the cold temperate regions, where the number of rainy and cloudy days is greatest. In tropical regions the average number of rainy and cloudy days is from 80 to 90. It is double that amount in the middle latitudes, and three times in the N. temperate regions, as shown in the diagram of cloudiness and sunshine at the bottom of the Map of Rains.

The average height of the clouds is greatest in the warm latitudes and in the summer of the temperate regions, and lowest in the polar regions and the winter season of the middle latitudes. As raindrops constantly increase while falling from the clouds to the ground, the size of the drops depends upon the height of the clouds as well as upon the abundance of condensation. Tropical rains and summer showers, therefore, fall in large and heavy drops, while slight, drizzling rains and fogs are characteristic of the winter season and the high latitudes.

The distribution of rain throughout the year is fully as important as its quantity, for its usefulness for the crops depends upon its falling in the right season—that is, in connection with a temperature favorable to vegetable growth. In this respect the great climatic zones differ very much. The warm zones have usually seasons of rains and drought, the rains being *periodical* within the tropics, and *semi-periodical* in the warm temperate zones. Toward the colder temperate zones the rains become more and more continuous throughout the year, or *perennial*, each month having an equal share. The diagram at the bottom of the rain-chart shows at a glance the distribution of the normal zones of rain. By comparing it with the diagram showing the course of the winds one can readily see how intimate is the connection between the two. A few words on each of these rain zones will illustrate it still more fully.

Rains within the Tropics.—Within the tropics, where the course of the temperature and of the winds is regular, that of the rains is equally so; and instead of seasons of temperature, which are there unknown, the inhabitants distinguish a dry and a rainy season. Whenever the trade-wind blows with its wonted regularity the sky preserves a constant serenity and a deep azure blue, especially when the sun is in the opposite hemisphere; the air is dry, and even when moist, as on the ocean, the atmosphere is cloudless. But in proportion as the sun approaches the zenith the trade-wind grows irregular, the air assumes a whitish tint; clouds appear, first at the horizon, later in the season rising higher and higher; the sky becomes overcast, and sudden showers, accompanied by fierce thunder and lightning, ensue. These thunderstorms occur regularly in the hottest part of the day, and increase in frequency and duration as the rainy season advances, inundating the earth with torrents of water. The atmosphere is at this time so damp that the inhabitants are in an incessant vapor-bath; the air is heavy and stifling; the body becomes dull and enervated, but vegetation puts on a new freshness and vigor, and the desert itself becomes animated and clothed for a few months with a rich verdure, which furnishes pasture to thousands of animals. Ere long, however, the sun, in his annual progress, advances to pour down his vertical rays upon other places; the rains diminish, the atmosphere becomes once more serene, the trade-wind resumes its regular course, and the windows of heaven are again shut until the following season.

Such is the normal course of the tropical rains. They fall everywhere during the passage of the sun through the zenith. The heat of its vertical rays, being then greatest, causes a strong ascending current, which neutralizes the horizontal trade-wind. The warm air, hurried to the heights of the atmosphere, grows cool by expansion, and the abundant vapors it contains are condensed, and fall back in a deluge of rain. As the sun passes and repasses from one tropic to the other, there is, in most intermediate places, a twofold rainy season, the two periods of rain running more and more into one as the latitude is farther from the equator. Thus the time of the rains in each place can be easily remembered; when the sun shines vertically upon it the wet season is near its height.

The equatorial zone of calms, being the region of the constantly ascending current of air, is also one of almost daily rain throughout the year. In the morning the sun shines in all his brilliancy, but hardly a day passes without heavy clouds accumulating rapidly between the hours of twelve and two, when the heat is greatest, which burst into violent thunderstorms with torrents of rain, soon to give way to the returning sunshine. Thus, within the tropics we distinguish three zones of rain: *the N. and the S. zone of periodical rains*, corresponding with those of the trade-winds, separated by *the equatorial zone* of daily showers, corresponding with the zone of calms.

The quantity of water that falls from the atmosphere in the tropical regions during the few months of the rainy season is enormous. The yearly average in the tropical parts of the Old World has been estimated at 77 inches of water, and 115 in tropical America, but in some localities, under the influence of certain circumstances, it is much more considerable. At Paramaribo, in Dutch Guiana, it has been known to fall to the amount of 142; at St. Louis de Maranhão, at the mouth of the Amazon, 276 inches. At Mahabuleshwar, in the Western Ghauts, in India, at the height of 4200 feet, it rises to 254 inches. But the greatest quantity ever observed was in India, in the mountains of

Cossyah, N. E. of Calcutta, where 610 inches have been collected in a single year—enough to cover the ground with a sheet of 51 feet of water. At Cayenne, French Guiana, 21 inches of rain have been seen to fall in one day. This is nearly as much as falls during the whole year in northern latitudes. The effect of these copious rains, falling during a short season, upon the tropical rivers may be easily conceived. The regular and so long mysterious overflowings of the Nile we now understand, for all its sources are in the region of tropical rains, and we no longer wonder at those inland seas which in the season of rains cover for hundreds of miles the plains of the Orinoco, of the Amazon, and the Paraguay, to ooze away during the dry season.

The sub-tropical belt, which may be called the *dry zone,* extends from about the 24th to the 28th degree of latitude, near the limit of the trade winds. It forms an intermediate zone, in which the tendency to drought is strongly marked. Situated somewhat beyond the region of the tropical summer rains, and in latitudes too low to be reached by the descending return trades, which bring the copious winter rains of the following zone, it has no source of regular supply. It is a significant fact that all the great deserts of the globe are in a sub-tropical situation. In the northern hemisphere, the arid peninsula of Lower California, the dry plateaus of New Mexico and Arizona, the Great Sahara, and the deserts of Arabia and Northern India; in the southern hemisphere, the desert of Atacama in South America, that of Kalahari in South Africa, and the arid wastes of Central Australia, are all traversed by one or the other of these remarkable sub-tropical belts.

The rains of the temperate regions offer a perfect contrast to those of the tropics. Instead of falling at *regular* periods, they are *variable,* as are the winds and the temperature of these zones, and fall at all seasons. The cause of this difference is found in the fact that while the tropical rains are due almost exclusively to ascending currents in the hottest part of the year, those of the temperate latitudes are mostly the result of the conflict of horizontal winds—that is, of the cold polar winds—with the warm and moist return trades, which takes place throughout the year. In any given latitude, however, the season at which the descending return trades reach the ground is likely to have a maximum of rain, which will travel with the declination of the sun. Thus, in the warm temperate zone, in the belt extending from 28° to about 35° N. lat., the return trades reach the ground when the sun is far away, near the southern tropic. The winter, therefore, is the rainy season, while the long summers are usually rainless. In the northern hemisphere, California, Algeria, a part of Palestine, the old Babylonia, in the southern hemisphere, a part of Chili, the Cape Colony, and the greater part of Australia, belong to the zone of winter rains.

Belt of Equinoctial Rain.—The sun advancing to the equator, the return trades fall farther up, in the latitudes of 35° to 45°. In this belt the winter rains diminish, the summers cease to be entirely dry, and most abundant rains fall about the time of the equinoxes, especially in the autumn. This is the régime of the rains in Italy, Greece, and Asia Minor.

Belt of Perennial Rains.—At the time of the solstice the equatorial winds reach the high latitudes and bring copious rains, which cause a slight increase in the warm season. This is the region of perennial rains with a maximum in summer: Central and Northern Europe, France, Germany, and the surrounding countries. In the polar regions the summer is also the wet season, but the long, sunless winters are dry and clear.

These general laws, however, are often considerably modified by the structure of the continents, the local features, and the climatic situation of the various countries in each belt. California, for instance, and the Southern States E. of the Rocky Mountains, are on the belt of winter rains; and still the régime of their rains is entirely opposite. While California has the normal winter rains with rainless summer, the S. Atlantic States and the Valley of the Mississippi have their maximum of rain in mid-summer. The quantity of rain is no less different. Los Angeles has hardly 10 inches, while the lower Valley of the Mississippi, under the same latitude, has no less than 50 or 60 inches. San Francisco has 23 inches, against 42 in the Atlantic States in the same parallel. Moreover, the amount of rain on the Pacific coast increases northward, and the régime of winter rains goes far beyond its natural limits to the 40th degree of latitude; while in the E. the quantity of rain decreases toward the N., according to the general law. This remarkable anomaly in the rains of the Southern States is explained by that vast indentation forming the Gulf of Mexico, which, like a great boiler, supplies the return trades that prevail throughout the summer with a large amount of vapors. These fall in copious showers on all the eastern portion of the U. S., increase considerably the total amount of rain, and entirely obliterate the dryness of the summer, which usually characterizes the climate of these latitudes. If the régime of the winter rains and dry summers extends farther in California, it may be traced to the influence of the great heat generated by the south-western plateaus, which retards the condensation of the vapors from the Pacific until the winds have reached a higher latitude, and to the absence of polar winds, which are turned away by the Rocky Mountains.

The situation and altitude of mountain-chains, and especially their direction in regard to the winds bearing vapors, has a great influence on the distribution of rain. No better example can be given than the effect of the long chain of the Andes on the condensation of rain. In the equatorial part, as far S. as their great bend at Punta Parina, both slopes are plentifully watered and clothed with a dense vegetation of forests; for here the frequent showers of the equatorial zone of calms fall equally on both sides. From Punta Parina to the S. tropic the eastern side has an abundance of drenching rains and magnificent forests, while the Pacific slope is a rainless and parched district. This is the region of the regular trade-winds coming from the Atlantic, whose vapors are condensed on the eastern slope, leaving the western rainless. Farther S., in Chili, the return trades from the N. W. water again the western coast during the winter months, while the eastern coast remains dry. Beyond the 40th parallel, the cool westerly and south-westerly winds prevailing in these latitudes strike the western slope of the chain, which nearly all the year is enveloped in clouds, and receives a quantity of water full as great as the tropics, while on the other side the Patagonian plains receive but a scanty supply. In North America the high border-chains from Oregon to the Alaska peninsula, which bend like a gigantic arm, catching the return trade-winds of the Pacific, receive an amount of rain greater than any part of the continent, while the E. side of these highlands has but a stinted share of the precious element. It is a remarkable fact that the Appalachian system does not increase the condensation of rain, as mountains usually do. This is doubtless due to their extending parallel with, and not transversely to, the winds bearing rain. In Europe the mountains exposed to the onset of the S. W. return trades, as those of the British Isles and Scandinavia, condense an amount of rain often double that which falls in the eastern portions of the same countries. In India the western coast, in Malabar, has its rainy season during the S. W. monsoon, and the quantity of rain, as in Mahabuleshwar, is ten times greater than on the plateau E. of the mountains. On the coast of Coromandel the rain comes by the N. E. monsoon at the opposite season. Extensive plateaus, increasing the summer heat of their atmosphere, prevent, in a degree, the condensation of moisture. As a rule, therefore, they are scantily provided with rain, and, like our western highlands and the great plateaus of the Old World, are too often but dry and sterile wastes. ARNOLD GUYOT.

Rains, county of N. E. Texas, on Lake Fork of Sabine River, formed since the census of 1870. The surface is rolling prairie, with considerable timber. Agriculture is the leading pursuit. Area, 220 sq. m. Cap. Emory.

Rains (GABRIEL J.), b. in North Carolina 1805; graduated at the U. S. Military Academy, and entered the infantry as second lieutenant in 1827; served with distinction in Florida and in action with the Seminole Indians Apr. 28, 1840, where he was severely wounded; gained the brevet of major; in the war with Mexico he was engaged in the defence of Fort Brown, May, 1846; in 1860 he attained the rank of lieutenant-colonel, and in July, 1861, resigned to enter the service of the South; became brigadier and major general, and was distinguished at Wilson's Creek, Shiloh, Perryville, etc.

Rains (GEORGE W.), b. in North Carolina 1820; graduated at the U. S. Military Academy, and appointed second lieutenant of engineers 1842; transferred to the artillery in 1843, and professor of chemistry, mineralogy, etc. at West Point 1844–46; served with distinction throughout the war with Mexico from Vera Cruz to the capture of the City of Mexico, and brevetted captain and major; in 1856 he resigned and became associated with the Washington ironworks at Newburg, N. Y., where he remained until 1861, when he went South to enter the service of the Confederate States.

Rains'borough, p.-v., Paint tp., Highland co., O. P. 220.

Rainsburg, p.-v., Colerain tp., Bedford co., Pa. P. 250.

Rainy Lake, a large lake on the boundary between Minnesota and Canada, receives the waters of the Nameken and many other rivers, and discharges its own waters

through Rainy Lake River into Lake of the Woods. It is in a marshy region, with few inhabitants. It abounds in small islands, and contains a great supply of fish of several species. Elevation, 1035 feet.

Rai'sin [remotely from Lat. *racemus*, a "bunch of grapes"], dried grapes, the fruit of the sweeter sorts of grapes, dried on lines in the bunch or spread upon platforms in the sun, or over-ripened and allowed to wither on the vine, the stalk half cut off. They are dipped after drying into a ley of grape-wood ashes or soda and water, slightly salted and mixed with a little oil. Then they are drained and dried again. The sweet muscatel, the sultana, etc. are the varieties employed. Raisins are brought only from Spain, Turkey, Calabria, and Sicily, but California is finely adapted to the production of raisins. One kind of CURRANT (which see) is a small variety of raisin.

Raisin, tp., Lenawee co., Mich. (RAISIN CENTRE P. O.), on Jackson branch of Lake Shore and Michigan Southern R. R. P. 1645.

Rai'sinville, tp., Monroe co., Mich. P. 1793.

Ra'jah [Hind. *râjâ*, a "king"], a title of many princes in the East, assumed by many of the Rajpoot caste, and by the great landowners, even of low caste. Many princes have assumed the title *mahârâjâh*, or "great rajah."

Rajahmun'dri, town of British India, presidency of Madras, on the Godavery, in lon. 81° 54' E., has large manufactures of linen, damask, and tablecloths. P. 15,000.

Rajmahal, town of British India, presidency of Bengal, on the Ganges, consists of twelve villages or market-places surrounded with miserable mud huts. It has no consequence except as a kind of inn, travellers in great numbers passing through the city. P. about 30,000.

Raj'poot [Hind. *rajaputra*, "king's son"], a name assumed in India by the Kshatriyas or warrior caste. Throughout India there are many families who claim to be Rajpoots, but their chief seat is in Râjputana, or the fifteen Rajpoot principalities S. and S. E. of the Punjaub. The Rajpoots destroy nearly all their female offspring and marry into other tribes; hence their stock, originally Aryan, is now mixed. The caste numbers several millions.

Rake, an agricultural implement used for gathering hay, and for smoothing the soil. A large part of the labor of raking hay is performed by horse-power.

Rakóc'zy, a celebrated Hungarian family, extinct in the male line. FRANCIS II., prince of Transylvania, b. in 1676, was a son of Francis I. and Helena Zrinyi. The father, early elected prince of Transylvania, never occupied the throne; he died a few months after the birth of his son. Francis II. was educated from 1688 at the Austrian court and in Prague by the Jesuits, but continued a Protestant. After his marriage with a daughter of the landgrave of Hesse he lived on his estates in Upper Hungary, but, suspected of entertaining connections with the discontented party in Hungary, he was carried to Vienna in 1701 and confined in a dungeon. He escaped, fled to Poland, and lived in retirement until in 1703 he joined the Hungarian revolutionists. In 1705 he was placed at the head of the Hungarian confederacy; in 1707 elected prince of Transylvania, supported by Louis XIV. and Peter the Great. Nevertheless, Count Palfy reconciled the Hungarians and the house of Austria by the Peace of Szathmár (1711). Rakóczy refused to accept the amnesty offered him by Austria. He went first to France, then to Turkey. D. at Rodosto Apr. 8, 1733. He wrote *Mémoires sur les Révolutions de Hongrie* (the Hague, 1738).

Rákóc'zy March, a fine national air of Hungary and Transylvania, named in honor of Francis Rakóczy II., or of some other prince of that family.

Rákos. See PESTH.

Râle [Fr. "rattle"] or **Rhonchus** [Gr. ῥόγχος, a "snoring"], names used in medical practice to denote certain noises heard in the air-passages, and caused by the presence of mucus or by other abnormal conditions. Râles are in general louder than the sounds called *bruit*, *fremitus*, and *souffle*. They are detected by auscultation, and their varied significance can be understood by the trained diagnostician. Among the numerous râles are mentioned "humid," "dry," "cavernous," "mucous," "crepitant," "sibilant," "sonorous," etc.

Rale (SÉBASTIEN), b. in Franche-Comté, France, in 1658; became a Jesuit and a teacher of Greek in a college at Nîsmes; went to Canada as a missionary 1689; labored at the Abenaki mission of St. Francis, near the falls of the Chaudière, and among the Illinois Indians, and settled in 1695 at Norridgewock on the Kennebec River, Me. He built a church, converted many of the Abenaki Indians, learned their language, and acquired so great an influence that he was believed by the English settlers to be the cause of the frequent border forays. A price was set on his head, and the Indian village of Norridgewock was several times attacked; Father Rale's church was burned by Capt. Hilton in 1705, and having been rebuilt, was again destroyed in 1722, when the missionary escaped to the woods, but his papers were carried off. A third expedition from Fort Richmond surprised Norridgewock Aug. 2, 1724, and Father Rale was shot. Among his papers carried off in 1722 was an Abenaki dictionary, preserved in the library of Harvard College, and edited with notes by John Pickering in the *Memoirs* of the American Academy of Arts and Sciences for 1833. A *Life* of Father Rale forms a part of vol. vii., series 2d, of Sparks's *American Biography.*

Ra'leigh, county in the southern part of West Virginia, between Kanawha River on the E. and Great Cherry Pond Mountains on the S. W. The surface is mountainous; agriculture and dairying are the chief industries. Cap. Beckley or Raleigh Court-house. Area, 380 sq. m. P. 3673.

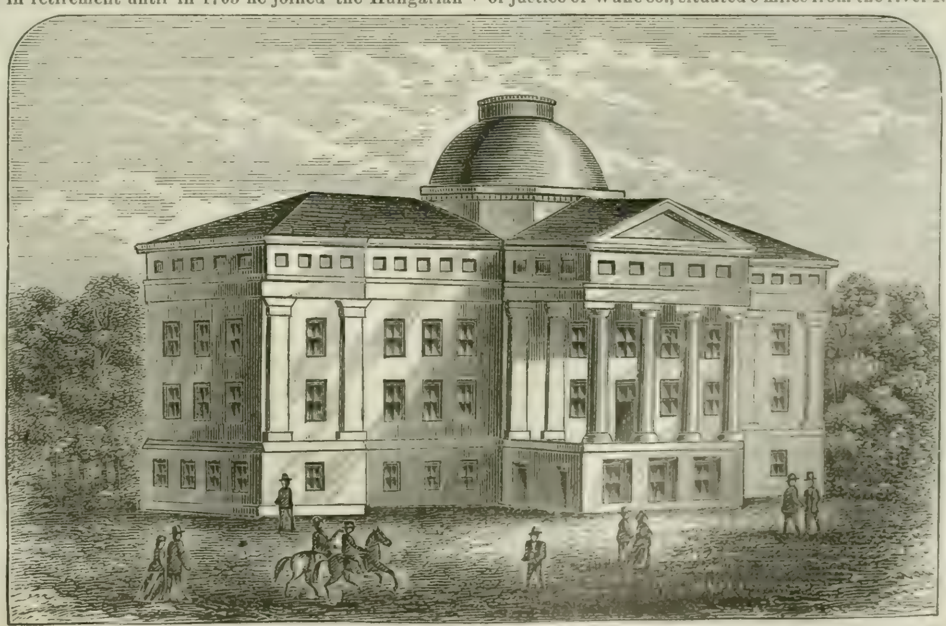
Raleigh, v., Pickens co., Ala. P. 476.

Raleigh, p.-v. and tp., Saline co., Ill. P. 2108.

Raleigh, p.-v., Washington tp., Rush co., Ind. P. 89.

Raleigh, p.-v., cap. Smith co., Miss. P. 111.

Raleigh, city and tp., cap. of North Carolina, and seat of justice of Wake co., situated 6 miles from the river Neuse,



State Capitol at Raleigh, N. C.

in about the geographical centre of the State (lat. 35° 47′ N., lon. 78° 48′ W.), upon Raleigh and Gaston, North Carolina, and Chatham R. Rs., which afford excellent commercial advantages. Raleigh was selected as the capital of the State in 1792, and possesses many fine streets shaded with native oaks, which, being wisely spared during the first settlement, and having attained a giant growth, have conferred upon the city the appropriate title of the "City of Oaks." It is the seat of all the principal public buildings of the State—legislative, penal, and charitable. The Capitol is a fine granite building located in the centre of a square of 6 acres densely shaded with oaks, while the institutions for the insane, the deaf, dumb, and blind, and the State penitentiary are all imposing works of architecture. The U. S. government is now erecting a court-house and post-office of the most approved style, of white granite which is quarried near Salisbury, N. C. Raleigh contains 2 Episcopal, 2 Baptist, 1 Presbyterian, 1 Roman Catholic, and 2 Methodist churches, with attendant chapels, while each of the above denominations, with the exception of the Roman Catholics, possesses its own institutions of learning, represented by costly buildings, with extensive and highly-improved grounds; 1 high school and a number of primary schools for both sexes and colors, and a series of buildings known as the Shaw Institute for the higher education of colored pupils, with a farm school under the charge of the Episcopalians, make up the list of educational advantages. There are 3 banks, 2 daily, 1 semi-weekly, 8 weekly, and 2 monthly newspapers, 2 foundries, a manufactory of steam-engines, an agricultural implement factory, several sash, blind, and planing establishments, several carriage-factories, 1 tobacco-factory, and several minor manufacturing interests. It is an extensive cotton-mart, handling about 40,000 bales annually. P. of city, 7790; of tp., exclusive of city, 2359. J. D. Cameron, Ed. "Raleigh News."

Raleigh, or **Ralegh** (Sir Walter), b. at Hayes, parish of East Budleigh, Devonshire, England, in 1552, second son of Walter Raleigh by his wife Catharine (Champernoun), widow of Otho Gilbert; was entered as a commoner at Oriel College, Oxford, about 1568; enrolled himself in a volunteer corps of auxiliaries commanded by his relative, Henry Champernoun, 1569, and passed several years fighting in behalf of the Huguenots in France; served under Sir John Norris, and afterward under the prince of Orange, in the Netherlands 1576–79. His half brother, Sir Humphrey Gilbert, having meanwhile obtained from Elizabeth letters patent dated June 11, 1578, empowering him to discover and possess any countries in North America not previously occupied, Raleigh sailed with him for Newfoundland 1579, but was forced by storms (and perhaps by an engagement with a Spanish fleet) to return without having landed in America; went to Ireland as captain of a company 1580; aided in suppressing the earl of Desmond's rebellion; was associated with Sir William Morgan in the government of the province of Munster; presented himself at court 1582; obtained the favor of Elizabeth; was employed in confidential negotiations with the French ambassador and the duke of Anjou; subscribed £2000 to the second expedition to Newfoundland under Sir Humphrey Gilbert, which resulted in the occupation of that island and the death of Sir Humphrey by shipwreck, 1583, and obtained from Elizabeth a new patent for discoveries and colonization in North America, by virtue of which an expedition headed by Philip Amidas and Arthur Barlow sailed from England Apr. 13, 1584, and explored Pamlico and Albemarle sounds in the summer of that year. Their enthusiastic accounts of the newly-discovered region being made known to Elizabeth, she bestowed upon it the name of Virginia, and conferred knighthood upon Raleigh 1585, who in the course of the year was made lord warden of the stannaries and seneschal of the counties of Cornwall and Devon; took his seat in Parliament for Devonshire; obtained the passage of a bill confirming his proprietary rights, and despatched to Virginia an expedition of 7 vessels and 108 colonists under Sir Richard Grenville, which made a settlement on Roanoke Island. Reinforcements were sent in the two following years, but the enterprise failed through the capture of two ships by the French, and from mismanagement on the part of the leaders of the colonists, some of whom returned home, and the remainder perished by starvation or massacre; the chief practical result being the introduction of tobacco and potatoes into England. After suffering a loss of $40,000, Raleigh transferred his patent to a company of merchants (1587), and was partially indemnified by a royal grant of the confiscated lands of Babington Mar., 1587, in addition to a similar earlier grant of a portion of the earl of Desmond's estates in Ireland. He took an active part in the preparations for repelling the Spanish Armada as captain of the queen's guard, member of the council of war, and lieutenant-general of the forces in Cornwall; commanded a vessel which rendered good service in the actions with the Armada July, 1588; accompanied Sir Francis Drake in his expedition to Portugal 1589; visited Edmund Spenser at Kilcolman Castle, Ireland, on his return, and in behalf of the poet presented to Elizabeth the first three books of the *Faerie Queene*. In 1590 he equipped a fleet of thirteen vessels, and with Frobisher cruised successfully against Spanish vessels in the West Indies. Imprisoned for two months in the Tower of London 1592, on account of his secret marriage with Elizabeth Throgmorton, one of the queen's maids of honor, and being forbidden to present himself at court, he organized an expedition of five vessels, with which he sailed from Plymouth Feb. 9, 1595, explored the coasts of Guiana, and ascended Orinoco River, and on his return published *The Discovery of the Large, Rich, and Beautiful Empire of Guiana* (4to, 1596). He served as rear-admiral at the taking of Cadiz, where he was wounded, June, 1596; was readmitted at court May, 1597; sailed with the earl of Essex to the Azores in the same year and took Fayal, but quarrelled with his commander and contributed to the ruin of Essex; obtained a grant of the fine manor of Sherborne, Dorsetshire; went as ambassador to the Netherlands 1600; became governor of Jersey 1601; lost favor at court on the accession of James I.; was accused of conspiring to raise Lady Arabella Stuart to the throne, committed to the Tower in July, and condemned to death at Winchester Nov. 17, 1603; suffered confiscation of his estates, which were given to Carr, the new favorite; was kept thirteen years in the Tower, during which time he wrote and published his principal work, *The History of the World* (1614); recovered his liberty, though not his pardon, through the influence of Villiers Jan. 30, 1616; obtained from James a commission as admiral, and sailed with a fleet of fourteen ships for the discovery of his promised El Dorado in Guiana Mar. 28, 1617; had several engagements with the Spaniards, in one of which he lost his oldest son; lost several vessels, and was foiled in his objects; landed at Plymouth on his return, June, 1618; was imprisoned on complaint of the Spanish ambassador, Gondomar, in consequence of his conduct in Guiana, and it having been decided by the judges that the sentence of death pronounced in 1603 was still valid, he was executed at the palace yard, Westminster, Oct. 29, 1618. Raleigh was a man of splendid genius and extensive attainments, wrote many miscellaneous, literary, and political essays, and a few poems of high order. His *Complete Works* were edited at Oxford in 8 vols. (1829). Biographies have been written by William Oldys, Arthur Cayley, P. F. Tytler, James A. St. John, and Edward Edwards, the two latter having appeared almost simultaneously in 1868. Porter C. Bliss.

Raleigh Court-house, or **Beckley,** p.-v., cap. of Raleigh co., West Va., on Piney Creek.

Ral′lidæ [Lat. *rallus*, "rail"], a family of birds including the rails, etc. They all have the form exemplified in the familiar rail; the neck is moderately elongated; the head rather small; the bill more or less elongated, compressed, and with the culmen advancing to a greater or less extent upon the forehead and decurved toward the apex; the nostrils are lateral, rather inferior, and in a membranous groove; the wings moderate and rounded, rather short, and with the humerus not passing beyond the acetabulum; the tail rather short, inclined upward, and rounded; the tibiæ are exserted; the tarsi rather long and slender, and in front covered with transverse scutellæ; the toes three in front, and well developed, the hinder comparatively short and rather elevated; the claws curved and acute. The family thus defined includes the common rails (Rallidæ) and gallinules (Gallinulinæ), the former containing 113 species, the latter 49. These are variously distributed through all parts of the world. They are aquatic birds, mostly frequenting the marshes and feeding upon worms and insects. (See Rail.) Theodore Gill.

Ralls, county of N. E. Missouri, on Mississippi and Salt rivers, has a rolling surface, with nearly equal extent of prairie and timber lands. Agriculture and dairying are the leading industries. Hannibal and St. Joseph and Missouri Kansas and Texas R. Rs. traverse the county. Cap. New London. Area, 525 sq. m. P. 10,510.

Ralph (James), b. in Philadelphia, Pa., about 1698; became a schoolmaster in his native city, where he made some pretensions to literary ability; was an early friend of Benjamin Franklin, with whom he sailed for England 1724, abandoning his wife and child; published in 1728 a poem entitled *Night*, which was sufficiently bad to merit notice by Pope in the *Dunciad;* sought favor with the Whig politicians by writing pamphlets and plays; was patronized by Frederick, prince of Wales, and received a pension on the accession of George III. D. at Chiswick Jan. 24, 1762. Author of *The Use and Abuse of Parlia-*

ments (2 vols., 1744) and of a *History of England during the Reigns of King William, Queen Anne, and King George I., etc.* (2 vols. folio, 1744–46), a work highly praised for its narration of facts by C. J. Fox and other critics.

Rals'ton, p.-v., McIntyre tp., Lycoming co., Pa., on Lycoming Creek and Northern Central R. R.

Râma. See RÂMÂYANA.

Ra'mah [Heb., *Ramah*, "height"], the name of several places in Palestine, two of which are historically interesting and important. One of these, first mentioned in Josh. xviii. 25, and identified by Robinson in 1838, is on the top of a high hill about 5 miles N. of Jerusalem. It belonged to the tribe of Benjamin. The other, where Samuel was born (1 Sam. i. 1), has not yet been identified with certainty. R. D. HITCHCOCK.

Ramapo', tp., Rockland co., N. Y. (RAMAPO WORKS P. O.), on Ramapo Creek and Erie R. R., includes ten villages and hamlets. P. 4649.

Râmâyana. The *Râmâyana* is undoubtedly the greatest Indian epic, not excepting the *Mahâbhârata.* Ample reasons for this opinion will be given subsequently, but the reader, before perusing this article, should consult the one under the heading MAHÂBHÂRATA. Much of that which will now be written of the *Râmâyana* will also be found to be applicable to the *Mahâbhârata.* In the first place, it will be interesting to place clearly before the reader's mind the circumstances under which the *Râmâyana* was penned; and the *Mahâbhârata* was composed under very similar conditions.

In the songs of the *Rig Veda* we are furnished with information concerning the state and the customs of the Aryans who first crossed the Indus and settled in Hindustan. When those songs were reduced to writing the Hindus dwelt in the *Panchanada*, or Panjaub, in the district called *Brahmavartta*, between the Sutlej and the Jumna. But this era of the Aryan invasion of India is decidedly anterior to that in which the *Institutes* of Manu were produced, and the *Mahâbhârata* and the *Râmâyana* written. These three later works point to a period when the Aryans had moved farther eastward and settled in the neighborhood of the Jumna and the Ganges and their tributaries. To speak generally, at least five centuries must have elapsed between the reduction of the Vedic hymns into written characters and the composition of the *Râmâyana.*

The dynasties which exercised unlimited sway over the northern portion of the Indian peninsula during the period referred to by the *Râmâyana* and *Mahâbhârata* were entitled the Solar and the Lunar. The Solar kings professed to be descendants of the god of the sun; the Lunar monarchs traced their origin to the god of the moon. Manu the lawgiver was said to be the son of the sun, and the progenitor of the Solar race; Manu's daughter and Budha, the son of the moon, were said to be the originators of the Lunar dynasty. Both of these royal lines increased and multiplied, became the heads of powerful families, founded states, conquered wide territories, and divided the best part of the immense continent of Hindustan between them. The *Râmâyana* is the epic which details the glories of the Solar dynasty. Kôsala, now called Oude, formed the principal territory owned by the Solar kings. The capital of Kôsala was Ayôdhyâ, which was situated on a tributary of the Ganges—a stream now known as the Gogra, but then called the Sarayu. The territory of the Lunar kings chiefly lay in the Doab, between the Jumna and Ganges, and in the time of the *Pândavas* the capital was Hastinâpura.

Neither the *Râmâyana* nor the *Mahâbhârata* can be fully understood unless attention is paid to the remarkable though gradual change of religious belief which had, at the time of the penning of those poems, come over the Aryan mind, primarily accustomed to the serene simplicity of Vedic teaching. The old religion, reflected in and inculcated by the *Rig Veda*, had in the process of time become elaborated and glossed over, if not sorely altered, even in its fundamental principles. The ancient worship of elements was superseded by the worship of heroes. The valiant Râma and the five noble sons of Pandu were extolled in the place of the cloud-compeller and the dispenser of warmth. If Indra were forgotten, Arjuna was remembered. The courtly poets vied with each other in their endeavors to tickle the ears of their princely patrons by recounting the exploits of their ancestors in the most extravagant manner. The deeds of any one hero were magnified just as it suited the purpose of the sûta or royal bard, and very frequently the most valiant exploits of a dozen warriors were boldly lumped together and ascribed in bulk to one favored hero. There is no limit to the fulsome adulation of an Oriental panegyrist. When laudation can go no farther, the Eastern poet simply declares the man praised to be an *avatâr* or incarnation; thus, Râma is exalted to be an incarnate Vishnu, and receives adoration accordingly. But there is art even in the wildest flattery of the professional Indian panegyrist: when a hero was said to be an incarnation of a deity, the deity singled out as the subject of this corporeal manifestation was generally that one held in highest esteem at the time when the panegyric happened to be penned. The author of the *Râmâyana* has been peculiarly fortunate in his adulation. The majority of Hindus at the present day are Vaishnavas, and throughout India there is no more common name by which the omnipotent Preserver is invoked than "Râma."

The *Râmâyana* means "The Sojourn of Râma." Hindus regard both the *Râmâyana* and *Mahâbhârata* as theological compositions, possessing divine authority. It must not be supposed, however, that either of the two poems is a *Purâna.* This is a common error, but the *Purânas*, exactly eighteen in number, are of later date, and constitute the recognized authority for the teaching and practice of that modern Hinduism which is much grosser and more debased than that sanctioned by the epics of the Solar and Lunar dynasties.

Much benefit will be gained by the student of Sanskrit literature who diligently compares the *Râmâyana* with the *Mahâbhârata.* The *Râmâyana* is pre-eminently an epic, or *Kârya;* the *Mahâbhârata* is rather an *Itihâsa*, or ancient narration, since it is more a storehouse of ancient Hindu traditions than a connected poem. Here the opinion of an eminent Orientalist may be quoted—an opinion in which the writer of this article entirely coincides: "The *Râmâyana*, having but one single object in view—namely, the description of the deeds of Râma—having apparently, at least in the greater portion of it, been composed by one poet—and having a poetical and highly adorned style throughout—certainly appears to deserve the name of an epic better than the *Mahâbhârata.*" It is a strange but true fact that outside of the small world of learned Sanskrit scholars the *Mahâbhârata* is much better known, at least in name, than is the *Râmâyana*, yet the latter is a poem which can only be placed side by side with the chief efforts of Milton, Goethe, and Dante.

Scholars seem to be agreed in considering the *Râmâyana* older than the *Mahâbhârata.* It may perhaps be conceded that a century and a half elapsed between the production of the two poems. The *Râmâyana* appears, however, to have been produced after the appearance of Buddhism in India. However, Buddhism at that time had not been embraced by the majority of the princes and peoples of India, as in time it was. Sanskrit was still a spoken language when the *Râmâyana* was composed. The date of its composition may perhaps be most safely placed at 250 B. C. Some portions of the *Râmâyana* may, however, have been added to the main work long after this early date. Yet the poem, as a whole, is undoubtedly the production of one poet, Valmiki, and not, as the *Mahâbhârata*, the work of many men and many times. Valmiki was a rishi of the Vedic period. His name is a very peculiar one. It signifies "white ant-hill." It is still a disputed question whether Valmiki was a real historical personage, just as everything about these ancient poems is disputed, especially their precise date. The *Râmâyana* is, as we know with considerable certainty from internal evidence, the work of one author; but it is a more difficult question to decide whether or no Valmiki was the strange name of that author. Anyhow, the personage is a more tangible being than the impossible "compiler," Vyâsa, the reputed author of the *Mahâbhârata* and a dozen other huge works. The *Râmâyana* itself states that it was first recited in public at an *aswamêdha*, or horse-sacrifice, by Kusalava (said to denote Kusa and Lava, sons of Râma), who had learned it from Valmiki. It may be remarked, however, that Kusa and Lava could not really have been Râma's sons. Kusalava (or Kusilava) means a *sûta*, or courtly panegyrist, and sûtas were accustomed to sing the *Râmâyana* at royal weddings, festivals, and public sacrifices from time immemorial. At the time when the *Râmâyana* was composed the art of writing was unknown amongst the Aryans of Northern India. So the poem was recited and sung from memory, and handed down from mouth to mouth. In the course of time, on account of this, several accretions added to the bulk of the poem, but as a whole the *Râmâyana* has wonderfully preserved its distinctive character intact. It contains 24,000 verses. It is divided into seven books. The poem is in no way disjointed. It has but one aim and end—namely, the history of Râma. The episodes it contains are few and far between, and do not seriously distract the attention of the reader. After the first portion of the work has been perused these episodes get still rarer, and the whole latter portion of the poem is one continuous, unbroken narrative. Throughout the *Râmâyana* we see the traces of the same skilful hand, the same poetical genius, the same facility of poetical expression. The

Râmâyana has been translated into each of the spoken dialects of India, and everywhere, from the Himalayas to Cape Comorin, enjoys unbounded popularity. Pre-eminent amongst the translations of the *Râmâyana* into Indian languages other than Sanskrit stands the Tamil version by the immortal Kamban. The elegant mellifluousness of this version is simply extraordinary; from every line of it it is apparent that a great poet, full of sympathy, enters heart and soul into the revelation to his Tamalian readers of the inner spirit of the masterpiece of a brother-poet. However, it is certain that at least 1300 years elapsed between the composition of the *Râmâyana* and its translation into Tamil. At this present day this truly Homeric poem, the *Râmâyana*, in the various vernacular dresses it has assumed throughout India, is undoubtedly the chief folk-song of the Hindus. The nomadic herdsmen of Scinde sing snatches of it in their tents; the wild Sonthal mountaineer croons verses of it over his fire as the chill night darkens over the Vindhyas; and the Tinnevelly Shânâr, as he climbs his palmyra, and the nude Tamil fisherman as he casts his net amongst the triple breakers of Cape Comorin, hum over to themselves the soft and silver-chiming quatrains of "The Sojourn of Râma." R. C. CALDWELL.

Ram, Battering. See BATTERING-RAM.

Ram'bla, town of Spain, province of Cordova, has some manufactures of pottery and woollen stuffs. P. 5926.

Rambouillet', Hôtel de, the name generally given to a social circle which for more than half a century gathered around Catherine de Vivonne, marquise de Rambouillet, and her daughter, Julie d'Angennes, duchess de Montausier, and which exercised a very conspicuous influence on French language, literature, and civilization. Catherine de Vivonne, a daughter of the marquis of Pisani, French ambassador at Rome, by a Roman lady, was b. in 1588 at Rome, and married in 1600 to the marquis de Rambouillet. When she was presented at the French court she found its tone and manners so coarse and frivolous that she determined to form a court of her own. She succeeded; her house soon became the place where all who had genius, wit, learning, talent, or taste assembled, and from these reunions originated the French Academy, the highest authority of French literature, and the *salons*, the most prominent feature of French civilization. The influence of the Hôtel de Rambouillet on conversation and language, manners and morals, was very great, and must, generally speaking, be called highly beneficial; but it occasioned imitations which were merely ridiculous (see Molière, *Les Précieuses ridicules*), and in the latter part of the seventeenth century it became itself a sort of literary coterie, with its prejudices and its intrigues. (See Röderer, *Histoire de la Société polie en France pendant le 17 Siècle* (1835), and Charles Livet, *Précieux et Précieuses* (1859).)

Rameau' (JEAN PHILIPPE), b. Sept. 25, 1683, at Dijon, where his father was an organist; travelled from 1701 to 1717 in Italy and Southern France as violinist in the orchestra of a troupe of strolling actors; was appointed organist successively in Lille, Clermont, and Paris, and published in 1722 his *Traité de l'Harmonie*, in 1726 *Nouveau Système de Musique théorique*, and in 1732 *Dissertation sur les differentes Methodes d'Accompagnement*. Having acquired by these works a great name as a reformer of theoretical music, he began composing for the stage. In 1732 his opera *Hippolyte et Aricie* had complete success, and he now composed about twenty operas and ballets, besides minor pieces of music, which gave him rank beside Lully, who at that time reigned almost absolutely on the stage. D. Sept. 12, 1764.

Ram'eses, the name of several Egyptian monarchs, signifying the "nascent sun," and used principally by the kings of the nineteenth and twentieth dynasties. A prince named Rames (not Rameses) appears among those of the eighteenth dynasty invested with the title of king, but does not appear to have reigned independently. The next Ramses is Rameses I., the first monarch of the nineteenth dynasty, who restored the native rule in Egypt after the close of the eighteenth dynasty. He appears to have carried on war with the Khita or Hittites, with whom he made a treaty, and to have made a prison for the slaves or prisoners taken during his wars in the second year of his reign, dedicated to Khem or Amon Horus. He was buried in the Biban-el-Moluk, or "Valley of the Tombs of the Kings," at Thebes. His grandson, Rameses II., was one of the most remarkable of Egyptian monarchs, and the supposed Sesostris. He ascended the throne at an early age, and at the commencement of his reign directed his arms against Kush or Ethiopia on the S., which he reduced under his sway, imposing on it his viceroy and receiving considerable tribute. The great event of his reign was the campaign against the Khita or supposed Hittites in his fifth year, represented on the walls of the temples of Thebes, Abusimbel (or Ipsambul), and Beitonalli, and described in the panegyric of Pentaur, a scribe of the period. Rameses defeated a confederation of the Khita, the people of Carchemish, the Chalybes, Ilion, and the Dardani at the N. W. of Kadeshon (the Orontes), after alone in his chariot escaping from the midst of a corps of the enemy. Many of the principal officers of the Khita and one of the allied kings were drowned in the stream. The war seems still to have continued, for Rameses in his eighth year took Salem (or Jerusalem), Tapura (or Debir), Bethanah, and Kanana. In his twenty-first year he concluded an extraditionary treaty with the Khita, and married a daughter of the king of that country. He also appears to have been engaged in wars with the Amorites, Canaanites, the Libyans, including the Tahennu and the Maxyes, and the Syrians. The affairs of the S. attracted his attention, especially the arrangements for the gold-mines, and he built or enlarged the temples at Gerf Hussein, Sebna, and Abusimbel, fortifying the E. of Egypt with a great wall from Pelusium to Heliopolis, and the towns of Heroöpolis and Tanis with forts built in his name. He states 400 years intervened between the Shepherd kings and his rule. Thebes rose to great magnificence during his government. He reigned upward of sixty-six years, and was entombed in the Biban-el-Moluk at Thebes. Rameses III. (the Rhampsinitus of Herodotus) was the second king of the twentieth dynasty, the son of Setnecht, who overthrew the foreign petty princes who distracted the country, and once more restored the native sway. On his elevation to the throne, Rameses reorganized the kingdom and improved the discipline of the army, composed of Sardinians and Libyans, as well as native forces. In his fifth year he had to sustain an invasion of the Maxyes and Libyans, led by five kings; these he defeated with great slaughter. Three years later a confederation composed of Pelasgi, Teukrians, Sicilians, Daunians, and Oscans landed on the coast of Palestine, overran the land of the Khita, Carchemish, Aradus, and the Amorites, and advanced to the eastern frontier and mouths of the Nile. Rameses assembled an army at Taha in Palestine and a fleet on the Nile, and defeated the invaders with great slaughter. He also had a successful campaign against the Libyans, who again invaded Egypt. After the restoration of peace he had made a reservoir at Ainau or Beersheba, despatched fleets to Arabia, obtained copper from the foundries of Ataka or Athak, and turquoise from the Sarbit-et-Khadim at Mount Sinai. The South he had also subdued, and given during his reign magnificent donations to the temples of Heliopolis, Memphis, and Thebes. His later days were disturbed by domestic treason, and after a reign of above thirty-one years he was buried in the Biban-el-Moluk at Thebes. His successors, Rameses IV., V., VI., VII., and VIII., were insignificant rulers, and the most remarkable event known of the reign of Rameses IX. is a sacrilegious robbery of the tombs of the ancient kings in the sixteenth year of his reign. Rameses X. and XI. were unimportant monarchs. The reign of Rameses XII. has been recorded in the temple of Choris on account of his marriage with a daughter of the king of the Bakhten and the mission of the god Choris in his ark in the fifteenth year of Rameses to expel a demon from the body of the sister of the Egyptian queen. The ark and priests of the god, richly rewarded, returned to Thebes in the thirty-third year of the king's reign. Rameses XIII., the last of the Ramessids of the twentieth dynasty, was also an inglorious monarch. Their reigns are supposed to have ended about B. C. 1000.

The name of Rameses, or Ramessé, was that of the treasure-city built by the Hebrews, evidently named after one of these monarchs, and generally supposed to be Rameses II., the name of the monarch who oppressed the Israelites, and father of Menephthat, the Pharaoh of the Exodus. Owing to the discrepancy of opinion as to this period, whether it took place in the eighteenth or nineteenth dynasty, some have supposed the city to be named after Rames, the prince already mentioned, but the name was Ramessé, not Rames. It is supposed to have been Paramessu, or Rameses, better known as Tanis, on the Tanitic branch of the Nile, and the city whence the Exodus took place. In the campaign of Rameses III. a Migdol of Rameses is represented. SAMUEL BIRCH.

Ram'ie, or **China Grass,** the fibre of *Bœhmeria nivea*, an Asiatic plant of the order Urticaceæ. This fibre is stronger than hemp, more durable when woven than linen, and almost as lustrous as silk. The goods known as grass-cloth are made in China from this fibre. Experiments have fully shown the fitness of the soil and climate of our cotton States for the production of ramie-fibre, superior in quality even to that of Java. It can be harvested three times a year, producing in all some 1500 pounds of fully-prepared

ramie per acre. It is perennial, requires comparatively little labor and attention, has few insect enemies, and stands a rainy season or a drought with little injury. It is manufactured to some extent in Europe.

Rammac'ca, town of Sicily, province of Catania, about 17 miles from Caltagirone, in a district very rich in olives. In its neighborhood is the site of the ancient *Palica*, and some ruins of its famous temple still exist. The bituminous lake Nastia is also near this town. P. 5180.

Ram Mohun Roy, b. at Burdwan, Bengal, about 1774, belonged to a wealthy Brahmanical family; studied Sanskrit, Persian, and Arabic; resided for some time in Thibet; learned English; held for five years the office of revenue collector in the district of Rungpoor; edited the Bengal *Herald* in English; was in 1830 sent to the British court from the sovereign of Delhi. D. at Bristol Sept. 27, 1833. He was a great scholar and a man of powerful conception. He early renounced the Brahmanical faith, and exposed with great boldness its incongruity with human reason. Much attention was attracted in 1820 to his *Precepts of Jesus, the Guide to Peace and Happiness*, published in English, Sanskrit, and Bengalee, and written from a Unitarian standpoint.

Ramnod', town of British India, presidency of Madras, in lat. 9° 13′ N., lon. 78° 56′ E., on the Vayah. It is well built and strongly fortified, and its climate, though hot, is healthy. It has some manufactures of coarse woollen fabrics. P. about 13,000.

Ra'moth Gil'ead [Heb., "heights of Gilead"], first mentioned in Deut. iv. 43, a Levitical city and one of the three cities of refuge on the E. side of the Jordan. Ahab, seventh king of Israel, fell in battle there about 897 B. C., and his son Jehoram, ninth king of Israel, was severely wounded there about 884. As identified by Gesenius, *Es-Salt* (Arabic adaptation of *Saltus Hieraticus*, "sacred forest") occupies the old site. It is about 23 miles N. E. of Jericho, up the wady Shaib, only 2 or 3 miles from the summit of Jebel Osh'a, the view from which is considered the finest in Palestine. Es-Salt has a population of about 4000, of whom 500 are Christians. R. D. HITCHCOCK.

Ram'pion, the *Campanula rapunculus* (order Campanulaceæ), a perennial European herb cultivated in gardens for its white, carrot-shaped root, and for its leaves, which are used in salads. It is principally grown in Italy and France, but little if at all in the U. S.

Ram'say (ALLAN), b. at Leadhills, Lanarkshire, Scotland, Oct. 15, 1686; was in early life a wigmaker at Edinburgh; afterward became a bookseller, and printed many poems, Scottish and English, usually on "broadsides" or single sheets. He ultimately acquired considerable celebrity, and his bookshop having become a favorite resort of the literary men of Edinburgh, he enlarged his business, becoming a publisher, and started the first circulating library in Scotland. The first collected volume of his poems appeared in 1721; others were soon added, of which the most popular were *The Tea-Table Miscellany* (4 vols., 1724), *The Gentle Shepherd, a Scots Pastoral Comedy* (1725), and *A Collection of Thirty Fables* (1730). Ramsay was an industrious collector of old popular songs, and to him must be credited the preservation of many relics of ancient Scottish literature. D. at Edinburgh Jan. 7, 1758. The best edition of his poetical works is that of George Chalmers (London, 2 vols., 1800; new ed., Paisley, 1874).—His son, ALLAN, b. at Edinburgh in 1713, became an eminent portrait-painter at London; became principal painter to George III. 1767, and was at one time considered (though without reason) a rival of Sir Joshua Reynolds. He figured in literary circles as a friend of Dr. Johnson, and published a number of pamphlets and essays, chiefly political. D. at Dover Aug. 10, 1784.

Ramsay (ANDREW CROMBIE), LL.D., F. R. S., b. at Glasgow, Scotland, Jan. 31, 1814; educated at his native city; was appointed a member of the geological survey of Great Britain 1841; became a director of that work 1845; professor of geology at University College, London, 1848; lecturer at the Royal School of Mines 1851; was president of the Geological Society 1862–63, and became director-general of the geological survey, and also of the museum of practical geology 1872. Author of numerous memoirs on theoretical questions in geology, of works on the geology of Arran (1841), North Wales (1858), and Switzerland (1860), of *Physical Geology and Geography of Great Britain* (1863), and of a large *Geological Map of England and Wales* (1859).

Ramsay (ANDREW MICHAEL), LL.D., known as the CHEVALIER DE RAMSAY, b. in Ayrshire, Scotland, in 1686; was educated at the University of Edinburgh; was converted to Roman Catholicism by Fénelon during a residence at Cambray; became successively preceptor to the duke de Château-Thierry, to the prince de Turenne, and to the two sons of the "Pretender," Charles Edward and Henry, then residing at Rome; and was made a knight of the order of St. Lazarus, thus acquiring the honorary title by which he is usually known. Returning to Scotland in 1725, he lived several years with the duke of Argyll, and was afterward intendant in the family of the prince de Turenne until his death at St. Germain-en-Laye, France, May 6, 1743. He wrote numerous works in French, of which the best were the *Voyages de Cyrus* (2 vols., 1727), an imitation of Fénelon's *Télémaque*, and biographies of Fénelon (1723) and of Marshal Turenne (1735). In English he wrote *The Philosophical Principles of Natural and Revealed Religion explained and unfolded in a Geometrical Order*, which appeared after his death (Glasgow, 2 vols. 4to, 1748).

Ramsay (DAVID), M. D., b. in Lancaster co., Pa., Apr. 2, 1749; graduated at Princeton 1765; studied medicine at the University of Pennsylvania; settled as a physician at Charleston, S. C., 1773; served in the war of the Revolution as a field-surgeon, participating in the siege of Savannah; was a leading member of the South Carolina legislature 1776–83, and of the "council of safety" at Charleston, on the capture of which city he was treated by the British as a hostage and kept eleven months in close confinement in St. Augustine, Fla., 1780–81; was a member of the Continental Congress 1782–84, and again 1785–86; was acting president of Congress during most of the latter period, on account of the sickness of Hancock; published a *History of the Revolution in South Carolina* (2 vols., 1785), *History of the American Revolution* (2 vols., 1790), a *Life of Washington* (1801), a *History of South Carolina* (1808), and an abridgment of universal history, posthumously published (12 vols., 1819), besides medical and other essays. He married a daughter of Pres. Witherspoon of Princeton, and again Martha, daughter of Henry Laurens, of whom he published a memoir in 1811. During the last fourteen years of his life Dr. Ramsay was a member of the South Carolina legislature, and for much of the time president of the senate. D. at Charleston May 8, 1815, from a wound inflicted by a lunatic two days before.

Ramsay (EDWARD BANNERMAN), LL.D., b. at Balmain, Kincardineshire, Scotland, Jan. 31, 1793; graduated at St. John's College, Cambridge, 1815; took orders in the Church of England; was a curate in Somersetshire several years; became minister of St. John's church, Edinburgh, 1830, and dean of the Reformed Episcopal Church of Scotland 1841. D. at Edinburgh Dec. 27, 1872. Author of several popular works, including a *Manual of Catechetical Instruction* (1851), *Memoir of Dr. Chalmers* (1867), *Reminiscences of Scottish Life and Character* (1857; 2d series, 1861), *Diversities of Christian Character* (1858), *The Christian Life* (1859), and *Pulpit Table-Talk* (1868).

Ramsay (GEORGE D.), b. in Virginia in 1800; graduated from the U. S. Military Academy, and entered the artillery 1820; transferred to the ordnance corps, with rank of captain, 1835; in war with Mexico he served as ordnance officer of the army of occupation; was engaged in the battle of Monterey, and was Gen. Taylor's chief of ordnance June, 1847, to May, 1848. Subsequently commanded various arsenals, and in Sept., 1863, became chief of ordnance with rank of brigadier-general. Retired Sept., 1864, though continued on inspection duty and in command of Washington arsenal until 1870.

Ramsay (NATHANIEL), b. in Pennsylvania May 1, 1771, brother of David and son of James, who emigrated from Ireland and settled in Pennsylvania; graduated at Princeton, N. J.; studied law and became a member of the bar of Cecil co., Md. Soon after the breaking out of the Revolutionary war he entered the army, and was in active service for the greater part of the contest. At the battle of Monmouth he commanded a Maryland regiment. Gen. Washington arrived on the field at the juncture when the retreat of Gen. Lee threatened to terminate in a total rout, and calling to him Cols. Stewart (also of Maryland) and Ramsay, and taking the latter by the hand, said (as related by an eye-witness on Washington's staff, the late James McHenry, subsequently secretary of war), "Gentlemen, I shall depend on you to check with your two regiments the enemy till I can form the main army." "We shall check them," said Ramsay—a pledge fulfilled, but at the cost of their entire command. Stewart was early wounded and carried off the field; Ramsay maintained the ground till, left without troops, he was cut down in a hand-to-hand fight with some British dragoons, and left for dead on the field. This important service was ever gratefully remembered by Washington, who when President made Ramsay marshal, and soon after naval officer,

at Baltimore. By his second wife, Charlotte Hall, of Harford co., Col. Ramsay has left descendants in Maryland. He was a devout man, of singular modesty and simplicity, probity, and great benevolence. D. at Baltimore Oct. 23, 1817. J. G. BARNARD.

Ramsaytown, p.-v., Yancey co., N. C. P. 452.

Rams'den (JESSE), F. R. S., b. at Salterhebble, near Halifax, Yorkshire, England, in 1735; was at first a cloth-dresser, afterward became an instrument-maker, and exhibited great ingenuity in improving the construction of sextants and telescopes. Having married the daughter of Dollond, he acquired an interest in the letters patent for achromatic telescopes, and constructed instruments for several continental observatories, all of which were noted for the perfection of their object-glasses. D. at Brighton Nov. 5, 1800, leaving a sum of money to his workmen.

Ramseur (STEPHEN D.), b. in North Carolina 1837; graduated from the U. S. Military Academy, and entered the artillery July, 1860; resigned Apr. 6, 1861, and entered the service of the Southern Confederacy, in which he attained the rank of brigadier-general. At the battle of Cedar Creek, Oct. 19, 1864, while in command of a division, he was mortally wounded, and died Oct. 21, 1864.

Ram'sey, county of N. Dakota, formed since the census of 1870, borders on the line of British America, includes Pembina and Stump lakes and a portion of Miniwakan or Devil's Lake in the S. W. corner. The surface consists of rolling prairie, agriculture being the only industry. Area, about 1500 sq. m.

Ramsey, county of E. Minnesota, on Mississippi River, consists of an elevated table-land, partly prairie and partly forest; is crossed by several railroads. Agriculture, dairying, and stock-raising are important industries; also lumbering and manufactures, the latter being centred in St. Paul, the capital both of the county and of the State. Area, 200 sq. m. P. 23,085.

Ramsey, p.-v. and tp., Fayette co., Ill., on Illinois Central R. R. P. 1862.

Ramsey, tp., Anoka co., Minn., on Mississippi River and on Chicago Minnesota and St. Paul and Southern Minnesota R. Rs. P. 265.

Ramsey (ALEXANDER), b. near Harrisburg, Pa., Sept. 8, 1815; was a Whig member of Congress from Pennsylvania 1843–47; appointed by Pres. Taylor governor of Minnesota Territory 1849, he negotiated treaties with the Dakotas and Chippewas, acquiring for the U. S. large tracts of land; was mayor of St. Paul 1855, governor of the State 1858–62, and U. S. Senator 1863–75.

Ramsey (FRANCIS M.), b. Apr. 5, 1835, in the District of Columbia; entered the navy as a midshipman Oct. 5, 1850; became a passed midshipman in 1856, a lieutenant in 1858, a commander in 1866; served during the civil war with distinguished gallantry on the Western waters and in both the Fort Fisher fights, and commended for "skill, conduct, judgment, and bravery."
FOXHALL A. PARKER.

Rams'gate, town of England, county of Kent, on the E. coast of the Isle of Thanet, and celebrated as a watering-place. P. 11,838.

Ra'mus (PETER), (PIERRE DE LA RAMÉE), b. at Cuth, department of Somme, France, in 1515, in humble circumstances; studied under great difficulties at the University of Paris, and published in 1543 his *Animadversionum in Dialecticam Aristotelis Libri XX.* and *Institutionum Dialecticarum Libri III.*, in which he attacked Aristotle and the scholastic method of philosophizing with great boldness. The university, the Church, the Parliament, took great offence; the books were condemned, and the author forbidden to teach. By the favor of the king he was nevertheless afterward appointed at the university, and continued till his death his opposition against the empty subtleties of the philosophy of his time. In 1561 he embraced Protestantism, and was killed during the massacre of St. Bartholomew, Aug. 24, 1572.

Ram, Water. See HYDRAULIC RAM, by J. P. FRIZELL.

Rancé, de (DOMINIQUE ARMAND JEAN LEBOUTHILLIER), b. at Paris Jan. 9, 1626; enjoyed while yet a boy several large ecclesiastical benefices, and was ordained a priest in 1651, but led nevertheless a very dissipated life until in 1660 he gave all his property to the poor, renounced his benefices, and retired to the monastery of La Trappe, where he introduced rules of the severest asceticism and founded the order of the Trappists. D. Oct. 27, 1700. He wrote *Traité de la Sainteté et des Devoirs de la Vie monastique* (1683) and *Relation de la Vie et de la Mort de quelques Religieux de la Trappe* (4 vols., 1696). (See Marsollier, *Vie de Rancé*, 1703.)

Ranche [Sp. *rancho*], in the parts of the U. S. near Mexico is the name applied to large farms, especially those devoted to stock-raising. The term more correctly designates the buildings upon such an establishment. Some of the ranches comprise hundreds of thousands of acres.

Ranco'cas, p.-v., Willingborough tp., Burlington co., N. J.

Rand (ASA), b. at Rindge, N. H., Aug. 6, 1783; graduated at Dartmouth College 1806; was for some years pastor of a Congregational church at Gorham, Me.; edited the *Christian Mirror* at Portland, Me., 1822–25; afterward conducted at Boston the *Recorder* and the *Youth's Companion;* established in 1833 a book-store and printing-office at Lowell, where he published the Lowell *Observer;* lectured against slavery; was pastor of churches at Pompey (1837–42) and Peterborough, N. Y., and wrote several volumes of sermons and polemical theology. D. at Ashburnham, Mass., Aug. 24, 1871.

Rand (BENJAMIN HOWARD), M. D., b. at Philadelphia, Pa., in 1827; graduated at the Jefferson Medical College 1848; became professor of chemistry in the Philadelphia Medical College 1853 and in the Jefferson Medical College 1864; has written for several medical periodicals; edited Metcalfe's *Caloric* (2 vols., 1859) and published *Medical Chemistry for Students* (1855) and *Elements of Medical Chemistry* (1866).—His sister, MARION H. RAND (b. 1824; d. at Grahamville, S. C., 1849), wrote poems, of which specimens may be found in May's *Female Poets*.

Rand (EDMUND SPRAGUE), b. at Boston, Mass., Oct. 20, 1834; graduated at Harvard 1855, at Cambridge Law School 1857, and became a law-partner of his father, of the same name. Author of *Life-Memories and other Poems* (1859), *Flowers for the Parlor and Garden* (1863), *Garden-Flowers, How to Cultivate them* (1866); of works on *Greenhouse Plants* and on *Orchids;* editor of several volumes on botany and entomology, and a frequent contributor to periodical literature.

Rand (ISAAC), M. D., b. at Charlestown, Mass., Apr. 27, 1743; graduated at Harvard 1761; accompanied Prof. Winthrop to Newfoundland in that year to observe the transit of Venus; studied medicine; became one of the most eminent physicians of Boston, and was president of the Massachusetts Medical Society 1798–1804. D. at Boston Dec. 11, 1822. Author of several medical essays and treatises.

Ran'dall, tp., Kenosha co., Wis. P. 533.

Randall (ALEXANDER WILLIAMS), b. in Montgomery co., N. Y., in Oct., 1819; studied law; settled at Waukesha, Wis., 1840; became postmaster of that town and its representative in the legislature; was judge of the second district 1856; governor of Wisconsin 1857–61, in which capacity he rendered eminent service in raising volunteers for the war; minister to Italy 1861–65; assistant postmaster-general 1862–66, and postmaster-general 1866–69, after which he practised law at Elmira, N. Y., until his death, July 25, 1872.

Randall (ARCHIBALD), b. in Pennsylvania in 1800; was admitted to the bar 1818; became a successful lawyer; was appointed judge of common pleas 1834, judge of the U. S. district court 1842, and (in addition) of the circuit court of Eastern Pennsylvania 1844. In that capacity he was especially distinguished for his decisions in bankruptcy cases, reported in the *Pennsylvania Law Journal* 1842–46. D. at Philadelphia May 30, 1846.

Randall (GEORGE MAXWELL), D. D., b. at Warren, R. I., in 1810; graduated at Brown University 1835; was for some years a Unitarian clergyman; afterward ministered to an Episcopalian church at Fall River; was rector of the Church of the Messiah 1844–65, during which time he became widely known as a champion of his Church, editing the *Christian Witness* and writing tracts which had a wide circulation; was in 1865 chosen missionary bishop of Colorado, having jurisdiction also in Wyoming and New Mexico, and organized many churches, schools, and seminaries, besides Jarvis Hall at Denver, the first collegiate institution in Colorado. D. at Denver Sept. 28, 1873.

Randall (HENRY STEPHENS), LL.D., b. in Madison co., N. Y., in 1811; graduated at Union College 1830; studied law and was admitted to the bar, but never practised; became secretary of state and superintendent of public instruction of New York 1851; published several volumes on agriculture, sheep-husbandry, and education, besides official reports on education; was for some years one of the editors of Moore's *Rural New Yorker*, and author of an elaborate *Life of Jefferson* (3 vols., 1857). D. Aug. 14, 1876.

Randall (JAMES RYDER), b. at Baltimore, Md., Jan. 1, 1839; received his education at Georgetown College, D. C. His health failing, he was compelled to leave this

institution before graduation, and sought its recuperation by travel. He visited several parts of South America, and returned not long before the outbreak of the late war. In this he cast his fortunes with the people of the South. As his constitution was still frail and delicate, he resorted to his pen in the promotion of the cause he had espoused. His "Maryland, my Maryland!" published in Apr., 1861, was set to music and sung at the hearthstone and in camp from the Potomac to the Rio Grande. It was the Marseillaise of the Confederate cause. Other poems from the pen of Mr. Randall were "The Sole Sentry," "Arlington," and "There's Life in the Old Land Yet." Shortly after the close of the war Mr. Randall became editor-in-chief of the *Constitutionalist* at Augusta, Ga., which position he still maintains (1876). A. H. Stephens.

Randall (Samuel J.), b. at Philadelphia, Pa., Oct. 10, 1828; received an academic education; became a merchant at Philadelphia; was for several years a member of the city councils; served in the State senate 1858–59; was elected to Congress as a Democrat 1862, since which time he has been continuously re-elected; is one of the leaders of his party, and was largely supported for the nomination as Speaker of the U. S. House of Representatives in Dec., 1875, and was Speaker to complete the 44th Congress.

Randall's Island, in the East River, opposite New York City, contains the juvenile delinquents' reformatory, infant hospital, nurseries, and nursery hospital. P. 1710.

Randaz'zo, town of Sicily, province of Catania, in the Val Dèmone, near the right bank of the Alcantara, and on one of the most frequented routes to the summit of Etna. It lies about 32 miles N. W. of Acireale, in the midst of an almost tropical luxuriance of vegetation. The castle of Randazzo is of Norman architecture, and the adjacent church of Santa Maria has still a Norman exterior, though the interior has been barbarously restored, and is only redeemed by some fine pictures by Velasquez. There are several other churches of some interest, and many of the private buildings bear evident traces of Norman taste. About 6 miles from Randazzo there is a very curious old Byzantine chapel, quadrangular and surmounted by a cupola. The neighboring lake, Gurrida, is dry in summer, though in winter it sends its waters through a distance of 95 miles to the sea. The origin of this town is uncertain, but remains of baths, etc. prove it to be as old as the Roman period. Fazzello says that in his time (1550) it was a large, wealthy, and noble city. The inhabitants are mostly occupied in the cultivation and sale of the rich products of the soil, and now number only about 8000.

Ran'ders, town of Denmark, Jutland, on the Guden-Aa, at its entrance into the Randers Fjord, is celebrated for its glove manufactures and salmon fisheries. P. 9200.

Ran'dol, tp., Cape Girardeau co., Mo. P. 1534.

Ran'dolph, county of E. Alabama, on the Georgia boundary, traversed by Tallapoosa and Little Tallapoosa rivers. Wheat, corn, sweet potatoes, cotton, and butter are the staple products, and small quantities of gold are found. Cap. Weldonville. Area, 650 sq. m. P. 12,006.

Randolph, county of N. E. Arkansas, on the Missouri boundary, watered by Big Black, Little Black, and traversed by Arkansas division of St. Louis Iron Mountain and Southern R. R. Cap. Pocahontas. Area, 870 sq. m. P. 7466.

Randolph, county of S. W. Georgia, traversed by South-western R. R. of Georgia, has a level surface, and is largely covered with pine forests. Agriculture is the chief industry. Cap. Cuthbert. Area, 400 sq. m. P. 10,561.

Randolph, county of S. W. Illinois, on Mississippi River, watered by Kaskaskia River and several smaller streams, traversed by Iron Mountain Chester and Eastern and St. Louis Belleville and Southern Illinois R. Rs., has a broken surface and a very fertile soil, producing immense crops of wheat and corn and considerable quantities of oats, hay, sorghum molasses, wool, and butter, has 10 saw-mills and above 30 manufactories, chiefly of carriages, wagons, saddlery, harnesses, and agricultural implements. Cap. Chester. Area, 600 sq. m. P. 20,859.

Randolph, county of E. Indiana, on the Ohio boundary, traversed by White, Mississinewa, and Whitewater rivers and by four railroads, has a rolling surface and a fertile soil; produces wheat, corn, wool, and butter, is well supplied with stock, has 19 saw-mills, 7 flouring-mills, 4 tanneries, and several manufactories of carriages and furniture. Cap. Winchester. Area, 440 sq. m. P. 22,862.

Randolph, county of N. Missouri, watered by E. and Middle forks of Chariton River, and traversed by Missouri Kansas and Texas and St. Louis Kansas City and Northern R. Rs., has a level surface, partly prairie, with considerable timber, and produces immense crops of tobacco. Other staple products are corn, oats, sorghum molasses, honey, wool, and butter. There are mines of bituminous coal, and gold is found in quartz. Cap. Huntsville. Area, 450 sq. m. P. 15,908.

Randolph, county of Central North Carolina, traversed by Deep and Uharie rivers; has a rolling surface. Agriculture is the leading interest. Cap. Ashborough. Area, 725 sq. m. P. 17,551.

Randolph, county in the N. E. part of West Virginia, traversed by several parallel ranges of the Alleghany Mountains, of which the principal chain is the E. boundary; contains many streams, which unite to form Cheat and Monongahela rivers; abounds in mineral wealth, especially coal, iron, and salt. Agriculture is the leading industry. Considerable quantities of maple-sugar, wool, and butter are produced. Cap. Beverly. Area, 1200 sq. m. P. 5563.

Randolph, p.-v., Bibb co., Ala., on Selma Rome and Dalton R. R. P. 2038.

Randolph, p.-v. and tp., McLean co., Ill., on Illinois Central R. R. P. 1958.

Randolph, tp., Ohio co., Ind. P. 3475.

Randolph, tp., Tippecanoe co., Ind., on Louisville New Albany and Chicago R. R. P. 948.

Randolph, p.-tp., Norfolk co., Mass., 15 miles S. of Boston, on Old Colony R. R., was incorporated in 1793, and contains 3 churches and 1 chapel, 1 newspaper, a public library and building donated by the heirs of Col. Royal Turner, and built of Quincy and Randolph granite, 1 national and savings bank, 1 high school, maintained principally from a fund bequeathed by Hon. Amasa Stetson, with several grammar and primary schools, manufactories of boots, shoes, and woollen goods. P. 5642.
D. H. Huxford, Ed. "Norfolk Co. Register."

Randolph, tp., Dakota co., Minn. P. 170.

Randolph, p.-v., in the village of Renick, Randolph co., Mo., on North Missouri R. R.

Randolph, tp., St. François co., Mo. P. 676.

Randolph, tp., Coos co., N. H. P. 138.

Randolph, tp., Burlington co., N. J. P. 450.

Randolph, tp., Morris co., N. J. P. 5111.

Randolph, p.-tp., Cattaraugus co., N. Y., on Atlantic and Great Western R. R., 18 miles W. of Salamanca, has 4 churches, the Chamberlain Institute and Female Seminary, 4 hotels, 1 newspaper, and repair-shops. Principal business, farming and dairying. P. 2167.
Frank J. Lockwood, Ed. "Register."

Randolph, tp., Montgomery co., O. P. 2077.

Randolph, p.-v. and tp., Portage co., O. P. 1564.

Randolph, p.-v. and tp., Crawford co., Pa. P. 1732.

Randolph, p.-v. and tp., Orange co., Vt., on Central Vermont R. R. P. 2829.

Randolph, tp., Cumberland co., Va. P. 2400.

Randolph, tp., Columbia co., Wis. P. 1157.

Randolph, v., Courtland tp., Columbia co., Wis. P. 61.

Randolph, p.-v., Dodge co., Wis.

Randolph (Edmund), b. in Virginia Aug. 10, 1753, nephew of Peyton and son of John Randolph, attorney-general of Virginia, a leading royalist (b. 1728; d. in London Jan. 31, 1784); studied law; entered the Continental army at Cambridge as an aide to Gen. Washington Aug., 1775; represented Williamsburg in the Virginia convention of May, 1776; became attorney-general of the State in July; married a daughter of Robert Carter Nicholas; was a delegate to the Continental Congress 1779–83, and to the convention which formed the Federal Constitution 1787; presented to that body the so-called "Virginia plan," but without success; refused to sign the Constitution, though he advocated its ratification in the Virginia convention; was elected governor of Virginia 1788; was the first attorney-general of the U. S. on the organization of the Federal government 1789; succeeded Jefferson as secretary of state 1794, and resigned in Aug., 1795, in consequence of disapproval by his colleagues of his dealings with the minister of the French republic, on which subject he published a *Vindication* (1795). D. in Frederick co., Va., Sept. 12, 1813. An interesting description of his person, character, and public services was given by William Wirt in his *British Spy*.

Randolph (George Wythe), son of Gov. Thomas M. Randolph and grandson of Thomas Jefferson, b. at Edge Hill, Va., about 1820; educated at the University of Virginia; was in early life an officer of the U. S. navy; became a lawyer at Charlottesville 1845, and subsequently at Richmond; entered the Confederate military service 1861; was made brigadier-general for gallantry at Big

Bethel; was secretary of war from Mar. to Dec., 1862, and resided in France as agent of the Confederate treasury department 1863–65. D. in Albemarle co., Va., Apr. 4, 1867.

Randolph (JACOB), M. D., b. at Philadelphia, Pa., Nov. 25, 1796; graduated in medicine at the University of Pennsylvania 1817; married a daughter of Dr. Physick 1822; became eminent in surgery, of which he was professor in the University of Pennsylvania from 1847 to his death, Feb. 29, 1848. Author of many medical and surgical papers, and of a *Memoir of Dr. Physick* (1839).

Randolph (JOHN) **of Roanoke,** b. at Cawsons, Chesterfield co., Va., June 2, 1773, descended from Pocahontas; lost his father, from whom he inherited a large estate, in infancy; was educated by tutors through the care of his stepfather and guardian, St. George Tucker; manifested little inclination to study, but spent some time both at Princeton and at William and Mary College; studied law at Philadelphia under Edmund Randolph; was elected to Congress as a Democrat in 1799, and re-elected, with the exception of two terms, until 1825; was chairman of the committee of ways and means 1801; was the chief manager of the impeachment of Judge Chase 1804; became conspicuous for his wit and eloquence, no less than for the bitterness of his speech and his numerous eccentricities; was prominent as a champion of State Rights and as a partisan of Jefferson's administration until 1806, when he separated from his political associates, opposed the election of Madison, the embargo, and the war with England in 1812, in consequence of which he was defeated in that year in his candidacy for re-election, but was returned at the election of 1814; opposed the Missouri Compromise with great vehemence, fastening upon its Northern supporters the epithet "dough-faces;" visited England in 1822, and again in 1824; sat in the U. S. Senate 1825–27; had a duel with Henry Clay Apr. 8, 1826, growing out of his denunciation of the political alliance between the latter and J. Q. Adams; supported Gen. Jackson in the election of 1828; sat in the convention of 1829 for revising the constitution of Virginia; went as minister to Russia 1830, but spent most of his time in London; returning in 1831, was again elected to Congress 1832, but before taking his seat d. at Philadelphia, Pa., of consumption, June 24, 1833. He was never married. By his will he emancipated and provided for his slaves, numbering above 300. Several biographies have been published, of which the best is that of Hugh A. Garland (2 vols., 1850).

Randolph (PEYTON), b. in Virginia in 1723, was the second son of Sir John Randolph; graduated at William and Mary College; studied law at the Temple in London; was appointed in 1748 royal attorney-general for Virginia; was elected to the house of burgesses; became chairman of a committee to revise the laws of Virginia; went to England as a commissioner to seek redress of grievances 1752; framed the remonstrance of the house of burgesses to the king against the passage of the Stamp Act 1764, but after its passage discountenanced Patrick Henry's celebrated "five resolutions" 1765; resigned the office of attorney-general in 1766, and was Speaker of the house of burgesses for several years thereafter; was chairman of the "committee of vigilance" chosen Mar. 10, 1773, and an efficient worker in promoting through correspondence a concert of action with the other colonies; presided over the Virginia convention at Williamsburg Aug., 1774; was chosen a delegate to the Continental Congress; was first president of that body upon its meeting at Carpenters' Hall, Philadelphia, Sept. 5, 1774, though from ill-health he soon resigned that post; presided over the second Virginia convention at Richmond Mar. 20, 1775; was again chosen Speaker of the Continental Congress when it re-assembled at Philadelphia May 10, 1775, but resigned May 24, returning to Virginia to preside over the house of burgesses; resumed his seat in Congress a few months later. D. of apoplexy at Philadelphia Oct. 22, 1775. He was buried in the chapel of William and Mary College.

Randolph (THEODORE F.), b. in New Brunswick, Middlesex co., N. J., June 24, 1826; received a liberal education, and entered political life in 1860 as a member of the New Jersey legislature; in 1861 he was chosen State senator to fill an unexpired term, and was re-elected in 1862; in 1867 was chosen president of the Morris and Essex R. R. Co.; in 1868 was elected governor of New Jersey by the Democrats, and in 1874 was chosen by the same party U. S. Senator for six years. J. B. BISHOP.

Randolph (THOMAS MANN), b. in Virginia about 1770; married a daughter of Pres. Jefferson; served in the Virginia legislature; was a member of Congress 1803–07; was colonel of the 20th infantry during the second war with England, and governor of Virginia 1819–22. D. at Monticello June 20, 1828.

Randolph-Macon College, an institution of learning founded in 1832 by the Virginia conference of the M. E. Church. It was first located in Mecklenburg co., Va., near the North Carolina border; suffered severely during the war of the rebellion, and was removed in 1866 to Ashland, Hanover co., on Richmond Fredericksburg and Potomac R. R. Instead of the ordinary mechanism of a four years' course, the college consists of several separate schools, affording courses of one year each. There is a special school of biblical literature and Oriental languages for theological students. There are now (1876) 10 professors and upward of 200 students.

Range, p.-v. and tp., Madison co., O. P. 1367.

Range 43, tp., Otter Tail co., Minn. P. 376.

Rangeley, p.-v. and tp., Franklin co., Me., on Rangeley Lake. P. 313.

Rangeley Plantation, tp., Franklin co., Me. P. 45.

Rangoon′, town of British India, capital of the Burmese dominions, Farther India, on the eastern branch of the Irrawaddi, 25 miles from the sea, in lat. 16° 47′ N. It is built almost exclusively of bamboo and mat-work, but carries on an important trade in wax, ivory, cotton, gems, bullion, and teak. About 2 miles N. of the city lies the curious Shoay-Dagon, a ludicrous and rather ugly monument, but stupendous in its proportions and dazzling with gold and brilliant ornamentation; around the principal monument, said to contain eight hairs of the head of Gautama, lie several other temples with statues of Gautama. P. 96,952.

Ran′idæ [Lat. *rana*, "frog"], a family of amphibians of the order Salientia or Anura, including the common frogs and kindred forms. As limited by Cope, the family is characterized by the presence of teeth on the maxillary and premaxillary bones; the ossification of the fronto-parietal bones, and want of a fontanelle; the presence of epicoracoids, and the presence of an osseous xiphisternum and manubrium; the sacral diapophyses are cylindrical; the coccyx simple and attached by cotyloid cavities; in some the extremities of the digits are dilated, but in most are simple. The family embraces about twenty genera, the best known of which is *Rana*, which includes the common frogs. Species of the family existed at least as early as the Miocene epoch, when the genus *Rana* was represented by species whose remains were preserved in the Braunkohle in Germany. (See also FROG.) THEODORE GILL.

Ranie′ri (ANTONIO), b. in Naples in 1809. An exile at twenty, he went first to Tuscany, then to Paris, where he took part in the revolution of July. After this he studied in England, then in Germany, and finally returned to Tuscany, where he formed the closest friendship with Leopardi, whom he took back with him to Naples. (See LEOPARDI.) There Ranieri wrote the following works: *Storia d'Italia dal quinto al nono secolo* (Brussels, 1841), *Ginevra, o l'Orfana della Nunziata* (Capolago, 1839), *Frate Rocco, Frammenti Morali, Prolegomeni di una Introduzione allo Studio della Scienza Storica.* On Sept. 6, 1860, Ranieri was the foremost of the sixty patriots who went to invite Gen. Garibaldi to take possession of Naples. He was afterward appointed professor of history in the University of Naples, and elected deputy to the Italian Parliament, in which he still holds a seat.

Ranifor′mia [Lat. *rana*, "frog"], a sub-order of Amphibia, Salientia, or Anura, distinguished by Prof. Cope, and characterized by the coracoids abutting; the epicoracoids, when present, continuous, transverse, and abutting on the coracoids, but not connected with the latter by overlapping longitudinal cartilages; the maxillary and premaxillary bones are furnished with teeth; the fronto-parietal bones are ossified, and not separated by a fontanelle. To the group belong the families Ranidæ and Colostethidæ. THEODORE GILL.

Ran′ke, von (LEOPOLD), b. at Wiehe in Thuringia Dec. 21, 1795; studied at Leipsic; was appointed teacher at the gymnasium of Frankfort-on-the-Oder in 1818, and professor of history at the University of Berlin in 1825. He wrote *Geschichte der romanischen und germanischen Völker von 1494–1535* (1824), *Fürsten und Völker von Süd-europa im 16. und 17. Jahrhundert* (1827), *Die serbische Revolution* (1829), one of his most brilliant productions, *Ueber die Verschwörung gegen Venedig im Jahre 1688* (1831), *The Popes of Rome, their Church and State* (3 vols., 1834–37; translated into English by Mrs. Austin in 1840, by Scott in 1846, and by E. Foster in 1848), *History of Germany in the Time of the Reformation* (6 vols., 1839–47; translated into English by Mrs. Austin); *Memoirs of the House of Brandenburg, and History of Prussia during the Seventeenth and Eighteenth Centuries* (3 vols., 1847–48; translated into English by Sir A. Duff Gordon), *Jahrbücher des deutschen Reichs unter dem sächsischen Hause* (3 vols., 1837–40), *Französische Geschichte vornehmlich im 16. und 17.*

Jahrhundert (5 vols., 1852–55), *A History of England, principally in the Seventeenth Century* (6 vols., 1859–68), *Geschichte Wallensteins* (1869), etc. The complete edition of his works comprises 36 vols. His very first productions immediately attracted great attention, both on account of the high merit of their style and composition, and on account of the ingenuity evinced in gathering and sifting the materials. It is also to this latter point that the expression "the school of Ranke" principally refers—to the method of studying history rather than to the method of writing it.

Ran'kin, county of Central Mississippi, on Pearl River, traversed by Vicksburg and Meridian R. R., has a level surface largely covered with pine timber, and a productive soil, the chief staples being cotton, rice, and Indian corn. Cap. Brandon. Area, 800 sq. m. P. 12,977.

Rank'ine (W. J. Macquorn), b. in Edinburgh July 5, 1820. In his early education his father, a retired lieutenant of the rifle brigade, was his chief instructor. He early displayed fondness for the natural sciences, and had the advantage of the eminent Prof. J. D. Forbes as his tutor in natural philosophy. To him he dedicated his earliest and a somewhat remarkable paper, advocating the use of cylindrical wheels for railway carriages. "A carriage, and especially a locomotive engine," he states, "with conical wheels never moves straight forward but for an instant at a time, so that whenever a small obstruction or an increase of speed beyond a certain limit causes it to leap higher than the depth of the flanges, it is almost certain to alight off the track." Civil engineering naturally attracted his attention, and from 1841 to 1851 he was employed on the railways of Scotland. But recognizing, as he did, engineering to be something more than a mere means of livelihood—viz. "the art by which the mechanical properties of matter are made to serve the ends of man"—he found his most congenial sphere in those investigations of physical facts and a reduction of their results to practice by which matter is made subservient to the needs of man. One of the most noticeable of his physico-mathematical researches was based on an hypothesis of "molecular vortices," by which was deduced the laws of elasticity, and of heat as connected therewith; by which he took at once prominent rank as an original investigator. His theoretical results, conforming closely to those subsequently obtained experimentally by Regnault and Dr. Ure, were in their ultimate form published in the *Philos. Mag.*, Dec., 1851 (*On the Centrifugal Theory of Elasticity as applied to Gases and Vapors*). Important papers on kindred subjects succeeded this—*e. g. On a General Law of the Transformation of Energy* and *Outlines of the Science of Energetics*; the latter of which is a masterly exhibit of what may be called the *modern* science of energy. In 1855, Mr. Rankine became regius professor of civil engineering and mechanics in the University of Glasgow. Soon after taking the chair he turned his attention to the production of a series of manuals for engineering students and practical men, which, taken together, constitute a monument of patient, persevering, and skilful original investigation, of brilliant literary workmanship—a monument which cannot fail to carry down to posterity the memory of their author. These manuals are thoroughly well known to, and appreciated by, American engineers. Laborious as were his occupations, rigidly mathematical as were the tasks to which his mind was daily subject, he had keen relish for music and literature, and was not only social, but convivial. "In imagination," says an appreciative biographer, "we still look upon his manly form and listen to the profound utterances of the philosopher, or we see him as one of the 'Red Lions' gathered round the social table after the sections at a British association meeting have adjourned for the day; and we hear him trill forth one of his admirable convivial songs, unwilling to realize that our intercourse with him is at an end, except through the work which has immortalized his name." D. at Glasgow Dec. 24, 1872. J. G. Barnard.

Rank of States. Every State, as such, has the properties of a State to the full extent, and so is equal to every other. Rank, therefore, as far as States' rights are concerned, there can be none. The word has reference to the etiquette of courts, which is governed by nothing but custom. In general, the great powers take rank before smaller ones. Formerly, there were complicated rules for this, as there were for court-dress. Some of these are fixed by the regulations concerning grades of ambassadors, and the relative rank of ambassadors of the same grade, which were agreed to by the parties to the Congress of Vienna and at Aix-la-Chapelle in 1815 and 1819, and which have now passed extensively into the practice of nations. (Compare the author's *Elements of International Law*, § 94.) T. D. Woolsey.

Ran'som [Fr. *rançon*], the name given to an agreement by a master of a captured vessel with his captor to pay a certain sum as a ransom for his vessel on condition of its being allowed to go on its way, safe from all further capture by the same enemy's vessels or by those of its ally. (See International Law.) T. D. Woolsey.

Ran'som, county of E. Dakota, recently formed, on Dakota and Cheyenne rivers, and consisting chiefly of rolling prairies.

Ransom, p.-v. and tp., Hillsdale co., Mich. P. 1624.

Ransom, p.-v. and tp., Luzerne co., Pa., on Pennsylvania and New York Canal and Lehigh Valley R. R., and on Susquehanna River. P. 603.

Ransom (Matthew W.), b. in Warren co., N. C., in 1826; graduated at the University of North Carolina 1847; was admitted to the bar the same year; became a planter and politician; was attorney-general of North Carolina 1852–55; member of the legislature 1858–60; peace commissioner to the Montgomery convention 1861; entered the Confederate service as lieutenant-colonel; rose to be major-general, serving through the war, and surrendering at Appomattox Court-house, and was elected as a Democrat in Jan., 1872, to the U. S. Senate for the term expiring in 1877.

Ransom (Thomas Edward Greenfield), b. at Norwich, Vt., Nov. 29, 1834; educated at Norwich University, a military institute presided over by his father, Col. Trueman B. Ransom (killed at Chapultepec, Mexico, Sept. 13, 1847); became in 1851 a civil engineer in Lasalle co., Ill.; was subsequently a real-estate agent at Chicago; raised a company of volunteers in Apr., 1861; was elected major of the 11th Illinois Vols. (three months' service), and lieutenant-colonel of the same regiment on its reorganization in July; distinguished himself in the surprise of Charleston, Mo., on the night of Aug. 19, when he was severely wounded; was at the capture of Fort Henry; was made colonel for gallantry in the assault upon Fort Donelson, where he was again severely wounded; was distinguished at the battle at Shiloh; became chief of staff to Gen. McClernand and inspector-general of the Army of the Tennessee June, 1862; was afterward on Gen. Grant's staff near Vicksburg; was appointed brigadier-general to date from Nov., 1862; took part in the Red River campaign, commanding McClernand's corps during that general's illness; was dangerously wounded in the knee at the disastrous battle of Sabine Cross-roads, Apr., 1864; took part in the Atlanta campaign at the head of a division, and subsequently in command of the 17th corps, which he insisted upon accompanying in pursuit of Hood, notwithstanding a painful illness, which resulted in his death at Rome, Ga., Oct. 29, 1864. He was one of the officers of most unquestioned military ability and of estimable personal character.

Ran'son (George M.), b. June 18, 1820, in New York; entered the navy as a midshipman July 25, 1839; became a passed midshipman in 1845, a lieutenant in 1854, a commander in 1863, a captain in 1870; commanded the Kineo at the passage of Forts Jackson and St. Philip and battle of New Orleans, Apr. 24, 1862, and in many other engagements on Mississippi River during the civil war, in all of which he was distinguished, according to the official reports, for "bravery and skill." Foxhall A. Parker.

Rantoul', p.-tp., Champaign co., Ill., on Illinois Central and the Havana Rantoul and Easton R. Rs., has 5 churches, good school advantages, several warehouses and grist-mills, a large cheese-factory, 1 newspaper, and shops. P. 1628. Cross & Bullock, Eds. "Rantoul News."

Rantoul, tp., Calumet co., Wis. P. 915.

Rantoul (Robert, Jr.), b. at Beverly, Mass., May 13, 1805; graduated at Harvard 1826; was a successful lawyer at South Reading, Gloucester, and Boston; served in the Massachusetts legislature 1834–37, distinguishing himself by his efforts for the abolition of capital punishment; became in 1837 a member of the Massachusetts board of education, in which capacity he rendered important services; was collector of the port of Boston 1843–45; was appointed U. S. district attorney 1845; filled a portion of the unexpired term of Daniel Webster in the U. S. Senate 1851, in which year he was elected as a Free-Soil Democrat to the House of Representatives. D. at Washington, D. C., Aug. 7, 1852. Mr. Rantoul was by nature a reformer, and a radical one; took a prominent part in questions affecting the condition of the masses and humanitarian efforts; and was conspicuous in his earnest resistance to the Fugitive Slave law. A volume of his *Speeches*, with a *Memoir* by Luther Hammond, was published in 1854.

Ranuncula'ceæ, or **Crowfoots** [*Ranunculus*, the buttercup genus, affords its typical forms], an important natural order of exogenous herbs, or rarely shrubs, remarkable as affording some of the highest types of exog-

enous vegetation—that is, forms the most completely differentiated from the simple ideal of exogenous growth. The order produces aconite, pæony, larkspur, and many handsome garden-plants and medicinal herbs, many of which are active narcotic poisons.

Ranz des Vaches [for the Fr. *rangs des vaches*, "rows of cows;" Ger. *Kuhreigen*], the name of the melodies which the Swiss herdsmen play upon the alp-horn while driving their cows. It is often related that hearing a *ranz des vaches* played causes homesickness among the Swiss mercenary troops, and hence its performance is not permitted in the military bands of such corps.

Rapal'lo (anc. *Tigulli*), town of Italy, province of Genoa, E. of the city of Genoa, and 7½ miles W. of Chiavari, on a small bay to which it gives its name. The situation of Rapallo is extremely picturesque, and commands one of the finest views on the Riviera. The neighboring hills were once crowned with towers, castles, and convents, and here was the theatre of many a conflict between the Ligurians and the Romans long before the Christian era. Two only of its five mediæval gates are still standing. Remains of the old citadel, destroyed by the Lombards in the seventh century, still existed in the fifteenth, but they have now disappeared. The churches are old and interesting, and in the façade of the Duomo (consecrated 1118) there is a very curious stone, a fragment from the heathen temple originally occupying this site, the inscription upon which has given rise to much discussion among antiquarians. In a private palace there is an ancient Greek bas-relief with an inscription, said by Cavedoni to be one of the oldest and rarest objects of its kind in Italy. Rapallo is believed by many to have been founded earlier than Genoa. After the Lombard devastation it rose again to importance, and as an independent republic including several of the neighboring towns it often successfully resisted the Saracens, the Pisans, the Romans, the Venetians, but was at last forced to seek the alliance of Genoa, by which republic it was finally absorbed. There is now some activity in the harbor of Rapallo, considerable shipbuilding is going on, there are several soap and candle factories in the town, and large quantities of lace are made by the women. P. 10,400.

Rape. See JURISPRUDENCE, MEDICAL.

Rape [Lat. *rapa*, a "turnip"], the *Brassica napus*, a plant of the order Cruciferæ, and closely related to the Swedish turnip and colza, from which it may be distinguished most easily by the fact that its young leaves are smooth. The navew is of the same species with the rape. Rape is largely raised in Europe for the oil of its seeds. Its stalks are valuable forage, and are good to plough under for manure. Its oil-cake is used as sheep-food and as a fertilizer. The oil is used for machinery, for lighthouse lamps, etc., and the seed is fed to cage-birds.

Rape-Seed Oil. See OILS, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D., M. N. A. S.

Raph'ael [It. *Raffaello*], called, in full, **Raffaello Sanzio da Urbino,*** by common consent the prince of painters, his name almost a synonym for perfection in his art, b. at Urbino, a ducal city of Umbria, Italy, Apr. 6, 1483.† His father's name was Giovanni Santi, an artist of repute, and also known as a poet. The mother's name was Magia Ciarla. She died in 1491, when Raphael was eight years old. Raphael's first master was his father, nor until Santi's death in 1494 did he have any other instructor. In 1494, Luca Signorelli visited Urbino, and the next year Timoteo della Vite came there, but there is no evidence of his having come under the influence of either of these artists. In 1495 he was placed by his guardian and paternal uncle, Bartolommeo, and with the consent of his maternal uncle, Simone di Battista Ciarla, in the studio of Pietro Vannucci, called "Il Perugino" from his living at Perugia. With him Raphael stayed until 1504, when he was twenty-one years old. He had, however, somewhat withdrawn from the studio as early as 1500, when he went to Città di Castello—it has been said with the intention of setting up for himself. While with Perugino he had submitted entirely to his master's instruction, and the few pictures we have of this period show him to have been a docile and sympathetic pupil. The *Resurrection of Christ*, now in the Vatican, and the two small pictures of the archangels Michael and Raphael, in the British National Gallery, belong to this time. While in Città di Castello he paid (in 1502) a flying visit to Siena, where Pinturicchio was painting the frescoes in the cathedral library. The story that Raphael assisted him in these frescoes is not now believed. Raphael made, however, a drawing from the fine but mutilated antique group of the three Graces recently discovered there, from which drawing he made in 1506 the picture belonging to Lord Ward. In 1503 he painted the *Coronation of the Virgin*, in the Vatican, and the *Connestabile Madonna*, painted for Count Staffa, constable of Perugia, which until 1871, when it was sold to the emperor of Russia, had always remained in the house for which it was painted. To this time also belongs the *Dream of a Young Knight*, in the British National Gallery. In 1504 he appears to have returned to Città di Castello, where he painted for the church of San Francisco the *Marriage of the Virgin*, now in the Brera Gallery, Milan. The composition of this picture is almost identical with that of Perugino, now in the museum at Caen, Normandy, but the changes in the architecture of the temple, and the grace and sweetness given to the figures and heads in Raphael's picture, make it essentially his own. In this same year we find Raphael revisiting Urbino, where he painted the *Christ on the Mount of Olives* which belonged to the late Fuller-Maitland, Esq., and also the two small pictures of St. George and St. Michael, belonging to the Louvre. Near the end of the year he went to Florence with a letter of recommendation to the gonfalonier Soderini from the duchess of Urbino. Here he found a fuller, richer life awaiting him, and made his entrance for the first time into the society of a great city, the intellectual and artistic head of Northern Italy. He remained at Florence, with the exception of short stays at Perugia, Urbino, and perhaps at Bologna, from 1504 to 1508. During these four years his talent reached its full maturity, and in our time there is a strong opinion that he never surpassed in beauty of execution, depth, and delicacy of feeling some of the pictures painted in what is called by distinction his "Florentine manner." In the first months of his residence he appears to have hesitated to enter the society of the famous men—Michel Angelo and Leonardo da Vinci chief among them—who were at that time in Florence. He preferred the society of younger men, though he was also strongly drawn to Fra Bartolommeo by a sympathy no doubt with his religious feeling and the character of his subjects, for Raphael came to Florence deeply imbued with the mysticism of the region where he had been born and bred; nor did he ever indeed entirely forsake it. Yet the style of Bartolommeo had been formed on other models, and he was able, therefore, to give a new direction to Raphael's manner without forcing him into wholly new ways of thinking. He became acquainted with Taddeo Taddei, at whose learned table he met an accomplished society, and by whom he was later introduced to some of the most distinguished names of Italy—to Castiglione, Bibbiena, and Bembo. He studied the frescoes of Masaccio in the Brancacci chapel, and the antiques which Lorenzo de' Medici had collected in the gardens of San Marco. But during the years 1504 and 1505 he painted few pictures of importance, the principal ones being the *Madonna* of the grand duke, in the Pitti, a small *Madonna* belonging to Lord Cowper at Panshanger, and a picture painted for the nuns of the convent of St. Antony of Padua at Perugia. The subject of the main picture is the Virgin with the child Jesus, and the infant St. John, St. Catharine, St. Dorothea, St. Peter, and St. Paul. In 1505 he painted at Perugia, in the church of San Severo, a fresco which is of importance, as its composition was almost textually repeated by the artist in his great fresco of the *Dispute*, in the Vatican. It represents the Trinity, with saints and angels. In 1521, the year after Raphael's death, Perugino painted a sort of predella to this fresco—six saints, three on either side of a central niche. From 1506 to the end of 1508, Raphael painted some of his most important works—the portraits of Agnolo Doni and his wife, in the Pitti; the *Portrait of a Lady*, in

* His name is variously spelled, but we have adopted the form more commonly accepted by English writers. The French also write it so, but the Germans generally follow the Italians in substituting the *f* for the *ph*. Raphael himself wrote his name *Raphael* and *Rafaele*, according to Mr. Dennistoun (*Dukes of Urbino*, vol. ii. p. 210), who says that he prefers the latter form, though he employs another—viz. *Raffaele*. He informs us that *Raffaelle* was a corruption introduced by Sir Joshua Reynolds, but it is of course no more a corruption than the one invented by Mr. Dennistoun. The name of *Sanzio* is said to have been contrived by Bembo from the name of Raphael's father—*Santi* or *Sanzi*—a patronymic formed from Sante, the name of Santi's father. Vasari, perhaps to flatter Raphael, writes it "*de' Santi*." Raphael is sometimes called, rather affectedly, the Urbinate, and the epithet "divine" is often added to his name.

† This is now the accepted date. Vasari and those who have followed him were probably wrong in saying that Raphael was born on Good-Friday. Vasari seems to have concluded that because Raphael died on Good-Friday, 1520, and because he died on the anniversary of his birthday, he must therefore have been born on a Good-Friday, which in 1483, however, fell on Mar. 28. But Bembo, in the epitaph which he wrote for his friend and caused to be set up over his tomb, says that he lived exactly thirty-seven years, *day for day*, and that he died on the anniversary of his birth, the 8th Ides of April. The 8th Ides of April is the 6th of the month, which in 1520 was Good-Friday. It seems conclusive, then, that the word "anniversary" must be understood as applying to the date of the month, and not to the movable feast which happened to fall on the day of the artist's death.

the "Tribune" of the Uffizi; the *Holy Family of the Palm,* in the possession of Lord Ellesmere; the *Madonna of the Casa Tempi,* in the Munich Gallery; the *Madonna of the Goldfinch,* in the Uffizi; the Orleans *Madonna,* belonging to M. Delessert; the portrait of himself, in the Uffizi; the *Three Graces,* belonging to Lord Ward; *St. Catharine of Alexandria,* in the National Gallery; the *Entombment,* of the Borghese Gallery;* the *Madonna of the Veil,* in the Louvre; the *Panshanger Madonna,* belonging to Lord Cowper; the *Madonna of the Casa Colonna,* at Berlin; the *Belle Jardinière,* and the *Madonna of the Canopy* (Baldachino), in the Pitti. In September of the year 1508, Raphael appears to have gone to Rome, summoned by Pope Julius II., who was of the ducal house of Urbino, at the instigation of Bramante, a compatriot and friend of Raphael. The work he was sent for to undertake was the decoration of some of the rooms in the Vatican. From 1508 to 1511, Raphael was engaged in painting the Chamber of the Signature (*Camera della Signatura*). On the four walls of this room he painted four of the great divisions of intellectual activity—Theology, Philosophy, Jurisprudence, and Poetry. On one side is the *Dispute concerning the Sacrament;* over it is Theology, and in the angle at the left, *Adam and Eve.* Opposite this is the *School of Athens,* with Philosophy above it, and a female figure in the angle looking at a starry globe, who perhaps represents Astronomy. Over the window at one end of the room is Mount Parnassus with Apollo, the Muses, and the poets, among them Homer, Horace, and Dante, with two other subjects in *grisaille* at the sides of the window—*Alexander collecting the Works of Homer* and *Augustus forbidding the Destruction of the Æneid.* Above is Poetry, and in the angle, *Apollo and Marsyas.* Over the other window is an allegory of Truth between Temperance and Strength, the whole symbolizing Jurisprudence, with two pictures at the sides—*Justinian giving his Digests to Tribonianus;* and *Gregory IX. publishing the Decretals.* Above is Justice, and in the angle *The Judgment of Solomon.* The *Parnassus* and the *Jurisprudence* were painted in 1511. In the same year Raphael painted the portrait of Julius II., now in the Pitti, a portrait of himself, now lost, but known by repetitions, together with the *Portrait of a Young Man leaning his head upon his hand,* in the Louvre, once thought to be his own portrait. Three important *Madonnas* of this year are the *Garvagli,* the *Maison d'Albe,* and the *Madonna di Fuligno.* In 1512, Raphael painted the portrait of Bindo Altoviti, the *Fornarina* of the "Tribune," the *Bridgewater Madonna,* and the *Virgin of the Fish.* In the next two years he was again busy at the Vatican. In 1512 he painted the chamber called "The Heliodorus" from his own fresco, one of four representing the power of the Church. First, he painted the *Heliodorus chased from the Temple,* and above it, *Moses and the Burning Bush.* Opposite it, *St. John arresting the March of Attila,* and over it, *Noah leaving the Ark.* Over one window, *The Mass at Bolsena;* above, the *Sacrifice of Abraham.* Over the opposite window, *St. Peter delivered from Prison,* with, above it, *Jacob's Vision.* In Feb., 1513, when he had just finished the *Mass at Bolsena* and the *Heliodorus,* Julius II. died, and the rest of the chamber was painted under Leo X., his successor. In 1514, Raphael was made architect-in-chief of the church of St. Peter by a papal brief dated Aug. 1. In this year he painted the *Prophets and Sibyls* of the church of Our Lady of Peace in Rome. The *Sibyls* were painted by his own hand—the *Prophets,* by Timoteo della Vite after his designs. He also painted the *Galatea* of the Farnesina Palace, the *St. Cecilia* of the Bologna Gallery, and the *Vision of Ezekiel* in the Pitti. From 1514 to 1517 he was again at work in the Vatican, where he painted *The Fire in the Borgo.* The other subjects in this room (called after this fresco) are not from Raphael's hand, though the designs no doubt were. In 1516 he painted the beautiful frescoes in the chapel of the Chigi family, church of S. M. del Popolo, and the Loggie of the Vatican. From 1515–16, Raphael made the designs for the tapestries intended to surround the Sistine Chapel. Seven of the cartoons remain, and are one of the great possessions of England. To 1516 belong the *Madonna della Seggiola,* Pitti; the *Madonna of the Candelabra;* the *Virgin of the Cloth,* Munich; *Lo Spasimo* and the Madonna called *The Pearl,* both at Madrid. In 1517 the great *St. Michel* of the Louvre was painted, and in 1518 the *Holy Family* of Francis I., also in the Louvre. Both these are signed and dated. To this year belong also the *St. Margaret* of the Louvre, the portrait of Leo X. in the Pitti, the portrait of Joanna of Aragon in the Louvre, the fresco of *Psyche* in the Farnesina, the *Violin-Player* of the Sciarra Palace, and the *St. John Baptist* of the Uffizi. The famous *Sistine Madonna,* painted in this year for the church of St. Sixtus at Piacenza, now in Dresden, was, all things considered, his greatest achievement. In 1519, Raphael made some of the designs for the Hall of Constantine in the Vatican, but died before the frescoes were commenced.

*To the period when the *Entombment* was painted belongs the very beautiful *Apollo and Marsyas,* the property of Mr. Morris Moore. This is one of the very few pictures of mythologic subjects painted by Raphael, and is not inferior in sentiment or execution to anything from his hand. The original drawing for it has long been owned by the Accademia delle Belle Arti of Venice. It is considered one of Raphael's most beautiful drawings. The beautiful fresco in the refectory of the former convent of S. Onofrio in Florence, which is generally believed to be by Raphael, is dated 1505. Authorities are disagreed about it, some giving it to Pinturicchio.

The last work of Raphael's life, and the one on which he was still employed when he was taken with his mortal illness, was the *Transfiguration,* now in the Vatican. It was finished by Giulio Romano. Raphael died of a malarial fever Apr. 6, 1520, on a Good-Friday, and was buried in the Pantheon at Rome. (*Life,* by Quatremère de Quincy; *Life and Works,* by J. D. Passavant; Kugler, *History of Italian Art;* Charles Clément, *Michel Angelo, Leonardo, and Raphael;* and Vasari, whose *Life,* corrected by the notes of later commentators, is, after all, the best.) CLARENCE COOK.

Ra'phall (MORRIS JACOB), PH. D., b. of Jewish parentage at Stockholm, Sweden, in Sept., 1798; educated in the Jewish college at Copenhagen and in England; studied at the University of Giessen 1821–24; settled in England 1825; began in 1834 the publication of the *Hebrew Review,* the first English periodical devoted to the interests of his race; went in 1840 to Syria as secretary to the chief rabbi of England to investigate the persecutions of the Jews; aided Dr. Sola in his translation of a large portion of the *Mishna;* became rabbi of the Birmingham synagogue 1841; aided in the foundation of the Hebrew national school; defended Judaism by his writings and lectures; supported Baron Rothschild in his successful candidacy for a seat in Parliament; settled in New York as pastor of the "Great Synagogue or Bnai Jeshurun" 1849, which position he retained until his death, June 23, 1868. Among his numerous works were translations from Maimonides and the Pentateuch, and *The Post-Biblical History of the Jews* (2 vols., New York, 1856; new ed. 1866).

Ra'pho, tp., Lancaster co., Pa. P. 3483.

Rapidan', tp., Blue Earth co., Minn. P. 449.

Rapidan, tp., Madison co., Va., on Rapidan River. P. 2306.

Rapid Ann Station, p.-v. in the village of Rapidan, Culpeper co., Va., on Orange Alexandria and Manassas R. R.

Rapidan' River rises by several head-streams at the base of the Blue Ridge, and flows between Green and Orange cos. on its right, and Madison and Culpeper on its left hand. Ten miles above Fredericksburg it joins the Rappahannock, after a course of 80 miles.

Rapides', parish of W. Louisiana, on Sabine River, which separates it from Texas, and traversed by Red and Calcasieu rivers, has a level surface covered with pine forests, and produces considerable quantities of cotton, sugar, and corn. Cap. Alexandria. Area, about 2000 sq. m. P. 18,015.

Rapides', tp., Halifax co., N. C. P. 2574.

Rapid River, tp., Kalkaska co., Mich. P. 424.

Rapids, tp., Linn co., Ia., on Cedar River. P. (exclusive of Cedar Rapids), 1068.

Rapids and Cataracts. See CATARACTS AND RAPIDS.

Ra'pier, a straight sword without edge, some three feet long, and used for a dress-sword on state occasions. It is also employed by duellists. The thrust and lunge are its only effective methods of offensive use.

Rapin-Thoyras' (PAUL), b. at Castres, department of Tarn, France, Mar. 25, 1661; studied first law; then entered the army, but was compelled to leave France in 1685, being a Calvinist, on the Revocation of the Edict of Nantes; went to Holland; joined William of Orange; fought in the battle of the Boyne; became tutor to the duke of Portland, but left England in 1707, and settled at Wesel on the Rhine, where he d. May 16, 1725. His *Histoire d'Angleterre* (8 vols., the Hague, 1724) was translated into English and continued by N. Tindal.

Rapp (GEORGE), b. in Würtemberg, Germany, in 1770; founded in early manhood a communistic religious association intended to restore the practices of the primitive Christian Church; came into conflict with the authorities of his native country; emigrated to the U. S. in 1803 with a number of his associates; settled on Conequenessing Creek, Butler co., Pa., where they founded the town of Harmony; engaged successfully in agriculture and manufactures, and removed in 1815 to a tract of 27,000 acres on Wabash River, Ind., and built up there a settlement called New Harmony. The Harmonists having become involved

in pecuniary difficulties, the lands were sold in 1824 to Robert Owen, by whom the socialistic experiment was tried on another basis. Rapp and his followers removed to Beaver co., Pa., and founded the town of Economy (now Harmony) on the bank of Allegheny River, 17 miles N. W. of Pittsburg, where the community still exists in a comparatively prosperous condition, occupying itself with agriculture, as well as silk, woollen, and cotton manufactures, and deserving esteem for strict morality and the promotion of education. Rapp d. at Economy Aug. 7, 1847.

Rapp (Jean), Count, b. at Colmar, Alsace, Apr. 29, 1772; entered the army in 1788; was aide-de-camp to Dessaix in 1794 and to Bonaparte in 1800; became brigadier-general in 1804, and general of division after the battle of Austerlitz; was appointed governor of Dantzic, and held the city in 1813 for twelve months against the Prussians and Russians; joined Napoleon during the Hundred Days; retired to Switzerland after the second restoration; returned in 1818 to France. D. Nov. 8, 1821, on his estate, Rheinweiler, in Baden. His *Mémoires* were published in 1823; he has also given a description of the siege of Dantzic.

Rappahan′nock, county of N. E. Virginia, extending from Rappahannock River on the E. to the Blue Ridge on the W., consists largely of ranges of hills affording picturesque scenery. The soil of the valleys is fertile, the staples being corn, wheat, and tobacco. Cap. Washington. Area, 250 sq. m. P. 8261.

Rappahan′nock, tp., Essex co., Va. P. 3208.

Rappahannock, tp., Fauquier co., Va., the scene of the battle of Nov. 7, 1863. P. 3132.

Rappahannock River rises in the foot-hills of the Blue Ridge, near the N. W. border of Fauquier co., Va., and flows in a S. E. course, generally parallel to that of the Potomac, reaching Chesapeake Bay through a broad estuary. Its largest branch is the Rapidan. At its rapids at Fredericksburg a fine dam has been constructed, affording extensive water-power. Below Fredericksburg it is a noble tidal stream, the navigation of which is important. Above the dam it has been canalized for 35 miles. It is some 250 miles in total length.

Rap′pen [a local name for the raven, whose head it bore], a Swiss coin worth one centime in French money. It is made of copper, and was first struck at Freiburg.

Rapp's Barren, tp., Marion co., Ark. P. 480.

Rar′itan, a river in New Jersey, rising in two branches in Morris co., flowing S. E. through Somerset and Hunterdon cos., and falling into Raritan Bay at Perth Amboy. It is navigable for vessels of considerable size as far as New Brunswick.

Rar′itan, p.-v., Bedford tp., Henderson co., Ill. P. 201.

Raritan, tp., Hunterdon co., N. J. P. 3654.

Raritan, tp., Middlesex co., N. J. P. 3460.

Raritan, tp., Monmouth co., N. J. P. 3443.

Raritan, p.-v., Bridgewater tp., Somerset co., N. J., on Raritan River and New Jersey Central R. R., 1 mile W. of Somerville. P. 1009.

Rash, a popular name for the acute exanthematous or eruptive diseases, or more frequently for the eruption itself which attends such diseases. Nettle rash or urticaria, scarlet rash (roseola), and canker rash (scarlet fever) are the diseases generally called by this name, which, though convenient for nursery use, is of no scientific value, for the diseases have nothing in common with each other.

Rask (Rasmus Christian), b. at Brendekilde, near Odense, in the island of Fünen, Denmark, Nov. 22, 1787; studied at the University of Copenhagen, and even while a schoolboy occupied himself with linguistic researches. In 1808, when only twenty years of age, he published his *Introduction to the Study of the Icelandic Language*, which, together with his edition of the *Eddas* (1817), the first critical and complete one ever published, forms the foundation for the study of Icelandic literature and language. In 1813 he began his extensive travels, which lasted to 1823. He spent first two years in Iceland, the result of which was his celebrated *Researches concerning the Origin of the Icelandic Language*, in which the first observations of the transpositions of sounds in the Teutonic languages were given to the world. He next spent one year in Stockholm, where he published a grammar of the Anglo-Saxon language and studied Finnish, and then, in 1817, he proceeded by St. Petersburg to Astrakhan, through Persia, and to India, which he traversed in its whole length, returning home, by Ceylon, in 1823. He brought to Copenhagen a great number of rare manuscripts belonging to Hindoo literature, and which are considered one of the greatest treasures of the library; but incomparably greater was the wealth of knowledge which he carried within himself, being master now of most of the languages composing the Indo-Germanic family, from the English to the Mantchoo. But his health was broken, and the results of his enormous linguistic acquisitions were fragmentary. He wrote essays on the Zend language, the genuineness of the *Zend-Avesta*, the ancient Egyptian and Hebrew chronology, and gave grammars of the Cingalese, Frisian, English, and Spanish languages. His richest and most original work is his *Introduction to a Scientific Orthography of the Danish Language* (1826), a book in which he gave to the science of comparative philology a new and powerful impulse, and in which he foreshadowed many ideas which later efforts have established as truths. D. in Copenhagen Nov. 14, 1832.

Raskōl′niks. The Raskolniks of Russia are the members of the *Raskól′*, or "schism," the name being derived from *raskolot′*, to "cleave." The schism dates officially from the year 1666. During the long period of the Mongol yoke numerous errors crept into the ritual and liturgical books of the Russian Church. In the early part of the sixteenth century an attempt to correct them was made by Maxim the Greek, an Albanian monk from Mount Athos, who was invited to Moscow in 1518 by the czar Vassily Ivanovich, but it proved fruitless. In the seventeenth century, however, during the reign of Alexis Mikhailovich, the patriarch Nikon introduced numerous reforms. Greek and Slavonic MSS. were collected, monks were summoned from Mount Athos and Byzantium, the Slavonic versions were compared with the Greek originals, interpolations were effaced, and the corrected liturgies, having been printed, were adopted by a council. But the reforms were met by great opposition, which became an organized resistance. Nikon himself fell, but the council which deposed him in May, 1667, confirmed his reforms. From that time the schism in the Russian Church became established, and it still remains uncured. The Raskolniks objected to the alterations in, and the printing of, the church-books, to the form of the cross, as well as the method of signing the cross adopted by the authorities, to the double instead of triple repetition of the hallelujah in the church service, and to various other matters of equal importance. Thence they took the name of *Staroobriádts*, or Old Ritualists (from *stary*, "old," and *obriád*, "a rite"); but, as they professed to be the preservers of old faith, as well as of old rites, they called themselves also *Starovery*, or Old Believers (from *vera*, "faith"). When Peter I. introduced his reforms into Russia the *Raskol* waxed stronger, its old religious opposition being fortified by a political resistance to the new ideas imported from the West. Muscovite conservatism objected to the census, to military conscription, to shaving, to giving up the national dress. The Raskolniks denounced Peter as Antichrist, and some of their descendants have always maintained a like horror of his successors and their government. Peter I. vainly endeavored to crush their opposition. Since his time their treatment has fluctuated. Peter III. was their avowed protector, and some of their sects regard him as still alive and destined to appear as their Messiah. Catharine II. treated them leniently for a time, granting them the official designation of *Edinovertsy*, or "Like-Believers," and allowing them to retain their old ritual. But after the insurrection of Pugachef, an outbreak of schismatic and rebellious fury, they met with less favor. Paul and Alexander I. showed them much leniency in the early part of their reigns. Nicholas in vain tried severer measures. Toward the end of his reign advances were made to them by the Poles and the Russian socialists, but the only result was the installation in 1846, at Belokrinitsa in Bukovina, of a Raskolnik metropolitan, Ambrose, formerly metropolitan of Bosnia. His successor, Cyril, visited Moscow in 1863, and there held a Raskolnik council-general. But just then the Polish insurrection broke out, and the Old Believers sent him away and addressed to the throne an assurance of loyal devotion. They were rewarded by tolerant measures, and since that time large concessions have been made to them. Up to Oct., 1874, their marriages, as a general rule, were not legal, the law recognizing religious marriages only, and all marriage registers being kept by priests of the established Church. But now special registers for the Raskolniks are kept by the police, and their marriages are legalized.

Little is known as to the numbers of the Raskolniks. The last official census, that of 1871, admits 1,093,452, but it is said that as many as 10,000,000 really exist. What appears certain is that they form the most industrious, honest, and sober portion of the Russian community. They belong exclusively to "Great Russia," and are chiefly found among the most energetic of the Russian people. Those in Poland, Livonia, Little Russia, and White Russia are all colonists from Great Russia. Everywhere they

evince a truly Russian faculty of organization, forming readily into communities ruled by practical systems of self-government. At a very early period they split into two great bodies—the *Popovtsy*, or "Priestly," and the *Bezpopovtsy*, or "Priestless" (from *bez*, "without," and *pop*, "a priest"). The former were obliged to depend for their priests upon fugitive "popes" from the establishment; the latter dispensed with the services of ecclesiastics, using those of elders instead. For about a century neither body possessed any legalized establishments, but about 1771, after the great plague of Moscow, each branch was allowed to build in the capital a cemetery with a church and convent, and these still exist as the head-quarters of the Raskol. In addition to the main body of the Raskolniks, under their various names of "Old Believers," "Old Ritualists," or "Like-Believers," the Raskol comprises a number of minor sects, mostly of foreign origin. Some of these are respectable, such as the *Molokane* (said to be so called from *molokó*, "milk," because they do not abstain during fasts from milk and its products) and the *Stundists* (from the German *Stunde*), both of which bodies hold what may perhaps be called Protestant doctrines. The *Dukhobortsy*, or "spirit-wrestlers," seem to have been originally harmless mystics, but they afterward changed their character, and were in consequence mostly transferred to the Caucasus. But some of the sects are of a terrible nature. The worst have either been crushed by the police or are but rarely met with, such as the *Detoubytsy*, or "child-killers," who put new-born babes to death in order to ensure their salvation, or the *Dukhilshchiki*, who kill their friends and relatives when ill, or the *Sojigately*, who commit suicide by means of fire. Only one of the noxious sects flourishes to any extent. It is illegal, but still it exists. It is that of the *Skoptsy*, or "self-mutilators," a set of gloomy fanatics greatly addicted to money-getting. (The best information on the subject, independently of works in Russian, is contained in Leroy-Beaulieu's *Empire des Tsars*, published in the *Revue des Deux Mondes*; Dean Stanley's *Eastern Church*; Haxthausen's *Russian Empire*; and the histories of the Russian Church by Muravief and Filaret, archbishop of Tchernigof.) W. R. S. Ralston.

Raso'res [Lat. *radere*, to "scratch"], an order of birds, including those which have strong feet, provided with obtuse claws for scratching up grains, etc., and the upper mandible vaulted, with the nostrils pierced in a membranous space at its base, and covered by a cartilaginous scale.

Rasp'berry [so named because the stalk *rasps* the hand], the common name of those species of *Rubus* (order Rosaceæ) which differ from blackberries in having a persistent receptacle, from which the ripe compound fruit slips off, while in the blackberries the receptacle is juicy and becomes a part of the fruit. The European and Asiatic raspberry is *Rubus Idæus*, and it is probable that our *R. strigosus*, or red raspberry, is but a marked variety of the same species. Our black raspberry, black-cap or thimbleberry, is the *R. occidentalis*. All the above are highly valuable in cultivation. There are many varieties. Raspberries are among the most valuable of our summer dessert-fruits, and are the foundation of many conserves, jellies, and other delicacies for the table and the sick-room.

Raspail' (François Vincent), b. at Carpentras, department of Vaucluse, France, Jan. 29, 1794; studied botany and chemistry at Avignon; settled in 1815 at Paris, and became famous both as a scientific writer and as a political agitator. He fought in the streets in 1830 and 1848, and was connected with the Commune in 1870–71; edited various revolutionary papers, *Réformateur*, *Marseillaise*, *L'Ami du Peuple*, etc.; wrote a number of violent pamphlets; founded several revolutionary societies and clubs; was several times imprisoned, and lived in exile from 1853 to 1869. The most prominent of his works are—*Essai de Chimie microscopique* (1831), *Nouveau Système de Chimie organique* (1833), *Nouveau Système de Physiologie végétale et botanique* (1837), *Histoire naturelle de la Santé et de la Maladie chez les Végétaux et les Animaux* (1839–43), *Cigarettes de Camphre* (1839), *Nouvelles Études scientifiques* (1861–64). D. Jan. 8, 1878.

Ras'tadt, town of the grand duchy of Baden, Germany, on the Murg, a small tributary of the Rhine, a few miles distant. It is one of the modern fortresses or "intrenched camps" of the former German confederation, commenced in 1841, and in that respect is interesting as illustrating the German systems as contrasted with those of the French school. The town is well built; was the residence of the last margraves of Baden, whose palace (planned after that of Versailles) still exists. The place is historically interesting from the treaty of peace (1714) which ended the war of the Spanish Succession, and of the congress of 1799, which terminated abruptly with the assassination of the French deputies. P. 11,559.

Rat [Ang.-Sax. *ræt*], a name applied to numerous species of the family Muridæ, being about the size of the familiar species known under that designation. The best known of these are the common brown rat (*Mus decumanus*), the black rat (*Mus ratus*), the Florida or cave rat (*Neotoma floridana*), and the cotton rat of the Southern States (*Sigmodon hispidus*). The common rat is too well known to need description. It was originally a native of India and Persia, but has become cosmopolitan within recent times, and its present distribution is almost coequal with that of man. It is generally believed not to have extended into Europe much before the middle of the eighteenth century, and to have been brought to America about 1775. It was anticipated in its incursions by the black rat, but its superior strength and aggressiveness have driven that species before it, and have now supplanted it in almost all countries. It is very prolific, breeding from four to five times during the year, and having about a dozen young each time. It is almost omnivorous, feeding upon grains, vegetables, and meat. The black rat (*Mus ratus*) is smaller than the brown species, and is much more timid. It also was originally peculiar to Asia, but in the course of time extended its range to many other countries; it is now, however, a not common animal, and its numbers are kept down by its antagonist, the brown rat. The Florida or wood rat (*Neotoma floridana*) is about the size of the brown rat, for which it is often mistaken, but it has much larger eyes, and the details of the structure at once define it; and it in fact belongs not only to a different genus, but to a different section of the family, from the common rat. Although found in the Middle and Western States, it is most abundant in the Southern Atlantic and Gulf States. It is mostly found in the woods, as one of its names indicates, and does not enter houses, as the common species do. It is chiefly granivorous. The cotton rat (*Sigmodon hispidus*) is much smaller than the others, its body being only about five inches long. It is quite abundant in the Southern States, where it lives mainly in waste fields and hedges. It often lines its nest with cotton, whence it has received its common name. Theodore Gill.

Ratabur'idæ [from *Ratabura*, the corrupted Indian name of a species], a family of eel-like fishes. The body has the usual anguilliform shape, but, on account of the backward position of the anus, the tail is much shorter than the trunk; the heart is situated far behind the head; the skin is quite naked, the head small; the posterior nostrils open in front of the eye; the mouth has a narrow cleft; the teeth are uniserial; the branchial apertures narrow and inferior, and their pharyngeal slits are wide; the vertical fins are rudimentary and limited to the caudal portion; the pectorals but slightly developed or absent. The family is composed of some half dozen species, confined to South-eastern Asia and the neighboring portion of the Pacific Ocean. These have been combined under two genera—(1) *Ratabura* or *Moringua*; and (2) *Aphthalmichthys*; or even under a single genus (*Moringua*) by Günther.

Theodore Gill.

Ratafi'a [a word of Malay origin], a name given to a large class of liqueurs, or sweet alcoholic drinks strongly flavored with aromatics. The term is a common one on the European continent.

Rath'bone, tp., Steuben co., N. Y. P. 1357.

Ra'thenow, town of Prussia, province of Brandenburg, on the Havel, has several spinning and weaving factories, tanneries, and manufactures of bricks, tiles, and spectacles. P. 6820.

Ra'tibor, town of Prussia, province of Upper Silesia, on the Oder, has manufactures of hosiery, linen and woollen stuffs, leather, and vinegar, and a large trade in flax, hemp, and wool. P. 15,323.

Ra'tio [Lat.], the numerical measure of the relation which one quantity bears to another of the same kind. The only way in which two quantities can be compared is by division. The operation of dividing one quantity by another of the same kind consists in dividing *the number of times* that any assumed unit is contained in the former by *the number of times* the same unit is contained in the latter. The operation of finding a ratio is therefore purely numerical, and the resulting ratio is consequently an abstract number. If the terms of the ratio are commensurable, their ratio is *exact*; if the terms are incommensurable, their ratio is only *approximate*; but it is to be remarked that the approximation to the true value may be made to any desirable degree of exactness. In comparing two quantities of the same kind, one is assumed to be known beforehand, and for this reason it is called the *antecedent*; the value of the other is then found by division, and for this reason it is called the *consequent*. Inasmuch as the measure of a quantity is the number of

times that it contains some quantity of the same kind taken as a unit, we say that the ratio of one quantity to another is *the quotient obtained by dividing the second quantity by the first.* It is to be observed that mathematical writers differ in their methods of using the term *ratio,* some adopting the rule above given, and some defining it to be *the quotient of the first quantity by the second;* all, however, agree in calling the first quantity the antecedent and the second quantity the consequent. From the meaning of these terms, as explained above, the former would seem to be the more natural definition of the term. It certainly has the advantage of *uniformity of meaning,* which is no minor quality, inasmuch as all writers regard the ratio of a geometrical progression as the quotient of the second term by the first. No error can arise from the adoption of either definition, provided the meaning of the term is fully understood and uniformly adhered to.

The term *arithmetical ratio* is used by some writers to denote the difference between two quantities. This would appear to be an incorrect application of the term *ratio,* inasmuch as a knowledge of the numerical difference between the quantities would not, in any proper sense, convey an idea of their relative value. To say that one line is an inch longer than another would impart no idea of the relative value of the two lines unless, perchance, the value of one of them should be known; in which case the idea of relation would resolve itself into the true idea of division. Euclid's definition of ratio is as follows: "Ratio is a certain mutual habitude of two homogeneous magnitudes with respect to *quality* or numerical composition." Peacock in his *Algebra* says that there is no geometrical definition of ratio by which the equivalence of different modes of representation may be ascertained as necessary consequences; and for this reason ratios in geometry are only considered in connection with each other as constituting, or as not constituting, a proportion.

Ultimate Ratio.—If two quantities, both functions of the same variable, vary in such a manner that their ratio shall continually approach to a fixed quantity, but cannot pass it, that quantity is said to be the ultimate ratio of the given quantities. The ultimate ratio of two quantities is nothing else than a limit, the term limit being used in the sense attributed to it in the modern calculus, in which it is synonymous with the differential coefficient, the fundamental element of the DIFFERENTIAL CALCULUS (which see). If we consider the case of an arc less than 90°, and its chord, it is evident that the arc is always greater than its chord; but as the arc decreases—that is, approaches 0—the ratio of the arc to the chord diminishes; and finally when the arc becomes infinitesimal, this ratio becomes equal to 1—that is, the ultimate ratio of a decreasing arc to its chord is a ratio of equality. In like manner, if we inscribe a regular polygon in a circle, and then increase the number of sides of the polygon by the process of continued duplication, the polygon will continually approach to an equality with the circle; and finally, when the number of sides becomes infinite, the two will become equal. In this case the ultimate ratio of an inscribed regular polygon to the corresponding circle is a ratio of equality—that is, the circle is a regular polygon with an infinite number of sides.

Prime and Ultimate Ratios.—The method of analysis used by Newton in his *Principia.* It is a simplification of the method of exhaustion as used by ancient geometers. To conceive an idea of this method, let us suppose two variable quantities whose values approach each other so that their ratio continually approaches a, and finally differs from a by less than any assignable quantity; then is a the ultimate ratio of the two quantities. Again, if two variable quantities simultaneously approach two other quantities, which on the same hypothesis remain constant, the ultimate ratio of the variable quantities is the same as that of the constant quantities. The ratios are called *prime* or *ultimate* according as the ratio of the variable quantities is receding from or approaching to the ratio of the constant quantities. W. G. PECK.

Ra'tionalism [Lat. *ratio,* "reason"], like naturalism, supernaturalism, and other terms expressive of the relation of reason and faith, was first used in its present sense by the philosopher Kant. Rationalism is that tendency in modern thought which claims for the unaided human reason the right of deciding in matters of faith. It asserts the prerogative of the intellect to be supreme arbiter in all departments of revealed truth. It requires certainty as the condition of its favor, and, with Wolf, promptly rejects what does not come before it with all the exactness and clearness of a mathematical demonstration. The scene where rationalism has exerted its chief sway is Germany. The sources were various, not only embracing different countries, but likewise different departments of investigation. The deism of England, one of the most polished and powerful of all forms of free thought, was industriously propagated in Germany, where the works of Lord Herbert, Hobbes, Shaftesbury, Tyndal, Woolston, and Wollaston were circulated in the language of the people and read by wide circles. In Holland the philosophy of Descartes and Spinoza was very powerful, and its influence was very decided east of the Rhine, particularly in the universities of Germany. The pantheism of Spinoza was very attractive to many minds, and was regarded as a welcome relief from the cold and heartless banishment of God from his own creation. France, however, was the chief foreign country which contributed to the rise and sway of German rationalism. The influence of Voltaire and the Encyclopædists was very great, and Berlin became as much a home to these men as Paris had ever been. The domestic causes were, first of all, the philosophy of Leibnitz, popularized and simplified by Wolf at Halle University; the destructive theology of Semler; the influence of the skeptical court of Frederick the Great, with its French surroundings; the *Wolfenbüttel Fragments,* published by Lessing; and the *Universal German Library,* issued by Nicolai. Rationalism was in the ascendant in Germany from 1750 to 1800, but with the beginning of the new century it began to lose its hold upon the best minds. Schleiermacher was the transitional theologian from the old rationalistic to the new evangelical faith of Protestant Germany. His *Discourses on Religion* diverted public attention from the rationalistic criticism to the necessity of feeling and a sense of dependence on God. Jacobi was really the first to introduce the sense of dependence into the domain of religious philosophy, but Schleiermacher was the first to apply it to the man of general culture. Neander, the Church historian, was the first positive theologian of the so-called "mediatory" school. His historical works breathe a fervent and devout spirit, at the same time that they evince the profound scholarship of the original student. In 1835 a new impulse was given to rationalistic criticism by Strauss's *Life of Jesus*—a work proceeding directly from the Hegelian school. It advocated the mythical origin of the Gospels. This work was promptly replied to by Neander, Ullmann, Tholuck, and many other representatives of evangelical thought. The most recent phase of rationalistic thought is materialistic. The views of Büchner, Carl Vogt, Moleschott, and others have gained a wide influence. Evangelical theology is, however, in the ascendant again in most of the German universities. The Broad Church of England, represented by Matthew Arnold and others, has affinities with the rationalism of Germany. (On the literature of rationalism compare Farrar, *Critical History of Free Thought* (Bampton Lectures, 1863); Lecky, *History of the Rise and Influence of the Spirit of Rationalism in Europe* (2 vols., London, 1865); Hurst, *History of Rationalism* (New York, 1865; London, 1866).) J. F. HURST.

Ration'al Quan'tity, a quantity which involves no radicals. Rational quantities are so called in contradistinction to radicals, which are then termed irrational. W. G. PECK.

Rat'isbon, or **Regensburg,** an old and interesting town of Bavaria, formerly a free city of Germany, on the right bank of the Danube, opposite the influx of the Regen, is surrounded with walls pierced by six gates, and has a fine cathedral begun in 1275, but not finished till the middle of the seventeenth century; a town-house, in which the imperial diet assembled from 1662 to 1806; a magnificent stone bridge over the Danube, 1100 feet long; and a monument of Kepler, who was born here. Gold, silver, brass, iron, steel, earthen and porcelain ware, leather, tobacco, and glass are manufactured here. P. 29,224.

Rat'itæ [Lat. *ratis,* "logs fastened together," "raft," alluding to the disconnected barbs of the feathers], an order or sub-order of birds contrasting with all the other living forms of the class, and containing the ostriches, cassowaries, and kiwis. It is distinguished, according to Huxley, by the sternum being devoid of a crest, and ossifying only from lateral and paired centres, the parallelism or identity of the long axes of the adjacent parts of the scapula and coracoid, and the non-development of an acromial process to the scapula, and of a clavicular process to the coracoid; the vomer has a broad cleft; the hinder and posterior ends of the palatines and the anterior ones of the pterygoids are very imperfectly or not at all articulated with the basisphenoidal rostrum. It may be further added that in all the living representatives the feathers are characteristic, the barbs being disconnected. The group embraces the largest of birds, all of which are incapable of flight, and progress by running. The species, though comparatively few, represent several well-defined families—viz. Struthionidæ, embracing the African ostriches; Rheidæ, including the South American ostriches

or nandus; Casuaridæ, with the cassowaries and emus of the Papuan Archipelago, Australia, etc.; and Apterygidæ, including the kiwis of New Zealand; the order was also well represented in former geological epochs, especially in New Zealand, by the gigantic Dinornithidæ, which seem to have been destitute of true wings. THEODORE GILL.

Rat-Mole. See MOLE-RAT.

Ratram'nus, also called **Bertramus** by an error of copyists, a learned monk of the famous abbey of Corbey, near Amiens, best known by his treatise *De Corpore et Sanguine Domini*, written to confute the transubstantiation doctrine of Paschasius Radbert (about 844 A. D.). He d. after 868. His writings occupy about 170 pages in vol. cxxi. of Migne's *Patrologia*. R. D. HITCHCOCK.

Rattan' [Malay, *rôtan*, "cane"], the slender stem of various plants of the genus *Calamus*, many of them climbing and trailing plants, often many hundreds of feet in length, others quite short, all having a beautiful head of feathery leaves. *C. viminalis, rudentum, rotang, verus, scipionum*, and *draco* are among the species of this interesting genus. The third and the last mentioned yield a part of the dragon's blood of commerce. The young shoots of some of the species are used as a potherb; some produce good fruits; but the chief use is that of the stalks. From Borneo to Bengal great quantities are gathered for the Chinese, the European, and the American markets. In China they are used for a great variety of purposes; mats, sails, and cables are among the articles made from them. In this country they are used for making chairs, baskets, canes, umbrella ribs, etc., and splinters of rattan are used in carriage trimming and other ornamental work. Tropical America has numerous rattan-like palms of the genus *Desmoncus*, armed with strong thorns. They are locally used like the true rattans.

Rattaz'zi (URBANO), b. at Alessandria, Italy, June 29, 1808; studied law at Turin, and began to practise as an advocate at Casale: was elected a member of the Sardinian Parliament in 1848; opposed in the most decided manner the Austrian authority in Italy, and became a member of the cabinet of Gioberti, but retired immediately after the battle of Novara; entered the cabinet of Cavour (1853–58) as minister of justice, and carried the law for the dissolution of the monasteries; formed a cabinet in opposition to Ricasoli in 1862, and again in 1867, but held the place only for a few months. D. at Frosinone June 5, 1873. By the radicals he was accused of being subservient to France; by the clericals, of being in compact with Garibaldi; thus his position was often very difficult, but he was a man of eminent ability and in possession of great talent as a speaker.—In 1862 he married the princess MARIE STUDOLMINE DE SOLMS, a daughter of the princess Lætitia Bonaparte and Sir Thomas Wyse, who died as English minister at Athens. Miss Wyse, b. in 1830, married in 1850 M. Frédéric de Solms, a rich Alsatian, but separated from him in 1852, and devoted herself to literature. Several of her romances have made quite a sensation.

Rat'tlesnake, a name applied to all the species of the family Crotalidæ provided with a rattle to the tail. The rattle is composed of articulated horny segments in varying number—from two or three up to thirty or more. The popular belief that the number of segments indicates the age of the animal is erroneous. The species of the group are peculiar to America, and are especially numerous in the arid regions of the South-western Territories of the U. S. According to the identifications of Prof. Cope, fifteen species are found within the limits of the U. S.: of these, eleven belong to the genus *Crotalus*, one to *Aploaspis*, both of which have the head covered with small scales, and four to the genus *Caudisona*, which is characterized by having large plates upon the head similar to those of ordinary snakes. The common rattlesnake of the Northern and Eastern States is *Crotalus horridus;* in the Southern States, from North Carolina to Florida, *Crotalus adamanteus* is also found. A species of *Caudisona* (*C. tergemina*) is also found in the Western States, and extends as far southward as Western New York, although the other species of the group are confined to the Western and South-western States and Territories. The venom of the rattlesnake has been the subject of special investigation by Weir Mitchell (1860). This varies in intensity with the climate, season, and the condition of the animal itself. It is most to be feared in warm weather. No certain antidotes to the venom are known. The best are believed to be active stimulants, among which alcoholic liquors are the most esteemed.

THEODORE GILL.

Rauch (CHRISTIAN), b. at Arolsen, Waldeck, Germany, Jan. 2, 1777; received his first instruction in art at Cassel and Berlin; resided for several years at Rome and Carrara in intimate intercourse with Thorwaldsen, Canova, and W. von Humboldt; settled subsequently at Berlin as professor at the academy. D. in Dresden Dec. 3, 1857. His most remarkable works are the monument of Frederick II. at Berlin, the statue of Queen Louisa at Potsdam, of Kant at Königsberg, of Blücher at Breslau, of Scharnhorst and Bülow in Berlin, etc.

Rauch (FREDERICK AUGUSTUS), D. D., b. at Kirchbracht, Hesse-Darmstadt, July 27, 1806; educated at the universities of Marburg, Giessen, and Heidelberg; was for some time professor in the two latter institutions; came to the U. S. 1831; was ordained to the ministry of the German Reformed Church 1832; professor of German at Lafayette College, Pa.; principal of high schools and professor of biblical literature at York and at Mercersburg, and president of Marshall College from 1836 until his death at Mercersburg Mar. 2, 1841. Author of works in German and English, one of which was *Psychology* (1840).

Rau'hes Haus [Ger., "rough house"], a famous reformatory institution for boys, and latterly for girls also, established in 1831 at Hom, near Hamburg, Germany, by Dr. J. H. Wichern. The children live in a number of distinct families under the care of young men belonging to a sort of conventual institute of brothers of the Inner Mission of the German Evangelical Church. They are all taught useful trades, and hitherto more than 90 per cent. of the pupils have been permanently reformed. Of late, more than 100 similar schools have been established in Germany.

Rau'mer, von (FRIEDRICH LUDWIG GEORG), b. at Wörlitz, in the duchy of Anhalt, Germany, May 14, 1781; studied law at Berlin, Halle, and Göttingen; received employment in the civil service of the Prussian government in 1801; was appointed professor of history at Breslau in 1811 and at Berlin in 1819; was a member of the German Parliament at Frankfort in 1848, and afterward of the Prussian upper house. D. at Berlin June 13, 1873. His principal works are—*Geschichte der Hohenstaufen und ihrer Zeit* (6 vols., 1823–25), *Geschichte Europas seit dem Ende des 15. Jahrhunderts* (8 vols., 1832–50), *Herbstreise nach Venedig* (2 vols., 1816), *Briefe aus Paris* (2 vols., 1831), *England im Jahr 1835* (2 vols., 1836; translated into English by Sarah Austin and H. E. Lloyd), *America and the American People* (2 vols., 1845; translated into English by W. W. Turner), *Antiquarische Briefe* (1851), *Vermischte Schriften* (3 vols., 1852–54).

Raumer, von (KARL GEORG), brother of the preceding, b. at Wörlitz Apr. 9, 1783; studied geology at Halle and Göttingen, and at the mining school of Freiberg under Werner; was appointed professor of mineralogy in 1811 at Breslau, in 1819 at Halle, in 1827 at Erlangen, where he d. June 2, 1865. Most widely known are his geographical works, *Lehrbuch der allgemeinen Geographie* (1832) and *Beschreibung der Erdoberfläche* (both often reprinted), *Palästina* (1834), *Geschichte der Pädagogik* (4 vols., 1857–61), *Autobiography* (published after his death).

Ravaillac' (FRANÇOIS), b. at Angoulême, department of Charente, France, in 1578; was first clerk to a notary, then a schoolmaster; subsequently imprisoned for debt; entered the order of the Feuillants, but was expelled as a visionary and fool, and became noted for his fanatical hatred of the Protestants; which feeling by degrees concentrated itself on the person of Henry IV., their former leader. Several times he sought in vain to approach the king; at last he succeeded. On the afternoon of May 14, 1610, the king rode out to pay a visit to Sully, who was sick in bed. In the narrow street Laferronnerie his coach was stopped for a moment by some heavily-laden carts in front of it. Ravaillac jumped up on the hind wheel and plunged a dagger into the heart of the king, who died immediately. The murderer was captured soon after, confessed the crime, and was put to death May 27, having been subjected to cruel tortures without revealing the secret instigators of the deed.

Ravanu'sa, town of Sicily, province of Girgenti, near the bank of the Salso, 32 miles E. S. E. of the city of Girgenti. Grain, grapes, olives, almonds, and pistachios abound here, and the inhabitants are chiefly occupied in the cultivation and sale of these productions. P. 7650.

Ra'ven [Ang.-Sax. *hräfen*], a large species of the genus *Corvus* (*Corvus corax*, Linn.), which differs from the crow chiefly by its larger size and the lanceolate feathers of its chin and throat. It is found over the greater part of the northern part of the Old World, as well as North America, although it is quite rare on the Atlantic seaboard. It generally associates in pairs, but sometimes is to be seen in small flocks. It builds a rude nest, chiefly on cliffs, and deposits therein from four to six eggs of a light greenish-blue, blotched with brownish spots. It is capable to some extent of mimicking the human voice. It was formerly,

and is still by some superstitious persons, looked upon as a bird of evil omen. THEODORE GILL.

Raven'na, city of Northern Italy, chief town of the province to which it gives its name, near the Adriatic, in lat. 44° 24′ N., lon. 12° 10′ E. It is in more or less direct communication by rail with all the great towns of the Peninsula, and by water, through the canal Naviglio (constructed in 1747), with Venice, Trieste, etc. The city is about 3 miles in circumference, but nearly half the enclosed space is occupied by vineyards; the surrounding district is low and marshy, and both town and country are subject to malarious fevers, though in ancient times this region appears to have been remarkable for its salubrity. This unfavorable change is no doubt owing in a great measure to the deposits from the Po, these having so filled up the sea here that Ravenna, once on the very shore, now stands 3 or 4 miles inland. In the time of Augustus the city was intersected by canals, the houses, mostly of wood, were built on piles, and the intercourse between different parts of the town was carried on by means of boats and bridges, as now in Venice. The Roman fleet, of 250 or 300 sail, then rode at anchor in the Portus Classis, 3 miles S. E. of the town, where now stands a dark forest of already aged pines.

But curious and important as are these physical changes to the student of nature, the great attraction of Ravenna, that which makes her unique among the cities of Italy and the world, is the fact that here are preserved so many monuments of the dark and stormy ages of transition from the Roman to the Teutonic—monuments of the highest possible interest to the lover of early Christian art. The first Christian structures were unquestionably at the Portus Classis, but these have for the most part so utterly perished that only a column or a cross tells where they stood. The oldest now existing are the cathedral of St. Orso (Basilica Ursiana), founded toward the end of the fourth century by Bishop Ursus, and the baptistery (*S. Giovanni in fonte*), founded by Bishop Neo a very few years later. The cathedral was almost entirely rebuilt in the seventeenth century, but the old campanile still remains, and in the church itself are preserved many curious memorials, such as sarcophagi of saints and bishops of a very early date, a silver crucifix of the sixth century, marble bas-reliefs of the same and even of an earlier age, the ivory throne of St. Maximian, etc. Of a more modern interest are the celebrated frescoes by Guido Reni. The baptistery is an octagonal brick building, with cupola, which was never cased in marble; the interior is formed by two tiers of arches rising one above another, the columns of the lower tier having capitals ornamented with Greek foliage. The mosaics, probably the most ancient in Ravenna, are in the highest degree interesting. The font is of the fifth century. SS. Nazaro e Celso, the once magnificent mausoleum of Galla Placidia, was founded by that empress in 440, is in the form of a Latin cross, and contains beautiful mosaics of the fifth century representing the Saviour, evangelists, prophets, etc. In this church is the sarcophagus of the empress, in which she was to be seen, seated in her royal robes of cloth of gold, as late as the sixteenth century, when the drapery was accidentally consumed by fire. Here are also the tombs of Honorius and Constantius III., with two smaller ones bearing the names of tutors of the royal household. The church of San Francesco, first dedicated to St. Peter, is also of the fifth century, though now much disguised by restorations; Sant' Agatha is of about the same period, and not greatly changed; and there are several other more or less ruined churches of the same age. The archiepiscopal palace also contains a chapel of the fifth century, which remains almost without a change, and the archives in this palace are said to have numbered 25,000 parchment MSS., though these are now partially scattered. Of the sixth century should be mentioned St. Apollinare in Classe, outside the town, the most striking of the ancient Ravenna basilicas, as a specimen of the purest early Christian art; the basilica of St. Apollinare Nuovo, built by the Arian Theodoric, and containing, besides mosaics still very curious though much restored, a representation (not, of course, as old as the church) of the suburb of Classis and of the city of Ravenna itself, with the church of San Vitale, the palace of Theodoric, etc. This palace, afterward the residence of the exarchs and of the Lombard kings, has wellnigh disappeared. The noble basilica of San Vitale is of a somewhat later period, but still nearly as old as Santa Sophia, after which it was modelled. It contains gorgeous mosaics representing, besides divine subjects, the emperor Justinian, with the empress Theodora and her court. Outside the walls, about half a mile to the N. E., stands the mausoleum of Theodoric, now commonly called Sta. Maria della Rotonda. The marble statues of the apostles which once decorated this building are no longer there, but the huge stones of which it was composed, and the hugest of all, the cupola, 30 feet in diameter, hollowed out of a single block, still stand as if to bear witness that this was the last resting-place of one of the greatest of mortal men. It is impossible in this brief notice even to hint at the countless details of architectural, artistic, and religious interest furnished by these ancient edifices and others not even named here, and we must refer the reader to the works recommended at the end of this article. Ravenna is comparatively poor in mediæval monuments, the church of Santa Maria in Porto Fuori, of the eleventh century, being the most interesting, but it contains one memorial of that time which calls forth higher associations and more profound feeling than mere stone or brass, however venerable, can ever awaken—the ashes of the immortal Dante. They rest in a tomb by the church of St. Francesco, and in 1865 Florence entreated in vain for the bones of her banished son. The name of Ravenna is also connected with that of another great poet, Lord Byron, whose partiality for this place and the motives for it are well known, as well as the fact that some of his finest works were written here. The house occupied by the English poet has acquired additional celebrity by having been, for a time, the abode of Garibaldi, and near the present harbor is pointed out the last resting-place of his brave Anita, who died on that terrible flight from the Austrians in 1849. The Biblioteca Communale, in the old Carthusian monastery, contains upward of 50,000 volumes and 700 MSS., the most precious of which is an Aristophanes of the tenth century; there is also a MS. of Dante of the fourteenth century, and an inferior one a little older; a beautiful illuminated Officium on white vellum, and another on violet; among the printed volumes are many *princeps* editions of great rarity and value. The museum, besides being rich in vases, bronzes, majolicas, etc., contains a very choice collection of medals, ancient and mediæval, and some gold ornaments believed to have belonged to Odoacer. The Academy of Fine Arts possesses, among other things of interest, many old Byzantine pictures and a beautiful mosaic pavement found at Classe. An enumeration of even the leading objects of interest in and around Ravenna would be incomplete without a mention of the famous Pineta, or pine forest, so praised by poets and painters. This forest, growing on a sandy soil thrown up by the sea, begins not far from St. Apollinare in Classe, and extends for some 25 miles southward along the Adriatic, with a width varying from 1 to 3 miles, and affording views of extraordinary beauty.

Tradition gives Ravenna an origin greatly anterior to Rome itself. Strabo tells us it was founded by a colony from Thessaly, and afterward became subject to the Umbrians. Little, however, is positively known of its history until it was subdued by the Romans (187 B. C.), it being at that time the capital of Cisalpine Gaul. Augustus constructed a fine harbor, Portus Classis, near the town, and turned the waters of the Po into the canals which intersected the city, thus bringing in sweet water, which before this time is said to have been more expensive than wine. Ravenna is asserted to have had a Christian bishop as early as 44 A. D. In 404, Honorius retired to Ravenna, as being a safer stronghold against the barbarians than Rome itself. After the flight of Valentinian and the dethronement of Romulus Augustulus (476) it fell into the hands of the Herulian Odoacer, who in his turn was driven out by Theodoric in 497. Under the rule of the great Ostrogoth the city rose to its highest point of splendor, and proudly named herself *Ravenna felix*. But her glory as the city of the Goths was of short duration. In 552, Belisarius besieged and took Ravenna, which then became a part of the empire of Justinian, and for the next 200 years it was governed by an exarch in the name of the emperors of Constantinople. In 752 it fell for a short time into the hands of the Lombards, but was soon retaken by Pepin, who handed it over to the pope. In 1318, Ravenna became a separate dukedom, and in 1440 it passed under the rule of Venice and became once more highly prosperous. Pope Julius II. recovered it in 1509, but lost it three years after by the bloody battle in which the French troops under Gaston de Foix were victorious, but in which the youthful hero lost his life. (This battle is commemorated by La Colonna de' Francesi, a square pillar erected in 1557 about 2 miles outside the walls.) The pope, however, soon retook the town, and it afterward continued to form a part of the papal territory (with the exception of a few years) till 1860, when it was united to the new kingdom of Italy. The fresh life now flowing apace through the great centres of Italy has not yet made itself sensibly felt in Ravenna, and the stranger finds little with which to occupy himself except in her past. P. in 1874, 57,900. (See A. Ferdinand von Quast, *Die alt-christlichen Bauwerke von Ravenna*, with illustrations (Berlin, 1841); *Mosaic Pictures in Rome and Ravenna*, by John Henry Parker (1866); Conte Pietro Desiderio Pasolini, *Delle Antiche Relazioni fra Venezia e*

Ravenna (Florence, 1874); also, *The Goths at Ravenna*, in *British Quarterly Review* for Oct., 1872.)

CAROLINE C. MARSH.

Ravenna, p.-v. and tp., Muskegon co., Mich. P. 1035.

Ravenna, tp., Dakota co., Minn. P. 236.

Ravenna, tp., Mercer co., Mo. P. 1129.

Ravenna, p.-v. and tp., cap. of Portage co., O., at the intersection of Cleveland and Pittsburg and Atlantic and Great Western R. Rs., 38 miles S. E. from Cleveland, has 6 churches, 1 union graded public school, 2 national and 1 savings bank, 2 newspapers, 2 glass-factories, 2 extensive carriage-factories, 1 foundry, agricultural implement manufactory, 1 cheese-box factory, 2 lumber-yards, 2 flouring and 3 planing mills, 1 spoke and hub factory, 1 machine-shop, and 1 woollen-factory. P. of v. 2188; of tp. 3423.

L. W. HALL & SON, EDS. "PORTAGE CO. DEMOCRAT."

Rav'ensburg, town of Germany, kingdom of Würtemberg, manufactures cotton and linen fabrics, paper, leather, and articles of terra-cotta. P. 6817.

Ra'venscroft (JOHN STARK), D. D., b. at Blandford, Prince George co., Va., in 1772; was carried to Scotland in infancy; received there a good classical education; returned to Virginia 1788; studied at William and Mary College; was admitted to the bar, but ultimately studied theology; took orders in the Episcopal Church 1817; was a minister in Mecklenburg co., Va., 1817–23, when he became bishop of North Carolina and pastor of churches successively at Raleigh and at Williamsburg, Va. D. at Raleigh Mar. 5, 1830. Two volumes of his *Sermons* were edited by Dr. J. M. Wainwright in 1830, preceded by a memoir. (See biography in *Amer. Church Review.*)

Ra'venswood, v., Beardstown tp., Cass co., Ill., on Illinois River. P. 55.

Ravenswood, p.-v., forming part of Long Island City, Queens co., N. Y., on East River, being the E. terminus of a projected bridge from Seventy-ninth street, New York. P. 1536.

Ravenswood, p.-v., Jackson co., West Va., on Ohio River, has 1 newspaper, and is a shipping-point for the coal oil and minerals of the interior. P. 362.

Ravignan', de (GUSTAVE XAVIER DELACROIX), b. at Bayonne Dec. 2, 1795; studied law, practised as an advocate, and held a high position in the judicature, when, in 1822, he resigned his office, and entered the Jesuit novitiate at Montrouge. In 1828 he took holy orders, and subsequently became noted as a powerful and eloquent preacher, succeeding Lacordaire in 1836 in the pulpit of Notre Dame. His work in defence of the Jesuits, *De l'Existence et de l'Institut des Jesuits* (1855), and also his *Clément XIII. et Clément XIV.* (1854), gave rise to hot controversies. D. at Paris Feb. 26, 1858.

Ra'wal Pin'di, town of British India, capital of a dominion of the same name in the Punjaub, in lat. 33° 35′ N. and lon. 73° 15′ E., carries on a brisk transit-trade between Hindostan and Afghanistan. P. 15,013.

Raw'don, p.-v., Montcalm co., Quebec, Canada, has extensive water-power, a quartz gold-mine, and a large trade in grain, provisions, grass-seed, potash, and timber. P. about 600.

Rawdon-Hastings (FRANCIS), marquis of Hastings and earl of Moira, b. in Ireland Dec. 7, 1754, eldest son of the earl of Moira; was educated at Oxford; entered the army 1771; was sent to America in 1773, being known by the courtesy title of Lord Rawdon; was present at the battle of Bunker's Hill as captain in the 63d Foot; became aide-de-camp to Sir Henry Clinton; participated in the battles of Long Island and White Plains and the attacks upon Forts Washington and Clinton; was appointed adjutant-general with the rank of lieutenant-colonel 1778; soon afterward raised in New York a corps called the "Volunteers of Ireland," of which he took command; distinguished himself at Monmouth; was made general and sent to the Southern States with reinforcements for Cornwallis 1780; took a prominent part at the battle of Camden, Aug. 16; remained in the Carolinas after Cornwallis's return northward; attacked and defeated Gen. Greene at Hobkirk's Hill, Apr. 25, 1781; relieved Fort Ninety-Six; fortified himself at Orangeburg; incurred much obloquy on account of the execution of Col. Isaac Hayne July 31; sailed for England Aug., 1781, in consequence of ill-health; was captured by a French cruiser and taken to Brest; was made Baron Rawdon and aide-de-camp to the king 1783; became an intimate friend and associate of the prince of Wales, afterward George IV.; assumed the name of Hastings on succeeding to the title of his uncle, the earl of Huntingdon, Oct., 1789; succeeded his father as earl of Moira 1793; was promoted to major-general, and given command of a force of 10,000 men sent to the relief of the duke of York in Flanders 1794; was entrusted with the direction of the expedition to Quibéron 1795; was appointed commander-in-chief of the British forces in Scotland and constable of the Tower of London 1803; effected a reconciliation between the king and the prince of Wales, and was made lord lieutenant of Ireland 1805; became master-general of ordnance 1806; made an unsuccessful effort to form a cabinet on the assassination of Mr. Perceval 1812; was honored with the order of the Garter and appointed governor-general of British India 1813, being charged to pursue the "policy of non-intervention" in regard to the wars between the native princes, but quickly perceived the necessity of vigorous action; successfully conducted the Nepaul, Pindaree, and Mahratta wars, and thus laid the final basis for the greatness of England as a "continental power" in India; was created marquis of Hastings Dec., 1816; retired from the government of India after a wise and successful administration of nearly ten years 1823, and became governor of Malta 1824. D. on board the Revenge in the Bay of Baia, near Naples, Nov. 28, 1826.

Raw'hide, p.-v., Lauderdale co., Ala. P. 757.

Ra'wicz, town of Prussia, province of Posen, has large tanneries, dyeworks, breweries, and manufactures of linen and tobacco, and an active trade in wool and tobacco. P. 100,672.

Rawle (WILLIAM), LL.D., b. at Philadelphia, Pa., Apr. 28, 1759; studied law at New York, London, and Paris; commenced the practice of his profession at Philadelphia 1783; was distinguished for legal, classical, and scientific attainments; an active member of many learned associations; became in 1822 chancellor of the Philadelphia bar, and was the first president of the Pennsylvania Historical Society 1826. Though averse to politics, he for some time sat in the State legislature, and accepted from Pres. Washington in 1791 the appointment of district attorney, which he held until 1799. D. at Philadelphia Apr. 12, 1836. Besides numerous printed discourses and contributions to learned societies, he published *A View of the Constitution of the U. S.* (1825), and was the chief author of the new civil code of Pennsylvania. (See a *Memoir*, by T. J. Wharton, Philadelphia, 1840.)

Rawle (WILLIAM, JR.), son of William, b. at Philadelphia, Pa., in 1789; was a distinguished lawyer, and became reporter of the supreme court of Pennsylvania, in which capacity (associated with Thomas Sergeant, C. B. Penrose, and F. Watts) he published (between 1818 and 1836) 25 volumes of cases. D. at Philadelphia in 1858.

Rawle (WILLIAM HENRY), son of William, Jr., b. at Philadelphia, Pa., in 1823; published *A Practical Treatise on the Law of Covenants for Title* (1852), and edited John William Smith's *Law of Contracts* (1853), also Joshua Williams's *Law of Real Property* (1857).

Rawles, tp., Mills co., Ia. P. 781.

Raw'lins, new county of N. W. Kansas, on Republican fork of Kansas River, consists of fertile rolling prairies. Area, 900 sq. m.

Rawlins (JOHN A.), b. at East Galena, Ill., Feb. 13, 1831. The son of a farmer and charcoal-burner, he had but limited opportunities for obtaining an education, being obliged to assist his father. At the age of twenty he began to attend school; in Nov., 1854, commenced the study of law, and in 1855 was admitted to the bar, and began practice in Galena. He won success in his profession, and became a leading Democrat of the Douglas school. Though using his best efforts to avert war, he ardently espoused the cause of his government when it came. While engaged in raising a regiment Gen. Grant offered him a position on his staff as assistant adjutant-general, with the rank of captain, which was accepted, and with the exception of two months, during illness, he was with Gen. Grant in all his battles and campaigns until the close of the war. He won the warmest regard and fullest confidence of his chief, and was advanced in rank from time to time, until in 1865 he was appointed chief of staff to the lieutenant-general with rank of brigadier-general U. S. A., and later was brevetted major-general. When Gen. Grant was elected President he appointed him to a place in his cabinet as secretary of war. In the few months of his administration he displayed the same executive ability which led to his selection. D. at Washington, D. C., Sept. 6, 1869.

Raw'linson (GEORGE), brother of Sir Henry, b. at Chadlington, Oxfordshire, England, in 1815; educated at Swansea and at Ealing School; graduated first class in classics at Trinity College, Oxford, 1838; became fellow and tutor of Exeter College, moderator 1852, public examiner 1854, 1856, and 1868, Bampton lecturer 1859–61; elected Camden professor of ancient history at Oxford 1861, and appointed canon of Canterbury cathedral 1874. Author of several theological works; of *The Five Great*

Monarchies of the Ancient Eastern World (4 vols., 1862–67; 2d ed. republished in New York, 1871), *A Manual of Ancient History* (1869), *The Sixth Great Oriental Monarchy, or the Geography, History, and Antiquities of Parthia* (1873), and of *The Seventh Great Oriental Monarchy*, treating of the Sassanians, which is announced as in the press in 1876, as is also a 3d edition of the work to which it is a continuation. Canon Rawlinson has written the commentaries on the books of Kings and other portions of the Old Testament for the *Speaker's Commentary*, and in connection with his brother and Sir Gardner Wilkinson published a translation of Herodotus (4 vols., 1858–60), valuable for the notes and illustrations, but defective in elegance and in strictly classical scholarship.

Rawlinson (Sir Henry Creswicke), D. C. L., b. at Chadlington, Oxfordshire, England, in 1810; educated at Ealing School; entered the Bombay army 1826; became proficient in the modern Oriental languages, on which account he was sent to Persia Nov., 1833, to aid in the instruction of the army of that country; resided several years at Kermanshaw, near the celebrated rock inscription of Behistun (see Cuneiform Inscriptions), which he was the first to decipher 1838; was sent to Kandahar as political agent 1840; held that capital to its allegiance during the Afghan war; went as political agent to Turkish Arabia 1843; was appointed consul at Bagdad Mar., 1844, and was consul-general 1851–55; became lieutenant-colonel in Turkey 1850; returned to England Feb., 1855; was knighted and made a director of the East India Company 1856; was member of Parliament 1858; member of the council of India 1858–59; was envoy to Persia, with the local rank of major-general, 1859–60; again sat in Parliament 1865–68, after which he was reappointed a member of the council of India; was president of the Royal Geographical Society 1871–73, and again 1875–76, and president of the Society of Biblical Archæology from its foundation in 1873. He obtained wide celebrity by his translation of the Persian text of the inscriptions of Darius, first published in the *Transactions* of the Royal Asiatic Society for 1846; has since contributed to the same journal many memoirs on the same subject or illustrative of the history and geography of the East; has edited (with E. Norris and George Smith) 5 folio vols. of cuneiform inscriptions (1861–70); furnished valuable material to his brother's edition of Herodotus (1858–60), and has published a volume of essays on Oriental politics, entitled *England and Russia in the East* (1874), in which he advises the occupation of Herat by the British as a check to the advances of Russia in Central Asia.

Rawlin's Springs, p.-v., cap. of Carbon co., Wy. Ter., on Union Pacific R. R., has a hotel and railroad repair-shops. P. 612.

Rawson (Albert Leighton), b. at Chester, Vt., Oct. 15, 1829; became an artist; made four visits to Palestine and other Oriental countries; made in 1851–52 a pilgrimage from Cairo to Mecca with the annual pilgrim caravan in the disguise of a Mohammedan student of medicine; accompanied by his friend and tutor, explored the mounds of the Mississippi Valley and visited Central America 1854–55, publishing thereafter *The Crania of the Mound-Builders of the U. S. and of Central America;* travelled in the Hudson's Bay territories 1863; published several maps of Palestine; drew some hundreds of sketches, which have appeared in *Harper's*, *Lippincott's*, and other American magazines, and in books on Oriental subjects, and has made various translations from the Persian, Arabic, and Italian. Author of *The Divine Origin of the Holy Bible, Hand-Book for Sunday-Schools and Bible Readers, The Pronouncing Bible Dictionary, The Comprehensive Bible Dictionary, History of All Religions, Statistics of Protestantism, Antiquities of the Orient, Grammars of the Turkish and Arabic Languages, A Vocabulary of the Bedawin Languages of Syria and Egypt*, and *The Chorography of Palestine.*

Rawson (Edward), b. at Gillingham, Dorsetshire, England, Apr. 16, 1615; settled at Newbury, Mass., about 1636; represented that town in the general court; became clerk of that body, and was for many years secretary of Massachusetts Colony, most of the early records being in his handwriting. D. at Boston Aug. 27, 1693. Author of *The General Laws and Liberties concerning the Inhabitants of the Massachusetts* (1660), and one of the authors of *The Revolution in New England Justified* (1691). His mother, Margaret Wilson, was sister of the first pastor of Boston and grand-niece of Edmund Grindall, archbishop of Canterbury.—Rebecca Rawson, his daughter, was the heroine of a romantic episode in the history of the colony, commemorated by Whittier in *Leaves from Margaret Smith's Journal.*—Grindall Rawson, his son, b. Jan. 23, 1659, graduated at Harvard 1678, was many years minister of Mendon, was an accomplished scholar and writer, and preached to the Indians in their own language. D. at Mendon Feb. 6, 1715. A genealogy of the descendants of Edward Rawson, prepared by Reuben Rawson Dodge, was printed in 1849, and a revised edition appeared at Worcester, Mass., in 1875.

Raw'sonville, p.-v., Grafton tp., Lorain co., O., on Columbus division of Cleveland Columbus Cincinnati and Indianapolis R. R.

Ray [Lat. *raia*, "ray" or "skate"], the vernacular name of species of the family Raiidæ and kindred groups. (See Raiidæ.)

Ray, county of N. W. Missouri, on the N. bank of Missouri River, traversed by St. Louis Kansas City and Northern R. R., has a rolling surface, partly prairie and partly timbered, the chief products being corn, wheat, tobacco, wool, butter, and sorghum-molasses. Horses, cattle, sheep, and swine are numerous. There are many saw-mills and several mines of bituminous coal. The bottom-lands along Missouri River are noted for extraordinary fertility. Cap. Richmond. Area, about 570 sq. m. P. 18,700.

Ray, tp., Franklin co., Ind. P. 2070.

Ray, tp., Morgan co., Ind. P. 761.

Ray, tp., Macomb co., Mich. (Ray Centre P. O.). P. 1555.

Ray (Isaac), M. D., b. at Beverly, Mass., in Jan., 1807; graduated at Bowdoin College 1827; commenced the practice of medicine at Portland 1827; removed to Eastport 1829; devoted his attention to the subject of insanity; published *The Medical Jurisprudence of Insanity* (1838; 5th ed. 1871); became superintendent of the State insane asylum at Augusta 1841, and of the Butler Asylum at Providence, R. I., 1845, filling that post until Jan., 1866, after which he settled at Philadelphia, Pa. Author of *Conversations on Animal Economy* (1829), *Education in Relation to the Health of the Brain* (1851), and *Mental Hygiene* (1863), besides many contributions to professional journals and a valuable series of official annual reports.

Ray (John), F. R. S., sometimes written **Wray,** b. at Black Notley, near Braintree, Essex, England, Nov. 29, 1627, son of a blacksmith; graduated at Trinity College, Cambridge, where he became a fellow 1649, lecturer on Greek 1650, and mathematical instructor 1652; took orders in the Church of England at the Restoration; resigned his fellowship from conscientious scruples 1662; resided for some years with his friend and pupil, Francis Willoughby, at Middleton Hall, Warwickshire, and afterward at his birthplace; devoted himself to botany and zoology, making extensive tours with Willoughby in Great Britain and on the Continent; was one of the early fellows of the Royal Society 1667; published a *Catalogus Plantarum Angliæ* (1670), the most formal work of the kind which had then appeared; published his travels on the Continent 1673; proposed a new system of botanical classification in his *Methodus Plantarum Nova* (1682), which was substantially adopted by Antoine de Jussieu in the next century; edited (with an English translation of the former) the *Ornithologia* and *Historia Piscium* of his friend Willoughby, to whose children he became guardian and tutor 1672, and published his great work, the *Historia Plantarum* (in 3 vols., 1686–1704). He also prepared a *Collection of English Proverbs* (1670), which was reprinted with improvements by Henry G. Bohn (London, 1850), and valuable *Glossaries of North and South Country Words*, which has recently been carefully edited by Rev. Walter W. Skeat, for the English Dialect Society (1874). He also wrote *The Wisdom of God manifested in the Works of the Creation* (1691, often reprinted), *Discourses concerning Primitive Chaos and Creation, the General Deluge, and the Dissolution of the World* (1693), and a *Synopsis Methodica Animalium Quadrupedum et Serpentini Generis Vulgarium* (1693), which gave him a similar rank in the history of zoological classification to that he had previously gained in botany. He published many occasional treatises and contributed largely to the *Transactions* of the Royal Society. D. at Black Notley Jan. 17, 1705. His *Correspondence* appeared in 1718, his *Life and Select Remains* by William Derham in 1760. The Ray Society, organized in 1844 for the purpose of issuing new editions of rare books on zoology and botany, has issued some 30 sumptuous volumes, two of which (vol. ii. of 1844 and vol. ii. of 1848), devoted to the *Memorials* and the *Correspondence* of Ray, were edited by Dr. Edwin Lankester.

Ray (Joseph), M. D., b. in Virginia Nov. 25, 1807; was self-educated in his youth, but by acting as a schoolteacher was enabled to study at Washington College, Pa., Athens College, O., and at the Ohio Medical College, where he graduated; became surgeon in the Cincinnati hospital, professor of mathematics at Woodward College, Cincinnati,

1834–51, and its principal from its reorganization as a high-school; was also for many years president of the board of directors of the Cincinnati house of refuge, and author of a series of textbooks on arithmetic and algebra. D. at Cincinnati Apr. 17, 1855.

Rayer' (Pierre François Olive), b. at St. Sylvain, department of Calvados, France, Mar. 8, 1793; studied medicine; practised as a physician at Paris; was appointed physician at the hospital of La Charité in 1832, and wrote, besides a number of minor works, *Traité théorique et pratique des Maladies de la Peau* (2 vols., 1826) and *Traité des Maladies des Reins et des Alterations de la Sécrétion urinaire* (3 vols., 1839). D. at Paris Sept. 10. 1867.

Ray'mond, tp., Champaign co., Ill. P. 323.

Raymond, p.-v. and tp., Cumberland co., Me. P. 1120.

Raymond, p.-v. and tp., Stearns co., Minn. P. 305.

Raymond, p.-v., cap. of Hinds co., Miss., about 30 miles E. of Mississippi River, has 6 churches, 1 female seminary, and 1 newspaper. Business, farming. P. about 800. George D. Harper, Ed. "Hinds Co. Gazette."

Raymond, p.-v. and tp., Rockingham co., N. H., on Concord and Portsmouth R. R. P. 1121.

Raymond, p.-v. and tp., Racine co., Wis. P. 1608.

Raymond (Henry Jarvis), LL.D., b. at Lima, N. Y., Jan. 24, 1820; passed his childhood on his father's farm; studied at the Lima seminary; graduated with honors at the University of Vermont 1840; gave lessons and wrote for Horace Greeley's *New Yorker* while studying law at New York 1840–41; became assistant editor of the New York *Tribune* at its commencement in Apr., 1841; attained great rapidity and skill as a reporter, employing a species of shorthand peculiar to himself, and developing a wonderful memory, which was conspicuously seen in his reports of Dr. Lardner's lectures, from which two volumes were published with the sanction of the lecturer, and exhibited great activity and enterprise in securing exclusive news. In 1848 he left the *Tribune* to accept the position of office-editor of the New York *Courier and Enquirer*, under Col. J. Watson Webb; maintained for some time a newspaper debate with Mr. Greeley on socialism, afterward published in a pamphlet; projected *Harper's Magazine*, for which he wrote the prospectus; contributed largely for several years to the periodical publications of the Messrs. Harper; was elected to the New York assembly as a Whig 1849; distinguished himself in debate; was re-elected 1850; chosen Speaker; devoted special attention to promoting legislation for the improvement of the school and canal systems; retired from the *Courier and Enquirer* 1850, on account of political differences with Col. Webb; spent the winter of 1850–51 in Europe, and on Sept. 18, 1851, issued the first number of the New York *Times*, which he made one of the leading journals of the country. Mr. Raymond took an active part in the Baltimore Whig convention of 1852; was elected lieutenant-governor of New York 1854; was prominent in the organization of the Republican party 1856, having been the author of the *Address to the People* issued by the Pittsburg convention; worked earnestly for the success of the Fremont ticket; declined a renomination as lieutenant-governor 1857; visited Europe 1859, and was an eye-witness of the Franco-Austrian campaign in Italy, gaining a journalistic triumph by the early publication in New York of his full account of the battle of Solferino; warmly urged Mr. Seward for the Presidential nomination 1860, but gave efficient support to Mr. Lincoln when nominated and during his administration, though often differing from him on questions of war-policy; was elected a member and Speaker of the New York assembly 1861; presided over the Union convention at Syracuse 1862; was defeated by Gov. Morgan in his candidacy for the U. S. Senate 1863; was chairman of the New York delegation in the national Republican convention 1864, in which year he was elected to Congress, in which body he separated from the majority of his party by giving a partial support to the policy of Mr. Johnson; took part in convoking the Philadelphia "Loyalists' convention" of 1866, and wrote its *Address and Declaration of Principles;* refused to be a candidate for re-election to Congress 1866; declined the mission to Austria offered him by Pres. Johnson 1867; made a third visit to Europe 1868, and had again devoted himself with great energy to journalism, which he considered his true vocation, when his career was suddenly terminated by an attack of apoplexy at New York June 18, 1869. Though a constant writer for thirty years, Mr. Raymond published but one book, a *History of the Administration of Pres. Lincoln* (New York, 1864), which in a revised edition was entitled *The Life and Public Services of Abraham Lincoln* (1865). As a journalist, an orator, and a debater Mr. Raymond occupied a position of acknowledged eminence, and had few competitors in the scope of his general attainments. Porter C. Bliss.

Raymond (Miner), D. D., b. in New York City Aug. 29, 1811; taught at Wilbraham Academy, Mass., and then as a Methodist preached in that State eight years. He was afterward principal of Wilbraham Academy from 1848 to 1864, then professor of systematic divinity in the M. E. theological seminary at Evanston, Ill.

Raymond (Rossiter Worthington), b. at Cincinnati, O., Apr. 27, 1840; graduated at the Brooklyn Polytechnic Institute 1858; studied mining engineering in Germany several years; became editor of the *American Journal of Mining* 1867; U. S. commissioner of mining statistics 1868; lecturer on economic geology at Lafayette College 1870; vice-president of the American Institute of Mining Engineers 1871, and president of that body 1872; has published extended annual reports of mining statistics since 1869; is author of two or three novels.

Raymund Lully. See Lull (Ramon).

Raynal' (Guillaume Thomas François), b. at St. Geniez, department of Aveyron, France, Apr. 12, 1713; studied theology at the college of the Jesuits at Toulouse; entered their order and began to preach, but went in 1747 to Paris, and, enjoying the company of Diderot, Holbach, Helvetius, etc., he entered on an entirely opposite course. Of his numerous historical works, *Histoire du Divorce de Henri VIII. avec Catharine* (1763) attracted some attention, and his *Histoire philosophique et politique des Établissements et du Commerce des Européens dans les Deux-Indes* (first published anonymously in 4 vols., 1770, then in an enlarged edition under his name, 5 vols., 1780) was condemned by the Parliament of Paris, and a warrant of arrest issued against the author. He fled to Switzerland, lived subsequently at the court of Frederick II., but was allowed to return to France in 1788; received several marks of distinction from the authorities. D. at Chaillot, near Paris, Mar. 6, 1796. He also wrote *Tableau et Révolutions des Colonies anglaises dans l'Amérique septentrionale* (2 vols., 1781), which was translated into English, but sharply criticised by Thomas Paine.

Rayne, tp., Indiana co., Pa. P. 1735.

Rayn'ham, p.-v. and tp., Bristol co., Mass., on Old Colony R. R. (Dighton and Somerset branch), noted for the first ironworks in America, established by James and Henry Leonard 1652, and maintained by the family more than 100 years. King Philip usually lived in the summer on Fowling Pond in this town. P. 1713.

Raynouard' (François Juste Marie), b. at Brignolles, Provence, Sept. 18, 1761; took part in the political movements of the Revolution and the First Empire; wrote several essays and tragedies, *Caton d'Utique* (1794), *Les Templiers* (1805), which were successful, but acquired his great reputation as a philologist by his researches concerning the Provençal language and literature—*Choix de Poésies originales des Troubadours* (6 vols., 1816–21), *Lexique roman, ou Dictionnaire de la Langue des Troubadours* (6 vols., 1838–44), *Grammaire romane* (1816). D. at Passy, near Paris, Oct. 27, 1836.

Ray'ville, p.-v., cap. of Richland parish, La., on North Louisiana and Texas R. R., 52 miles W. of Vicksburg, has a union church, a Masonic hall, and 1 newspaper. P. 106. W. P. Mangham, Ed. "Richland Beacon."

Ray'wick, p.-v., Marion co., Ky. P. 160.

Ré, an island of France, department of Charente-Inférieure, in the Bay of Biscay, in front of the harbor of La Rochelle. It is 18 miles long, 4 miles broad, treeless, with steep coasts, and strongly fortified, and has about 18,000 inhabitants, who are mostly employed in fisheries, oyster-farming, wine-cultivation, and the manufacture of salt.

Read, p.-v. and tp., Clayton co., Ia. P. 840.

Read (George), b. in Cecil co., Md., Sept. 18, 1733; became a lawyer at Newcastle, Del., 1754; was attorney-general of Delaware and member of the Delaware legislature for many years; a member of the Continental Congress 1774–77, and one of the signers of the Declaration of Independence; president of the constitutional convention of Delaware 1776; member of the convention that framed the Federal Constitution; was appointed judge of appeals 1782; was U. S. Senator 1789–93; and chief-justice from 1793 to his death, at Newcastle Sept. 21, 1798.—His sons George and John were also lawyers of some eminence.

Read (George Campbell), b. in Ireland about 1788; came to the U. S. in childhood; entered the U. S. navy as midshipman 1804; became lieutenant in 1810; participated in several noted engagements during the war with England, especially that between the Constitution and Guer-

riere; became captain 1825, and rear-admiral 1862, when he was appointed governor of the Philadelphia Naval Asylum, where he d. Aug. 22, 1862.

Read (JOHN J.), b. June 17, 1842, in New Jersey; graduated at the Naval Academy in 1861; became an ensign in 1862, a lieutenant in 1864, a lieutenant-commander in 1866; served in the Hartford at the taking of New Orleans and in all of Farragut's battles on Mississippi River during the civil war, and commended for "courage and coolness." FOXHALL A. PARKER.

Read (JOHN MEREDITH), b. at Philadelphia, Pa., July 21, 1797, grandson of George Read, one of the signers of the Declaration of Independence, and through his mother of John Meredith, the first treasurer of the U. S.; graduated from the University of Pennsylvania 1812, and in 1818 was admitted to the bar; in 1823 was elected to the lower branch of the Pennsylvania legislature, where he served two terms; in 1833 was appointed U. S. district attorney for the eastern district of Pennsylvania, and held the office till 1841; in 1845 was nominated a judge of the Supreme Court of the U. S., but the Senate declined to confirm him on account of his opposition to the Southern construction of the Constitution; in 1846 was appointed attorney-general of Pennsylvania, resigning the office at end of six months. In 1858 he was elected judge of the supreme court of Pennsylvania, of which body he became chief-justice in 1872. D. at Philadelphia Nov. 29, 1874. J. B. BISHOP.

Read (JOHN MEREDITH, JR.), b. at Philadelphia in 1837; graduated at Brown University 1858, and at the Albany law school 1859; was adjutant-general of New York during the civil war; published *A Historical Inquiry concerning Hendrick Hudson* (1866); wrote much for periodicals; was appointed consul-general at Paris 1869, and minister to Greece 1874.

Read (NATHAN), b. at Warren, Mass., July 2, 1759; graduated at Harvard 1781; was tutor there 1783–87; settled at Danvers 1795; formed a company which established an iron-foundry at Salem 1796; was the first petitioner to the U. S. government for a patent, obtaining one for a method of cutting and heading nails by the same operation Jan., 1798; was an early experimenter upon the steam-engine; is said to have invented multitubular boilers and high-pressure engines, and to have placed upon Wenham Lake Aug., 1791, a boat propelled by steam with paddles instead of wheels; invented many kinds of agricultural implements and labor-saving machinery; was a member of Congress 1800–03, subsequently a judge of common pleas, and removed in 1807 to Belfast, Me., where he d. Jan. 20, 1849. His nephew, David Read, published a memoir in 1870.

Read (THOMAS BUCHANAN), b. in Chester co., Pa., Mar. 12, 1822; studied sculpture at Cincinnati, but soon turned his attention to painting, which he practised at New York (1841), and soon afterward at Boston; removed to Philadelphia 1846; went to Florence, Italy, in 1850, and resided there with few intermissions until 1872, when he returned to the U. S. D. at New York May 11, 1872. Author of several volumes of poems, and a successful portrait-painter. He will be best known by his picture and poem, both entitled *Sheridan's Ride.*

Reade (CHARLES), D. C. L., b. at Ipsden, Oxfordshire, England, in 1814; graduated at Magdalen College, Oxford, 1835; was elected to a Vinerian fellowship at Oxford 1842; was called to the bar at Lincoln's Inn 1843; published in 1852 *Peg Woffington,* a novel which gave him an immediate reputation, and has since issued many novels, among which are *Christie Johnstone* (1853), *Never Too Late to Mend* (1856), *Love me Little, Love me Long* (1859), *The Cloister and the Hearth* (1861), *Hard Cash* (1863), *Griffith Gaunt* (1866), *Put Yourself in his Place* (1870), and *A Terrible Temptation* (1871). Mr. Reade displays great skill in plot and incident, has a picturesque style, often writes with a social or political object in view, and may be considered, since the death of Dickens, as dividing with George Eliot the foremost place among British novelists. Most of his novels have been successfully dramatized by himself or by Boucicault, and he has written several independent plays. He has gained some note for his lawsuits on questions connected with the rights of authors and the limits of permissible literary criticism, also for his vigorous advocacy of international copyright with America, on which subject he published a number of letters in the New York *Tribune* in 1875.

Reade (WILLIAM WINWOOD), nephew of Charles, b. at Ipsden, England, in 1839; received a good education; published several novels, one of which, *The Veil of Isis, or the Mysteries of the Druids* (1861), displayed much ethnological knowledge, combined with a strong anti-theological bias; traveled on the W. coast of Africa 1862–63; published on his return *Savage Africa* (1863); made a journey from Sierra Leone to the sources of the Niger 1868–70; published *The Martyrdom of Man* (1872), an elaborate and learned impeachment of Christianity from an historical and ethnological point of view, and *The African Sketch-Book* (1873); accompanied the Ashantee expedition as correspondent of the London *Times* 1873–74, incurring thereby a constitutional disease, which resulted in his death at Wimbledon Apr. 24, 1875. His latest publications were *The Story of the Ashantee Campaign* and a novel, *The Outcast,* both of which appeared in 1875.

Read'field, p.-v. and tp., Kennebec co., Me., on Maine Central R. R. P. 1456.

Read'ing, town of England, capital of Berkshire, on the Kennet, 1½ miles from its junction with the Thames, has manufactures of silk, velvet, and ribbons, and has trade in corn, flour, malt, timber, wool, and cheese. P. 32,324.

Reading, p.-v. and tp., Livingston co., Ill., on Vermilion River. P. 70; of tp. 1503.

Reading, p.-v. and tp., Middlesex co., Mass., 12 miles N. of Boston, on Boston and Maine R. R., was incorporated in 1644, and contains 6 churches, 13 schools, a public library, 1 weekly newspaper, and a savings bank. Its manufactures of shoes, cabinet furniture, refrigerators, organ-pipes, etc. are important. Reading is the residence of many gentlemen doing business in Boston. P. 2664. HIRAM BARRUS.

Reading, p.-tp., Hillsdale co., Mich., on Fort Wayne Jackson and Saginaw R. R., 10 miles S. of Hillsdale, the county-seat. It has 4 churches, an academy, 1 bank, several manufactories, 2 hotels, and 1 newspaper. P. 1657. GEO. GRAY, ED. "READING PRESS."

Reading, p.-v. and tp., Schuyler co., N. Y., on W. bank of Seneca Lake and on Northern R. R. of Pennsylvania. P. 1751.

Reading, p.-v., Sycamore tp., Hamilton co., O. P. 1575.

Reading, tp., Perry co., O. P. 3334.

Reading, v. (HAMPTON P. O.) and tp., Adams co., Pa., has 1 newspaper. P. 1326.

Reading, city, cap. of Berks co., Pa., on the E. bank of Schuylkill River, 58 miles N. W. of Philadelphia and 128 miles W. of New York City, was incorporated as a borough in 1783 and as a city in 1847. The city is supplied with water of an excellent quality, and the streets are well laid out and kept scrupulously clean. Reading contains some very costly churches, representing all denominations, fine educational advantages, 2 handsome opera-houses, a number of fine hotels, 3 daily and several weekly newspapers, the repair-shops and rolling-mills of Philadelphia and Reading R. R., and numerous manufacturing interests. The city was laid out by Thomas and Richard Penn upon an original survey of 450 acres, taken in 1748 with the sanction of John and Samuel Finny. P. 33,930. JESSE G. HAWLEY, ED. "READING EAGLE."

Reading, p.-v. and tp., Windsor co., Vt. P. 1012.

Readington, p.-v. and tp., Hunterdon co., N. J., on S. branch of Raritan River and on Central R. R. of New Jersey. P. 3070.

Readsborough, p.-v. and tp., Bennington co., Vt., on Deerfield River. P. 828.

Readville Station, p.-v., Hyde Park tp., Norfolk co., Mass., on Boston and Providence and Boston Providence and Erie R. Rs.

Rea'gan (JOHN H.), b. in Sevier co., Tenn., Oct. 8, 1818; studied law; settled in Texas during its existence as an independent republic; became surveyor, judge, member of the legislature, and colonel of militia; was a member of the U. S. Congress 1857–61, and postmaster-general in the cabinet of the Confederate government 1861–65, after which he was for some time a prisoner in Fort Warren.

Re'al [Sp. for "royal;" Port. *rial*], in Spanish and Portuguese countries a coin and money of account. The old silver real (the eighth of the *piastre, peso,* or dollar) was long a familiarly current coin in the U. S., where it was worth 12½ cents, and bore various popular names. In Spain the rial is now about five cents. In Portugal 40 reis make one rial, but it is never coined. In Spanish America the real has various local values.

Real Estate. See REAL PROPERTY, by PROF. J. N. POMEROY, LL.D.

Real'gar [Fr.], mineral protosulphide of arsenic, a resinous-looking ruby-red or orange-yellow mass, transparent or translucent, and of conchoidal fracture. Its crystallization is monoclinic. It is not found in any American locality. It may be prepared artificially by

melting together 1 part of sulphur and 2 of arsenious acid. Realgar is sometimes used as a pigment. H. Wurtz.

Re'alism, as opposed to nominalism (see Nominalists), is the doctrine that universals (notions of species and genera, such as *man, animal*) have real existences corresponding to them. In the Middle Ages the disputes of the Schoolmen (which see) over the solution of some questions of Porphyry (see Philosophy) developed this doctrine into sharp contrast with nominalism. The dispute was not an idle one, but involved the all-important theological and metaphysical question of personal individuality. At an earlier period, Boëthius and St. Augustine had been decided Realists; so were all Platonists and Neo-Platonists. In the ninth century John Scotus Erigena and Remigius of Auxerre were Realists, while Hrabanus Maurus and Eric of Auxerre indicated nominalistic proclivities. Roscellinus in the eleventh century boldly announced nominalism, and applied it to the Trinity, making three Gods, but no unity. Realism prevailed against him, if not by argument, then by authority. The great Realists of the eleventh and twelfth centuries were Anselm, William of Champeaux, Gilbertus Porretanus, John of Salisbury; of the thirteenth century, Alexander of Hales, Bonaventura, Albertus Magnus, Thomas Aquinas, and Duns Scotus. Their doctrine was *universalia ante rem* (in God's mind), *in re* (in things), and *post rem* (in man's thought). Although in that age of authority we find most of the Schoolmen adopting and defending tenets with a blind zeal often devoid of any clear understanding, yet to the great thinkers here named must be conceded an insight into the true grounds of this doctrine as held by Plato and Aristotle. That universals are real in a different sense from individual things was held by all true Realists—a point not sufficiently considered by the Nominalists, who objected that one individual cannot be predicated of another individual, using in this the very language of Aristotle (*De Cat.*, cap. v.), who carefully distinguishes the reality of universals (δεύτεραι οὐσίαι) from that of individuals (πρῶται οὐσίαι). It was held by Realists that individual things are fleeting and transitory; each thing has its history; it originates in some former thing, runs its course of action and interaction with other things, and finally disappears, giving place to another, its successor. Hence, each individual thing is only a momentary phase of some process which has many potentialities; these potentialities it realizes in the series of individual things, each thing realizing some of them. Thus, the process, as embracing the rise and dissolution of many individuals, is generic or a universal; it possesses the potentiality of each thing, and at the same time possesses the reality of each; the reality of each thing is the reality of the universal process which causes it. Inasmuch as it —the process—annuls individual things, and likewise originates them, it includes in itself the total of reality, and is therefore real in a more complete sense than any individual thing. Again, it must be noted that what we call "individual things" are arbitrarily limited phases of processes. Each "individual," so called, is identified by nominalism with only a portion of its history, as it were, for it can be traced by degrees back into another thing, in which it originated, and forward into another, in which it finally disappears. Moreover, it is correlated in space with other things, and it is arbitrary in the Nominalist to assume that he has an individual thing before him when he has only a dependent part of a whole process of interrelated things. Thus, the word "process," to which natural science in our day has arrived (Darwinism teaching that things are to be studied in their history and development, "evolution" and the "correlation of forces" being doctrines of the supreme reality of universals in the shape of a law or "persistent force"), interprets realism, and reinstates it as a more advanced stage of thinking than nominalism. Realism may be (*a*) psychological, holding in regard to artificial things —*e. g. table* or *chair*—that the general notion or name conventionally signifies the purpose or design which creates such things, and therefore corresponds to what reality they possess; (*b*) natural, a realism which recognizes the natural objective processes in nature and mind. Mind is considered immortal as individual (not as a thing), for the reason that it is a total process within one reality; each thinking being has potentially in his mind the universal reason, and is able to realize the same by his own activity. In thus realizing his possibilities by culture and education he does not annul his individuality (as the process of forces annuls things), but rather intensifies his consciousness of self, and deepens his subjectivity by the same act in which he realizes his universality. This doctrine is expressed by Aristotle's "entelechies." First entelechy (self-contained being—"End-in-itself"—entire process in one reality) has all the possibilities and the power to develop them, but has not energized as yet (the man as infant or savage); second entelechy has developed its potentialities through self-activity (the man as cultured, civilized, and enlightened).—Realism, as contrasted with idealism in the school of "common sense," is the theory that we cognize external objects by direct perception instead of by means of interposed ideas. William T. Harris.

Real Presence. See Transubstantiation.

Real Prop'erty. In the law of the U. S. and of England the term "real property" or "real estate"—for the two expressions are synonymous—is applied to all those species of property where the material objects over which the rights of ownership or of user extend are things real—that is, lands or articles regarded by the law as equivalent to land. (See Property.) It therefore includes two quite distinct classes of rights—namely, (1) those of ownership or dominion in the land itself, whereby the very corpus of the soil belongs either absolutely or qualifiedly to the proprietor—rights which are denominated by Blackstone and other text-writers on the common law "corporeal," and by the civilian jurists *jura in rem;* and (2) those to use in a certain prescribed manner, or to derive a certain benefit from, the land, which belongs to another as its owner—rights called by the common-law writers "incorporeal," and by the civilians *jura in re aliena.* The first of these classes embraces all estates held in the land itself. The term "land," however, includes not only the soil, but also all those objects which are either actually or constructively attached or affixed to it so as to become in contemplation of the law a part thereof. Thus, the growing trees and perennial plants, except those raised in nurseries for purposes of sale, are parts of the land; and also articles originally movable, but which have been so firmly attached to the soil as to become "fixtures;" and even certain movable articles which constitute necessary portions of buildings, such as door-keys, blinds, millstones, and the like. The manure which is produced on farms is also regarded as forming a part of the land. Annual crops while growing have a double character. They are so far a part of the land that they pass with it by a deed of conveyance which is silent in respect to them; while they are so far things personal that they may be separately sold, and may be seized and sold on execution; when harvested they of course immediately become chattels to all intents and purposes. The second of the classes above mentioned embraces rents, franchises, and the extensive group of rights in or over the land of another person which are collectively known as "easements" or "servitudes." (See Easements.) Real property is variously divided and classified by the American and English law. In respect to the extent and duration of the interest held by the proprietor, three grades are recognized in this country—estates in fee simple, estates for life, and estates for years; to these the English law adds estates in fee tail. An estate in fee simple is the absolute, unqualified property, and its distinguishing characteristic is its inheritable capacity or its descent to the heirs of the owner who dies intestate. An estate for years or leasehold estate, on the other hand, passes to the administrators or executors of the deceased holder, and in this particular resembles personal property. With respect to the time of its enjoyment, real property is either present or future, and the future interest may be vested or contingent; with respect to the number of the proprietors, it is either several, joint, or common. Finally, real property may be either legal or equitable. A legal estate is an interest of whatever nature or grade created by the common law and protected by the courts of law. An equitable estate is an interest unknown to the common law which courts of equity have created, and which they alone will recognize and protect as property.

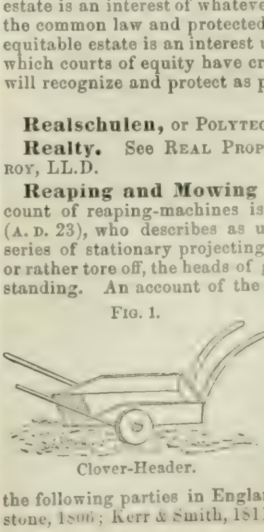
John Norton Pomeroy.

Realschulen, or Polytechnic Schools (which see).

Realty. See Real Property, by Prof. J. N. Pomeroy, LL.D.

Reaping and Mowing Machines. The first account of reaping-machines is given by Pliny the Elder (A. D. 23), who describes as used in Gaul a cart with a series of stationary projecting combs in front, which cut, or rather tore off, the heads of grain, only leaving the straw standing. An account of the continued use of the same kind of machine was given by Palladius (A. D. 391). This machine is similar to the modern clover-seed header, shown in Fig. 1. The first English patent for a reaping-machine was granted in 1799 to Boyce. Attempts were made to build reaping-machines by the following parties in England: Plucknett, 1805; Gladstone, 1806; Kerr & Smith, 1811; Dobbs, 1814; Scott, 1815;

Fig. 1.

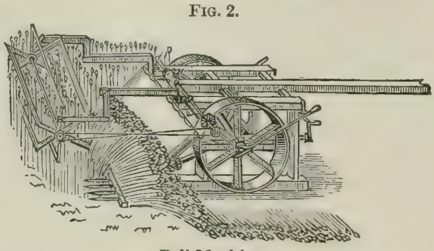


Clover-Header.

Ogle, 1822; Thomas and Joseph Brown, 1823; and in America by French & Hawkins, 1803; Comfort, 1811; Ten Eyck, 1825; Cope & Hoopes, 1825; Manning, 1831. Prior to 1832 there were granted in the U. S. only eight patents for machines for cutting grain. No inventor, however, succeeded in producing machines which possessed sufficient practical merit to be used otherwise than experimentally until we come to Bell, Hussey, and McCormick, whose machines are described below. The Hussey cutter is in universal use to this day. A modification of Bell's moving platform is still largely used in harvesters. McCormick's platform, arranged for delivery behind the horses, is also largely used with Seymour's improvement. Since the introduction of Bell, Hussey, and McCormick's machines the number of patents for harvesting-machines in the U. S. has constantly increased, and had reached in 1874 the number of 4500.

The first successful reaping-machines were so organized that the cut grain should be deposited in gavels on the ground. The essential parts of a reaping-machine are the gathering device, the cutting apparatus, the table or platform to receive the cut grain, and an arrangement for depositing the grain in gavels on the ground. In the order of invention and reduction to practical use reaping machinery preceded mowing machinery. The Rev. Patrick Bell built and tried a reaping-machine in Scotland in 1828 and 1829, composed of a reel to gather the standing grain to the cutters, a series of scissors projecting in front to cut the grain, and an inclined endless apron to receive the grain and carry it to the ground at one side. This machine was used from 1828 to 1832 in Scotland, and one was imported and tried by John B. Yates at Chittenango, N. Y., in 1835. Bell's machine again appeared in competition with Hussey & McCormick's in England in 1853. It is shown in Fig. 2.

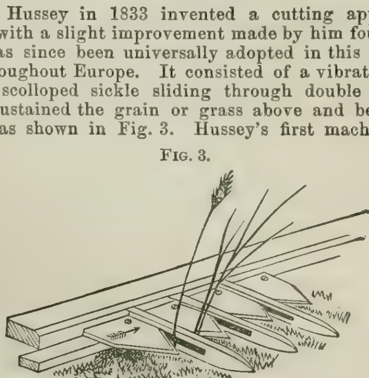
FIG. 2.



Bell Machine.

Obed Hussey in 1833 invented a cutting apparatus, which, with a slight improvement made by him four years later, has since been universally adopted in this country and throughout Europe. It consisted of a vibratory zigzag or scolloped sickle sliding through double fingers, which sustained the grain or grass above and below the sickle, as shown in Fig. 3. Hussey's first machine was

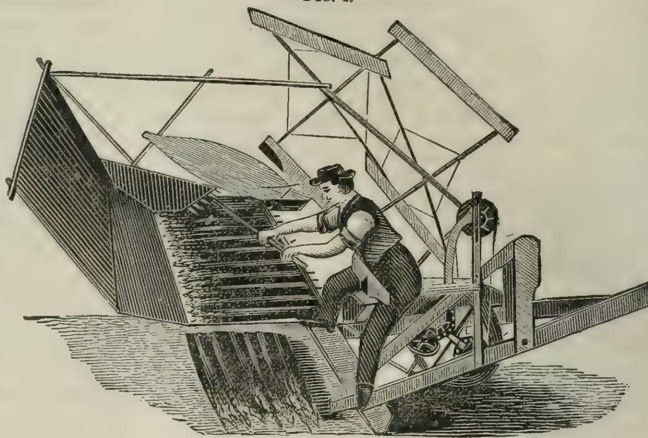
FIG. 3.



Hussey's Cutter.

tried in Hamilton co., O., in 1833, and patented in the same year. C. H. McCormick, formerly of Virginia, but now of Chicago, patented in 1834 a reaping-machine which he further improved, as described in patents granted to him in 1845 and in 1847, and it came into large practical use. McCormick's machine, as thus improved, is shown in Fig. 4. The main features were the reel to gather the grain, in combination with the platform to receive it, and a raker's stand to support the man while he raked the grain off the platform at intervals. McCormick adopted Hussey's cutting device. Hussey's machine had a platform and support for the raker, but so arranged that the grain was raked directly backward. The next improvement in reapers was introduced by Seymour of Brockport and Palmer & Williams in 1851. This consisted in making the grain platform of a quadrantal shape and in adding a vibrating automatic rake, which discharged the grain automatically from the quadrant platform. In 1856,

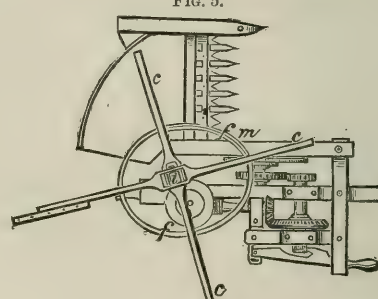
FIG. 4.



McCormick's Machine.

Dorsey of Maryland dispensed with the old reel, and adapted to the quadrant-shaped platform a continuously revolving rake and a series of continuously revolving beaters, so arranged that while the beaters and rake brought the grain to the cutter and platform, the rake continued to follow the cut grain on the platform, and deposited it in gavels on the ground, as shown in Fig. 5.

FIG. 5.



Dorsey's Machine.

In 1865, Samuel Johnston of Brockport, N. Y., improved the Dorsey rake by pivoting each revolving radial-reel-arm separately, and placing rake-teeth in each arm; and by employing a double guideway, part of which was movable, the driver was enabled at pleasure to cause any one of the four revolving arms to descend on to the platform and rake off the grain. This machine is now largely adopted here and in Europe. It is shown in Fig. 6, ap-

FIG. 6.

Johnston Rake.

plied to a Buckeye machine. Various modifications of Dorsey & Johnston's rake have been made within six years past, and several other forms of rake, known as Wood's chain-rake, Miller's table-rake, McCormick's rake, Osborne & Kirby's rake, Burdick's rake, have been introduced and largely manufactured for this country and Europe. The Champion machine is extensively manufactured with the Johnston rake, and with numerous improvements invented by W. N. Whitely. C. W. and W. W. Marsh invented and patented a machine in 1858 which carried upon it the

binder, and in which the cut grain was received on an endless apron and carried thereby to a secondary apron, which carried it to a stand on the machine, where the binders while riding along bound it into tight bundles and threw it off. (See Fig. 7, which represents Elward's improve-

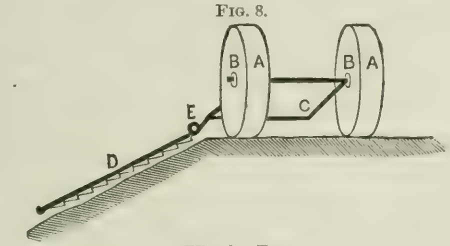
FIG. 7.

Elward Harvester.

ment built by St. Paul Harvester Co.) This and the Marsh harvester have gone into very extensive use in the Western States. A large number of patents have been lately granted for automatic attachments to the Marsh machines, which dispense with the necessity of the binder's riding, wire or cord being applied automatically. No one of these automatic binding-machines has up to 1876 gone into general successful use. Seiberling invented about 1856 a vibrating platform composed of slats which automatically dropped the grain at intervals on the ground behind the cutter known as the "dropper."

Mowing-machines employ the Hussey cutting apparatus, but have no receiving platforms or tables, the grass falling as cut. The three principal types of mowing-machines in use have two supporting wheels, and they differ as to the organization by which their cutting apparatus is conformed to inequalities in the surface of the ground. (1) Wheeler's type was invented in 1854, illustrated in Fig. 8,

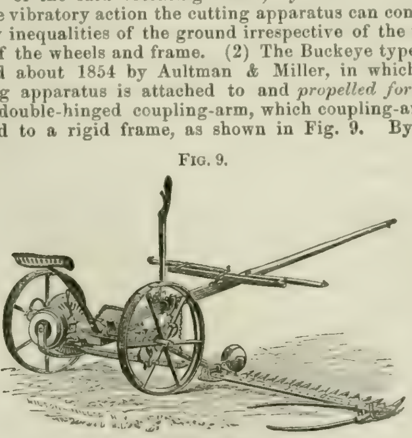
FIG. 8.



Wheeler Type.

by a vibrating frame C with a cutter D hinged to one corner of the said vibrating frame, by means of which double vibratory action the cutting apparatus can conform to any inequalities of the ground irrespective of the position of the wheels and frame. (2) The Buckeye type, invented about 1854 by Aultman & Miller, in which the cutting apparatus is attached to and *propelled forward* by a double-hinged coupling-arm, which coupling-arm is hinged to a rigid frame, as shown in Fig. 9. By this

FIG. 9.



Buckeye.

arrangement the cutting apparatus can freely follow the inequalities of the ground. (3) The Ball type, consisting of a double-hinged coupling-arm connection to the main frame, and a hinged or swivelling drag-bar to drag the cutter-bar forward. Ketchum & Kirby invented one-wheel mowers which have had much popularity. The latter continue to be largely made and sold.

GEORGE HARDING.

Reappearance, the coming back to sensible perception of anything which had previously disappeared from it. That many physical phenomena wholly disappear to us, and yet reappear, or can be made to do so under certain conditions, is a fact of every day occurrence. The solar spectrum is a striking instance of reappearance; the different-colored rays in a beam of light lose their visible identity, and appear as one ray; but by means of a prism the colorless beam is resolved, and each ray reappears in its own hue. Hereditary physical and mental traits and tendencies not unfrequently disappear in one generation, and reappear in some succeeding one. So, what we call force is in many cases only the reappearance in another form of one, the manifestation of which had been interrupted or had escaped our observation. The vital force of a plant becomes latent in the seed, only to reappear in a succeeding plant and in successive generations of its kind. Philosophers have even gone so far as to affirm that no impression made upon matter or mind is ever obliterated—that, for example, every image thrown upon the retina of the eye always remains there. It is certain that innumerable mental impressions, of which the individual had apparently no after consciousness, or had wholly forgotten, reappear after intervals of indefinite duration. Sometimes they are called up by a chain of associations of which we can trace the several links, and sometimes by causes which utterly elude our observation. A very common example of this is in the case of aged persons, in whom the recollection of long-forgotten incidents of childhood reappears with the utmost vividness. Coleridge refers to a case where an aged peasant-woman, when suffering from severe sickness, would utter words and sentences in an unknown tongue, which were written down and found to be Greek and Hebrew. It was learned that in youth she had been a domestic in the service of a clergyman who was in the habit of reading aloud passages of the Scriptures in the original tongues as he walked up and down his study, and these had remained impressed upon the mind of the ignorant peasant-woman, to reappear after the lapse of years. Instances are upon record in which persons apparently on the point of sudden death have survived, who state that every incident of their past lives reappeared before them, as though seen in a mirror. The well-authenticated case of the Rev. William Tennent is a striking example of the disappearance and reappearance of mental impressions. He had nearly completed his theological studies when he fell into an illness which resulted in apparent death, but the somewhat singular appearance of the body caused the burial to be postponed for a week. He was finally brought back to life, but was in knowledge a mere infant; all that he had learned had disappeared, and he had to be taught to speak, to read, and to write. Suddenly occurred what he described as a shock in the head, and in a little time all his former knowledge came back to him, and he resumed existence as he was before he fell into the trance.

Rea'son [*ratio*, from *reor*, to "calculate" or think], in its first or most general signification, the conscious intelligence of man as contrasted with the instinct of brutes. In this sense stress is laid on the ability to adapt means to ends. From it are derived the expressions "reasonable" and "according to reason"—*i. e.* according to a proper regard for the adaptation to ends; "rational," meaning correct appreciation of this adaptation; "irrational," lacking such appreciation. Its second signification is that of ground—the "reason why anything is or is done." This includes (*a*) the ground as motive of action, (*b*) as efficient cause or "sufficient reason." Aristotle's formal cause (*τὸ τί ἦν εἶναι*), the ideal totality of the possibilities of a thing within which exists mutual adaptation of parts, is the distinction upon which rests this and the former use of the term "reason." The verb "to reason," in the sense of to argue or adduce grounds, also the noun "ratiocination," come from the second meaning. The third use of the words is as an equivalent of Aristotle's *νοῦς*: (*a*) *νοῦς ποιητικός*, *actus purus*, active or divine reason, the thinking occupied with creating and contemplating divine ideas; (*b*) *νοῦς παθητικός*, passive reason, including the activities of the mind in mere feeling or desire, sense-perception, imagination, and reflection. This "active reason" is nearly what Victor Cousin calls the "impersonal reason," that to which "we owe the knowledge of universal and necessary truths, of principles which we all obey and cannot but obey"—"the light that lighteth every man that cometh into the world." The fourth meaning of "reason" is akin to that of "active reason," and distinguishes it from "understanding." Kant, its author, makes the latter deal exclusively with the results of sense-perception, while reason deals with the supersensuous. With him, reason (*Vernunft*) is not a faculty of cognition, but only "regulative" of the practical conduct of life. Hegel and others restored it to its function of highest faculty of cognition, but preserved its function as practical, inasmuch as they make it to be the recognition of universal and necessary

principles, not in a mere abstract sense, but as realized in the institutions of civilization, including under this head family, society, state, art, religion, and science.

WILLIAM T. HARRIS.

Réaumur′, de (RENÉ ANTOINE FERCHAULT), b. at La Rochelle, France, Feb. 28, 1683; educated in the Jesuits' college at Poitiers; studied law at Bourges; settled in 1703 at Paris; devoted himself with great enthusiasm to the study of natural history, physics, and mathematics; attracted much attention by some mathematical essays; became a member of the Academy in 1708; received a pension of 12,000 livres a year from the government for his *L'Art de convertir le Fer forgé en Acier* (1722), by which he first made his countrymen acquainted with the art of making steel of iron. D. Oct. 18, 1757. Of his numerous discoveries and inventions, the thermometer (1731), dividing temperature from the freezing to the boiling of water by a scale of 80°, is still in use; also, the so-called Réaumur's porcelain is employed for many purposes. Of his works, the most remarkable is *Mémoires pour servir à l'Histoire naturelle des Insectes* (6 vols., 1734–42).

Re′bec, a musical instrument introduced by the Moors into Spain, whence its use spread over Europe. It was a sort of violin, and was of various sizes. From the neck it grew larger until the base was reached. It was played with a bow. It was one of the precursors of the violin. Similar instruments were anciently in use among the Celts, Slavi, and many Asiatic peoples.

Rebellion. See CONFEDERATE STATES, by HON. HORACE GREELEY, LL.D.

Récamier′ (JEANNE FRANÇOISE JULIE ADELAÏDE), b. Dec. 4, 1777, at Lyons; married in 1793 a Paris banker, M. Récamier, three times her age; bought in 1798 the Hôtel Necker, and gathered, during the time of the Directory and Consulate, a most brilliant circle around her, which even aroused the jealousy of Napoleon. On account of the sudden collapse of M. Récamier's business in 1804, she left Paris, and resided for some time at Coppet with Madame de Staël. Here she met with Prince August of Prussia, and his marriage proposals form a very curious episode in her life. In 1815 she returned to Paris, and although new pecuniary reverses compelled her to keep a rather modest establishment in the Faubourg St. Germain, her salon became nevertheless very soon the rendezvous of the most gifted and finest developed spirits of Paris, and continued so till her death, May 11, 1849. One of her most faithful worshippers was Chateaubriand, who, after the death of his wife in 1846, even proposed to marry her. (See his *Mémoires d'Outre-Tombe*, vols. viii.–x.) Personally, she was in the highest degree fascinating and perfectly blameless, but her salon was at various times the focus of political, religious, and literary intrigues which have occasioned some very severe criticism. (See Mad. Lenormant, *Souvenirs et Correspondance tirés des Papiers de Madame Récamier* (2 vols., 1860), and *Madame Récamier, les Amis de sa Jeunesse* (1872), both translated into English by Isaphene M. Luyster (Boston, 1867 and 1875).)

Recana′ti, town of Italy, province of Macerata, 8 miles S. W. of Loreto, on a hill about 900 feet above the sea. The adjoining country is very productive, the grapes and figs being of the finest quality. Picturesque fragments of the old town walls and gates are still standing, and the churches, convents, and other public buildings in and near the town—some of them very ancient—are well worthy of notice. The Palazzo Communale contains some important old lapidary inscriptions, and on the façade is a bronze representation of the translation of the Holy House to Loreto. The educational and charitable institutions of this town are very respectable. Recanati (*Recinetum*) was built in the fifth century on the ruins of the ancient *Recina*, which had been destroyed by the Goths, and it was a strong fortress in the time of Belisarius. It plays no unimportant part in Italian mediæval history, having been the theatre of long and desperate conflicts between popes and emperors. It was sacked by the French in 1799. P. in 1874, 19,570.

Recap′ture [Lat. *re*, and *capere*, "to take"] is recovery of a captured vessel by a cruiser of the same nation or of an ally before any sentence of a prize-court of the captor's sovereign has decided upon the validity of the capture. Before sentence, by which the ownership of the captured vessel is determined, if retaken, it goes to the owner; after such sentence, if retaken, it goes to the captor. The captor in the first of these two cases is entitled to a reward. (See SALVAGE.)

T. D. WOOLSEY.

Rec′co, a pretty Italian town in the province of Genoa, on the Riviera. Its little harbor was formerly defended against the corsairs by two small castles, and it still serves for the immediate coast-trade. P. 5150.

Receipt′ [Lat. *receptum*, "received"], a written acknowledgment of the payment of money or the delivery of chattels executed by the creditor or the one to whom the payment is made, and given to the debtor or the one by whom it is made. A simple receipt may always be used as evidence against the person who gives it or his representatives, for it operates as an admission that the facts therein stated are true. It is not, however, conclusive evidence; it does not necessarily act as a release and discharge the pre-existing obligation; it is only *primâ facie* evidence of the payment or delivery which it relates, and, like any other mere admission by a party, it may be explained or contradicted by oral proof. It is not embraced within the operation of the general rule that a written instrument cannot be qualified or contradicted by verbal evidence, since it is not an instrument, but simply an admission. The party giving such a receipt may therefore always show the circumstances under which it was executed, and not only that it was obtained through mistake or by fraud, but also that no money was actually paid or property delivered to him according to its terms. A receipt which purports to be in full of all demands, or which acknowledges payment of a certain sum in full of all demands, or which contains language of like import, possesses a somewhat higher and more binding character. It implies an adjustment of accounts, a settlement of disputed claims, an ascertainment of the balance due and the payment thereof. Although such receipts are, in the absence of fraud or mistake, generally conclusive, yet their effect may be overcome by showing fraud or such a mistake as would invalidate the settlement itself which they presuppose. When a receipt is more than a simple acknowledgment of payment, and contains in addition thereto a contract between the parties, it comes within the operation of the general rule above mentioned in relation to all written instruments; it is an instrument in writing, and cannot be contradicted or qualified by oral evidence. The admission which it contains is absorbed in the agreement, and the entire writing is governed by the doctrines applicable to contracts in general.

JOHN NORTON POMEROY.

Receiv′ers. In a large class of equitable actions brought to determine the rights of the litigants in certain specific property, either real or personal, where it would be improper that either of the claimants should have the exclusive possession during the controversy, and especially where, from the nature of the subject-matter, it is necessary, or even expedient, that some indifferent person should be placed in charge thereof until the final judgment is rendered, the court theoretically assumes this custody and oversight; but since it is impossible for the judge to act personally in such a capacity, an agent or representative is appointed for that purpose, who, as a special officer of the court, takes possession of the fund, becomes vested with its ownership as a trustee, is empowered to do whatever may be necessary for its security and preservation, and finally disposes of it according to the directions given by the court in its decree. Such an officer is termed a "receiver," and he and his functions have long been recognized as ordinary features of equity procedure. Statutory legislation has also provided for the appointment of receivers under special circumstances which were beyond the ordinary jurisdiction of equity. One of the most familiar instances of receivers in equity occurs in suits brought by one partner against his copartners to obtain a dissolution of the firm and a winding up of its affairs. In such an action a receiver is appointed almost as a matter of course to take possession of the partnership assets, to collect the claims due, to ascertain and discharge the liabilities, and to distribute the surplus among the partners according to the directions given by the judgment. Another very common case is the "creditors' suit," brought to reach the property of a judgment debtor which cannot be taken on execution, in which a receiver is appointed to collect in and take possession of such assets in order that they may be applied in discharge of the judgment against the defendant. The principle of which these cases are illustrations is one of wide application, and extends to all equitable actions of which the subject-matter is a fund or property in which both parties are interested, and which cannot properly be left in the exclusive possession of either, nor in the joint possession of both. In these classes of suits the receiver is generally appointed by an order of the court made on the application of either party at the commencement of the litigation or at any time during its pendency. Of the special cases provided by statute for receiverships, the most important is the winding up of insolvent corporations. By a system of legislation adopted very generally among the different States, when a business corporation becomes insolvent any person interested therein as a stockholder or a creditor may apply to a specified court

by a summary proceeding and procure the nomination of a receiver, who thereupon becomes vested as a trustee with the corporate assets and all the powers necessary for the winding up and settlement of the company affairs. By the system of procedure which prevails in many States receivers may also be appointed over the property of judgment debtors against whom an execution has been returned unsatisfied, to the end that such property may be collected, converted into money, and applied in payment of the judgments. The functions of all these receivers are substantially the same, except that the powers and duties of those provided for by statute to wind up insolvent corporations are generally defined and regulated by the legislation itself with much care and precision. Every receiver is an officer of the court, and acts under its direction in all his proceedings. He obtains its authority to commence all actions, and no suit can be brought against him without its permission. He is a trustee for all the parties interested in the property or fund, and as such is bound to use the utmost good faith and reasonable care, diligence, and skill in all his transactions. As trustee he is vested with a legal estate in the assets over which the receivership extends, which in some instances arises by operation of law, and in others from an assignment made by the parties. By virtue of this ownership he takes possession of the fund, brings all actions in his own name necessary to secure it or to recover it or any portion of it from the possession of others, or to collect the demands owing to it; he settles and discharges the liabilities due from it; in short, he does any act which an owner may do so far as may be necessary for the purposes of the trust and to preserve the rights of all those who are ultimately interested. He is, however, in all these proceedings guided by and accountable to the court, and often must, and always may, procure its special authority before taking any important step.

JOHN NORTON POMEROY.

Recent Period, a geological term intended to designate that portion of geological history which includes the present time, and reaches back to the Quaternary, or Drift Period. Throughout the Recent Period the aspects of nature, both as regards the organic and inorganic worlds, have remained essentially the same, but minor changes have been constantly going on that serve well to illustrate and explain the manner in which the globe has been revolutionized in past ages. These changes consist in the elevation and depression of coast-lines, the scooping out of valleys, the draining and filling of lakes, the outbursts of volcanic matter, and the extinction of certain kinds of animal and vegetable life. Among the latter may be mentioned the dodo, the solitaire, the great auk, the gigantic turtles of Mauritius, etc. It has been said that no species of animals or plants have been known to originate in the Recent Period, but permanent varieties have been produced by derivation from other forms, and these, if their history had not been known, would have been regarded as species of independent origin.

Re′chabites [Heb., "horsemen"], descendants of Rechab, the father or ancestor of Jonadab, a branch of the Bedouin Kenites, who entered Palestine with the Israelites. The Rechabites were strict abstainers from wine. They built no houses and sowed no grain, but dwelt in tents. In recent times attempts have been made to identify them with the Beni Khaibir, an Arabian tribe. There is a secret society of total-abstinence men and women in the U. S. and Great Britain known as the Independent Order of the Rechabites.

Recife. See PERNAMBUCO.

Recip′rocal [Lat. *reciprocus*]. The reciprocal of a quantity is the quotient of 1 by that quantity; thus, ½ is the reciprocal of 2. A *reciprocal equation* is an equation whose form remains unchanged when the reciprocal of the unknown quantity is substituted for the unknown quantity itself.

Recitative′ [It. *recitativo*], in oratorios, operas, etc. a kind of musical reading or declamation resembling ordinary speech in time and accent, but differing from it by a strict adherence to the tones of the musical scale. The recitative is usually confined to such words as pertain to narrative, description, passion, and declamation. In ordinary recitative the rate and style of utterance are chiefly dependent on the discretion of the vocalist, sustained by an accompaniment of only a few plain chords; but in recitative with full accompaniment a more strict observance of musical time is required, although the rhetorical or declamatory character of the recitation is still to be retained. WILLIAM STAUNTON.

Reclus′ (JEAN JACQUES ELISÉE), b. at Ste. Foy la Grande, department of Gironde, France, Mar. 15, 1830; was educated in Rhenish Prussia, and studied in Berlin under Karl Ritter; travelled from 1852 to 1857 in England and America, and published after his return to Paris a number of valuable geographical works, partly in the *Revue des Deux Mondes*, partly in book-form, of which the most prominent are *The Earth* (2 vols., 1867) and *The Ocean, Atmosphere, and Life* (1872; translated into English by B. B. Woodward, New York, 1871 and 1872). Of his *Nouvelle Géographie universelle* the first part was published in 1875.

Recluse′ [Lat. *reclusus*, "shut up"], in strict language, designates a monk or nun who from choice is retired from communication even with members of the same order. The secluded person sometimes adopted this life by way of penance, sometimes as a means of spiritual progress. No one could be thus secluded without permission. The recluse was locked up and the door sealed in the presence of a superior officer, and could only be unlocked by the command of a bishop.

Reco′aro, town of Italy, province of Vicenza, near the sources of the Agno, on the border of the Trentino. The medicinal waters here have a great reputation, the various springs possessing different properties, and the number of annual visitors is from 8000 to 10,000. P. 5700.

Recog′nizance [Fr. *reconnaissance*], an obligation entered into before a court or an officer duly authorized, and made a judicial record, containing a condition or stipulation that some particular act therein specified shall be done. It resembles a bail-bond in its design, and partially in its effects, but differs from such an instrument in being a record of the court, so that upon default it can be enforced by a direct proceeding without any action brought and judgment recovered upon it, since it is itself a species of judgment. It should be observed, however, that in modern legal nomenclature the term "recognizance" is sometimes applied to ordinary bail-bonds, upon which suit must be prosecuted and judgment obtained. At the common law the recognizance, in its original and proper signification, was employed both in civil and in criminal cases, but in the U. S. its use is now chiefly confined to the criminal procedure. In civil cases the persons entering into a recognizance were the debtor himself or bail or sureties, who became thereby bound in a certain sum upon the condition that they should pay the debt and costs recovered by the plaintiff in the contingencies specified. In criminal cases the parties entering into it are also bail or sureties, who become bound in a certain amount with the condition that the person accused shall appear before the court at the proper time to answer the charges made against him, or that he will keep the peace. Upon a breach of the condition the recognizance becomes in effect a judgment against the parties who are bound, and is enforced by direct process against them without suit. In many States bail-bonds are now used in place of recognizances to effect the same objects through the means of sureties, who, upon default, become liable to suit and judgment as in the case of any other written undertaking. JOHN NORTON POMEROY.

Rec′ollet Friars and **Nuns,** a name usually applied to one of the congregations of Franciscans of the strict observance, but sometimes designating reformed bodies of other orders. A congregation of Augustinian Recollets dates from 1530. The Franciscans who bear this name are especially those of the French congregation, founded in 1592 by the duke of Nevers, Louis de Gonzaga (1539–95).

Recon′naissance [Fr. *reconnaissance*], a preliminary or rough survey of a portion of country. A reconnaissance may be geologic, civil, or military. A civil reconnaissance may be undertaken for the purpose of selecting suitable points for trigonometrical stations preparatory to a geodesic survey; for ascertaining the relative advantages and disadvantages of two or more routes preparatory to locating a line of railroad, canal, or aqueduct; or for the purpose of acquiring a general idea of the features of an unexplored country. A military reconnaissance may be undertaken to ascertain the military resources of a tract of country; for determining the best line of march for an army; or for obtaining information in regard to the military character of a defile, of a crossing, or of a position of defence. The information obtained by a reconnaissance is usually embodied in a map and an accompanying memoir. The map is intended to show the general topographical features of the country examined, and the memoir is designed to supply such information as cannot be presented by the map. Both the map and the memoir vary in character according to the object to be attained. In reconnoitring for the purpose of opening or extending a geodesic survey, one of the most important objects is to make a judicious selection of points to be used as points of reference, called triangulation points. These points are to be chosen so that the triangles formed by joining them shall be well conditioned—that is, shall have no very acute

angles; so that as many as possible shall be visible from each station; and for the primary triangulation the triangles should be as large as possible, their sides gradually increasing in length from the base up to the longest admissible line. In reconnoitring for the location of a railroad the objects to be attained are to find the most direct route between the points to be connected, with the most uniform grades and the fewest curves. Attention should also be paid to the facilities for construction and the convenience of operating the road. In locating a line of communication between two points due regard should be paid not only to the accommodation of the inhabitants at the extremities of the line, but also to the convenience of the greatest number of people along the general direction of the route. In reconnoitring for the purpose of determining the prominent features of an unexplored country two sets of operations are generally carried on by the same party: *First,* a system of astronomical observations for fixing the latitudes and longitudes of the principal points of the country; and *secondly,* a running survey, intended to fill in the astronomical outlines. To this class belong the numerous surveys that have been made during the last thirty years in the Territories of the U. S. lying to the W. of the Valley of the Mississippi. In reconnoitring for military purposes, the general object to be aimed at is to acquire a knowledge of the principal lines of communication, the obstacles which they present to military movements, the character of the roads to be traversed and of the streams to be crossed, the nature of the marshes, swamps, defiles, and mountain-passes, the general resources of the country; in fact, to gather all the information that may be of use to the commanding general. In all cases the materials from which the map is to be constructed are of the roughest character. Angles are usually measured with a pocket-sextant or a pocket-compass, distances are determined by estimation or by the time required to traverse them, distant points are laid down by intersection of lines whose directions are determined by the compass, and slopes are judged of by the difficulty of ascending them. In the more extended reconnaissances previously alluded to, distances are frequently determined or checked by a *viameter,* an instrument attached to a wagon-wheel, and so constructed as to record the number of times the wheel revolves in passing over a certain line. The information obtained is recorded in the field, and the principal features of the map are plotted down or sketched as the survey progresses. Of course the value of a reconnaissance depends in a great degree on the skill and ability of the person who makes it. W. G. PECK.

Rec'ord [Lat. *recordari,* "to call to mind"]. The term *record,* when used alone, primarily denotes the written account or history of the successive important proceedings had in an action or suit brought in some one of the higher courts, including the process by which the defendant is summoned, his appearance, the pleadings, the issue joined, the continuances or postponements (if any) from time to time, the summoning and empanelling of the jury, the submission of the issue to them, their verdict, and the judgment of the court thereon. In England the records of the three superior courts of law are kept upon long pieces of parchment, which are rolled up as fast as written over, and are therefore technically called the "rolls." The practice of entering the history of a suit by the clerks of the law-courts upon these parchment rolls commenced at a very early period of the English judicial history, and the language of their records still continues to be used in the present tense, as though the accounts were actually taken down in open court while the transactions themselves are going on. Such, at least, was the method in vogue down to the time when the radical changes in the procedure went into operation in the year 1875. The analogous proceedings in courts of equity are also records. In the U. S. paper has been universally substituted in place of parchment, and the external form of the judicial records in this country differs widely from that which existed in England; their substantial character, objects, and effects, however, are the same. In England and in many of our States the record is wholly made up and composed by officers of the court. In some of the States, however, a great laxity prevails in the practice; the process, pleadings, judgment, and other important papers in an action are simply attached together and filed in the proper office, and they constitute the entire record of the judicial proceeding. Even this careless and slovenly work is actually done by the attorneys, and not by the clerical officers. The effect of a record is remarkable. It is the highest species of evidence known to the law. It imports absolute verity, and is a complete proof, admitting no contradiction of the statements therein contained. A record is therefore said to prove itself; its own averments are taken as the best evidence of the facts which they narrate. Although commonly referring to judicial transactions, the term is also used in connection with legislative proceedings. The acts of Congress and of the State legislatures, duly authenticated and filed in the offices of the secretaries of state, are records of the highest character, possessing all the attributes which belong to the judicial records above described. The journals kept by the clerks of the national and the State legislatures also possess, to a certain extent at least, the same quality. By a system of legislation prevailing in all the States, deeds, mortgages of land, and other muniments of title may be made records for certain prescribed purposes. (See RECORD OF CONVEYANCES.)

JOHN NORTON POMEROY.

Recording of Deeds. See RECORD OF CONVEYANCES, by PROF. J. N. POMEROY, LL.D.

Rec'ord of Convey'ances. The practice of recording conveyances is a striking feature of the American law and social customs. It is true that certain English statutes have provided for a partial registration of deeds and mortgages in two or three counties or parts of counties, but the very principle of public records is opposed to all the tendencies of British society and the habits of thought of the British landed proprietors. By the system of legislation adopted by all the States an officer is appointed in every county whose duty it is to record all conveyances brought to him in books which are open to the public inspection, and which are provided with alphabetical indexes of the grantors and grantees, mortgagors and mortgagees, etc., so as to facilitate the examination thereof by persons interested. All deeds of conveyance, leases for more than a specified term, mortgages of land, assignments of mortgages, and other muniments of title may be recorded at the instance of the parties holding the same. In order that an instrument may be thus recorded, it is generally made a requisite that the same should have been duly acknowledged by the party executing it before some designated officer, and that his certificate of such acknowledgment should have been attached thereto. The object of the record is to protect the holder of the conveyance or incumbrance against other conveyances or incumbrances of the same premises made by the same owner, and to give notice to all persons having occasion to ascertain whether there has been any prior deed or mortgage of the same estate. In order to effect this purpose, the general provision of the legislation is that every conveyance or mortgage not so recorded shall be void as against any subsequent purchaser or incumbrancer in good faith and for a valuable consideration of the same real estate or any portion thereof, whose conveyance or incumbrance shall be first duly recorded. Between the immediate parties to a deed and their heirs and devises its validity is not at all affected by a failure to record. The same is generally true of mortgages, although in a very few States their lien is postponed unless they are left for record within a certain prescribed time after execution. It is also a general principle that the record is a constructive notice only to subsequent purchasers or incumbrancers of the same lands—that is, to all persons claiming the same land or a portion thereof or a lien thereon by means of a subsequent purchase or mortgage from the same grantor or mortgagor. It is not, therefore, a notice to persons whose rights accrued prior to the execution of the instrument recorded, but only to those whose rights accrued subsequent thereto. The result of this doctrine is that successive mortgages of the same premises made by the owner to different mortgagees, and by them put on record, take effect and become valid securities in the hands of such holders from the time of their recording, and according to the priority thereof, in the absence of any actual or constructive notice derived from sources other than the record itself. The same is true of successive deeds of the same land given by the same grantor to different grantees. No record of any instrument is a constructive notice unless it is authorized by law, nor unless all the requisites prescribed by law have been complied with, nor unless it is made in the manner and form provided by the statute; and the record itself also determines the extent of the notice which it conveys. In most of the States an instrument which has been properly recorded can be offered in evidence in any judicial trial without further proof of its execution, and in many of them the record itself has the same force and effect of evidence as the original would have were it produced. In construing the statutory language above described, and especially the words "in good faith," the courts have settled the doctrine in a very large majority of the States that an actual notice of a prior unrecorded deed or mortgage given to a subsequent purchaser or incumbrancer has the same effect on his rights of priority as the record of such prior instrument would have had. It follows that the party who first places his subsequent deed

or mortgage on record, having at or before the same time received notice of a prior unrecorded conveyance or incumbrance of the premises, does not acquire a precedence for his own, but is left in exactly the same situation as though the prior grantee or mortgagee had also obtained the prior record. This interpretation of the statute is highly just and equitable, and is based upon the plain intent of the entire legislation. What will amount to such a notice is a question which has been much discussed. The general principle may now be considered as settled, however, that the knowledge of any circumstances sufficient to put a reasonable man upon an inquiry, when such inquiry, if reasonably followed up, would lead to a discovery of the actual facts, is a sufficient notice to satisfy the requirements of the rule. Probably no single doctrine of the American law of real property has done so much to quiet titles, to render the transfer of land easy and inexpensive, and to prevent litigations between adverse claimants, as this system of recording, which to the American proprietors and lawyers is so simple and necessary, but which the English land-owners are so unwilling to adopt. JOHN NORTON POMEROY.

Record′er, an ancient form of the flageolet, having a rather wide open extremity, and a soft, agreeable tone of high pitch.

Recoup′ment [Fr. *recouper*, to "cut off"], a species of defence in actions brought to recover damages for the non-performance of a contract, whereby the defendant alleges that he has himself sustained damages by the plaintiff's breach of the same contract, or by the plaintiff's fraud in procuring him to enter into it, which he seeks to cut off or "recoup" from the amount that would otherwise be recovered against him. The doctrine of recoupment has become established by judicial decision both in England and in the several States of this country, although there are some slight differences in the extent to which it has been carried by the various courts. Like the defence of set-off, it is confined to actions upon contract, and must itself arise from contract, but here all resemblance ends. A set-off must be for a debt, a certain fixed sum; recoupment is of damages often entirely unliquidated: a set-off is necessarily a demand arising upon a different contract from the one in suit; recoupment is necessarily of damages arising from a breach of the very same contract sued upon; in set-off the defendant may sometimes recover a balance from the plaintiff; in recoupment this can never be done. The doctrine, as generally settled throughout the U. S., was clearly and briefly stated by an eminent judge in the following manner: "It cannot be denied but that, in an action for a breach of contract, the defendant may show that the plaintiff has not performed the same contract on his part, and may recoup his damages for such breach in the same action, whether they were liquidated or not, or may at his election bring a separate action." Recoupment, however, can only be used as a defence, and can do no more at most than defeat the plaintiff's recovery; even if the defendant's damages should exceed those of the plaintiff, he can have no judgment for such excess. In this last-mentioned particular the doctrine of recoupment has been greatly enlarged by the reformed American system of procedure prevailing in many of the States, which permits the defendant by means of a counter-claim to recover an affirmative judgment for damages against the plaintiff when the grounds for such recovery have been established by the proofs.

JOHN NORTON POMEROY.

Recov′ery, tp., Mercer co., O. P. 1118.

Recovery, Common, in law, a mode of assurance in the form of a fictitious action, by means of which conveyances were made by various tenants possessed of limited rights in real property (more particularly by tenants in tail), which has been generally abolished, and in the U. S. this mode of limitation is made equivalent to a conveyance in fee simple. (See FEE and FINE OF LANDS.)

Rectifica′tion [Lat. *rectus* and *facere*]. The rectification of a curve is the operation of finding an expression for its length. A curve is said to be rectifiable when the length of any portion of it can be expressed by a finite number of algebraic terms.

Rec′tum, Diseases of [Lat. *rectus*, "straight"]. The rectum is the third and last portion of the great intestine, receiving the fæcal matters from the colon, and opening outward by the anus. Not infrequently in new-born children occur congenital defects of the rectum; such are preternatural narrowness of the anus, imperforate anus, absence of the anus, with partial or complete non-development of the rectum. In childhood disease of the rectum is exceptional; atony and relaxation of its muscular coat may result in obstinate constipation and overloading of the rectum with fæces. Reversely, in strumous and delicate children continued diarrhœa may result in prolapse of the rectum or protrusion, usually of the mucous membrane only, less frequently of the muscular coat. Adults are subject to numerous rectal diseases. Dysentery is not infrequently limited to the rectum. (See DYSENTERY.) Chronic ulcer is a frequent sequel of the destruction of tissues in dysentery; ulcers may also arise from tubercular or syphilitic deposit. Irritable ulcer of the lower end of the rectum, especially just within the sphincter muscle of the anus, is termed a fissure. It causes intense pain when stretched by the passage of fæces, and the dread of suffering causes voluntary inaction of the bowels and habitual constipation. Fissure often can be detected only by use of the rectal speculum, the patient being anæsthetized by chloroform. Stricture of the rectum is often the result of former dysenteric inflammation, ulceration, sloughing, and the subsequent formation of dense scars of fibrous tissue. It results in obstruction, difficult and small stools, constipation, straining and bearing-down pain in the bowels, loins, and lower region of the back, with general depression of health. Stricture is often the result of cancer of the rectum, when, in addition to the symptoms and signs of stricture, exist also the cachectic facial appearance and progressive emaciation of the body indicative of cancer, and intense lancinating pains in the rectum, due to the malignant local growth. Hæmorrhoids or piles (see PILES) are the frequent result of congestions and inflammation of the abundant venous circulation of the rectum and anus. Polypus of the rectum is an attached tumor, originating in a relaxed fold of mucous membrane, or in a hæmorrhoidal mass, or redundant growth following the healing of ulcers; it may grow to such size as to obstruct the bowel, or by the dragging efforts of defecation be protruded from the body. Fistula in ano is the result of abscess adjacent to the lower bowel or verge of the anus, the purulent contents being discharged into the rectum, and leaving an unhealed passage or sinus. There may be an additional sinus opening on the surface without the anus; fistula may also be "blind," or terminating in a *cul-de-sac* adjacent to the bowel, but opening only externally. The origin of fistula is usually piles, constipation, or other disease of the lower rectum. Intense neuralgia of the rectum, though a frequent forerunner of malignant disease, is often present in persons reduced in health or of highly nervous temperament. Pruritus of the anus (obstinate itching) is often present associated with constipation, piles, the climacteric period, and old age. Eczema often affects the anus.

Preternatural narrowing of the rectum demands stretching by the fingers, aided by anæsthesia, and the use of rectal sounds. The imperforate anus is to be punctured or incised, and kept open by sounds while healing. Prolapse usually yields to improved diet, tonics, and internal and local use of astringents. Excision of a chronic prolapsed rectum is rarely demanded. Ulcers may be treated by astringent tonics, but more effectively by local use of suppositories or direct caustic applications through a speculum of considerable size. Fissure may be cured by keeping the bowels habitually open and by local use of anodynes, astringents, and mild caustics. A more certain cure is by rupture of the sphincter ani under anæsthetics, allowing the fissure or ulcer a period of rest. Stricture when not malignant may be relieved by cautious incision and subsequent use of large rectal sounds. The operation endangers peritonitis and portal phlebitis (inflammation of the portal vein), with abscess of the liver. Cancer of the rectum is incurable. The intense pain is modified by keeping the bowels open and by local and internal use of anodynes, opium and atropine being most efficacious. (See FISTULA and PILES for treatment.) Neuralgia, pruritus, and eczema demand local use of anodyne and emollient suppositories and ointments, while the constitution is improved by corrected diet and tonics.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Recur′ring Series. A recurring series is one in which each term is equal to the algebraic sum of the products obtained by multiplying one or more of the preceding terms by certain fixed quantities. These quantities, taken in order, constitute what is called the "scale of the series." The order of a recurring series is determined by the number of terms in its scale. A geometrical progression is a recurring series of the first order. As an illustration of a recurring series of the second order, let us take the equation—

$$\frac{1-x}{1+x+x^2} = 1 - 2x + x^2 + x^3 - 2x^4 + x^5 + x^6 - 2x^7 +, \text{etc.}$$

The second member is a recurring series of the second order, whose scale is $(-x, -x^2)$. Every term after the second may be found by multiplying the preceding term by $-x$, the second preceding one by $-x^2$, and then taking the algebraic sum of the results. Recurring series may be of any order whatever. W. G. PECK.

Red. See COLOR.

Red Bank, p.-v., Shewsbury tp., Monmouth co., N. J., on Neversink River and on New Jersey Southern R. R., has 1 newspaper. P. 2086.

Red Bank, tp., Armstrong co., Pa. P. 1341.

Red Bank, tp., Clarion co., Pa. P. 1434.

Redbird. See CARDINAL BIRD.

Red Bluff, p.-v., cap. of Tehama co., Cal., on Sacramento River and on Oregon division of Central Pacific R. R., has 2 newspapers, a glove manufactory, a flourishing lumber-trade, and considerable river traffic. P. 992.

Red Bluff, v., Marlborough co., S. C. P. 1308.

Red Bud, p.-v., Union tp., Randolph co., Ill., on Cairo and St. Louis R. R. P. 880.

Red Cedar, tp., Dunn co., Wis. P. 648.

Red Cloud, p.-tp., cap. of Webster co., Neb., in the centre of a large and very fertile district, has three church organizations, excellent schools, 1 newspaper, 1 steam saw-mill, a flouring-mill, 2 hotels, and a wagon-factory.

C. L. MATHER, ED. "RED CLOUD CHIEF."

Red Colony, tp., Sevier co., Ark. P. 463.

Red Creek, v., Perry co., Miss. P. 80.

Red Creek, v., Southampton tp., Suffolk co. (L. I.), N. Y. P. 46.

Red Creek, p.-v., Wolcott tp., Wayne co., N. Y., on Lake Ontario Shore R. R., has 3 churches, an academy, 2 grist-mills, several saw-mills, and a woollen-factory. P. 529.

Red'den (LAURA C.), b. in Somerset co., Md., about 1840; lost her hearing at the age of twelve years; became editorially connected with the St. Louis *Presbyterian* in 1860; has since been a contributor over the signature "Howard Glyndon" to several periodicals and magazines, including those of the Messrs. Harper & Bros., in which her poems attracted favorable notice. Author of *Notable Men of the Thirty-seventh Congress* (1862) and *Idylls of Battle and Poems of the Rebellion* (1864). Several poems from the latter volume have been included in *Loyal Lyrics* and in *Ballads of the War*.

Red'ding, tp., Jackson co., Ind., on E. fork of White River and on Jeffersonville Madison and Indianapolis R. R. P. 1525.

Redding, p.-v. and tp., Fairfield co., N. Y., on Danbury and Norwalk R. R. P. 1624.

Redding (CYRUS), b. at Penryn, Cornwall, England, in 1785; became editor of the London *Pilot* 1806; soon afterward founded and edited the Plymouth *Chronicle;* conducted at Paris *Galignani's Messenger* 1815–18; was joint editor with Thomas Campbell of the *New Monthly Magazine;* edited Liberal papers at Bath and Stafford; returned to London 1840, and was an industrious writer until his death in that city, May 28, 1870. Author of many works, the best known of which are a *History of Modern Wines* (1833), *Fifty Years' Recollections* (1858), *Reminiscences and Memoirs of Thomas Campbell* (1860), and *Past Celebrities whom I have Known* (1865).

Red'ditch, town of England, in Worcestershire, has manufactures of pins, needles, and fish-hooks. P. 5571.

Red'dle, or **Red Chalk,** an argillaceous oxide of iron brought from Germany and England, is used for carpenters' chalk, for marking sheep, for drawing on paper, and fine grades for polishing spectacle-lenses.

Redemption, Equity of. See MORTGAGE, by PROF. T. W. DWIGHT, LL.D.

Redemp'tionists, called also **Mathurins, Fathers of Mercy,** and **Trinitarians** (*Ordo Sanctissimi Trinitatis*), a brotherhood of the Roman Catholic Church founded by John de Matha and Felix of Valois at Cerfroi in France for the deliverance of Christian captives in Barbary. It was approved by Innocent III. in 1199.

Redemp'torist Fathers, or **Liguorians** (*Congregatio Sanctissimi Redemptoris*), a congregation of missionary priests founded in 1732 by Alphonso de Liguori at Scala in Italy. They are most numerous in Italy, Germany, Austro-Hungary, and the U. S. They devote themselves chiefly to the holding of "missions" for the increase of religious activity among the people.—The REDEMPTORIST NUNS were founded in 1732 by Alphonso de Liguori.

Red'field, p.-v. and tp., Oswego co., N. Y., on Salmon River and on a branch of Rome Watertown and Ogdensburg R. R. P. 1324.

Redfield (ISAAC FLETCHER), LL.D., b. at Weathersfield, Vt., Apr. 10, 1804; graduated at Dartmouth College 1825; practised law at Derby and at Windsor; became a justice of the State supreme court 1835; was chief-justice 1852–60; professor of medical jurisprudence at Dartmouth 1858–61; removed to Boston in the latter year, and resided in Europe 1867–69 as U. S. special counsel upon claims against England. Author of many esteemed treatises on legal subjects.

Redfield (WILLIAM C.), b. at South Farms, near Middletown, Conn., Mar. 26, 1789; was in early life a mechanic; conceived the fundamental idea of his famous "law of storms" as early as 1821; soon afterward established a line of steam towboats on the Hudson; issued many essays and pamphlets in favor of steamboat navigation; was subsequently an active promoter of railways, especially such as would connect the Hudson with the Mississippi; published at different times 40 essays upon meteorology; promulgated his *Theory of Storms* in 1831, and his views upon hurricanes in 1833; devoted much attention to fossil fishes from 1836 onward; issued a *Genealogy of the Redfield Family* (1839), and was the first president of the American Association for the Advancement of Science 1843. (See his *Biography*, by Denison Olmsted, 1857.)

Red'ford, p.-v. and tp., Wayne co., Mich., on Detroit Lansing and Lake Michigan R. R. P. 1872.

Redford (ALBERT H.), D. D., b. in St. Louis, Mo., Nov. 18, 1818; joined the Kentucky conference of the M. E. Church in 1837; performed efficient and successful service in missions, circuits, stations, and districts till he was made agent of the Louisville Conference Book and Tract Society; in 1866 became book-agent of the M. E. Church, South, at Nashville; wrote and published *Fred Brenning*, understood to be an autobiography; *History of Methodism in Kentucky*, in 3 vols.; and *Western Cavaliers*, a sequel to the history; is a member of the Louisville conference, which he represented several times in the General Conference. T. O. SUMMERS.

Red Fork, p.-v. and tp., Desha co., Ark. P. 2078.

Red'grave (RICHARD), R. A., b. in Pimlico, England, Apr. 30, 1804; studied at the Royal Academy; became celebrated for his genre pictures, and subsequently for his landscapes; was head-master of the government school of design; was one of the most efficient promoters of the South Kensington Art Museum, inspector-general of art schools, and surveyor of Crown pictures. Author of *An Elementary Manual of Colors* (1863) and (with his brother Samuel) of *A Century of Painters of the English School* (1866). He was one of the art-jurors in the universal exposition of 1851; was commissioned to superintend the department of English art in the French universal exposition of 1857, and selected the English pictures which figured in the British universal exposition of 1862.

Red Hill, p.-v., Marshall co., Ala. P. 428.

Red Hill, tp., Ouachita co., Ark. P. 476.

Red Hill, p.-v., Mitchell co., N. C. P. 299.

Red Hill, tp., Marlborough co., S. C. P. 1505.

Red Hook, p.-v. and tp., Dutchess co., N. Y., on Rhinebeck and Connecticut R. R., 3 miles from Hudson River, has 3 churches, a good public school, 1 newspaper, a national bank, an extensive tobacco and cigar manufactory, and good hotels. It is located in the centre of an excellent farming section. Pop. of v. 861; of tp. 4350.

A. PIESTER, ED. "RED HOOK JOURNAL."

Red House, p.-v. and tp., Cattaraugus co., N. Y., on Allegany River and Atlantic and Great Western R. R. The best portion of the township forms a portion of the Allegany reservation of the Seneca Indians, whose councils are held at the school-house near the mouth of Red House Creek. A bridge here crosses the river. There are saw-mills and some indications of petroleum. P. 407.

Re'di (FRANCESCO), b. at Arezzo, Italy, Feb. 18, 1626; studied medicine, and settled at Florence, where he became physician to the grand duke and gained great celebrity as a poet, classical scholar, and scientist, attacking in a most decided manner the prevalent view of spontaneous generation, against which he produced many ingenious experiments and observations. D. at Pisa Mar. 1, 1698. His complete works were published in 6 vols. at Venice (1712), and at Milan in 9 vols. (1809). The most celebrated of his scientific works is his *Esperienze intorno alla Generazione degl' insetti* (1668; translated into Latin 1671).

Red Jack'et, the English name of SAGOYEWATHA, a famous chief of the Seneca Indians, b. at Old Castle, near the foot of Seneca Lake, N. Y., in 1752; did not originally rank as a sachem, but obtained that dignity through his activity on the British side in the war of the Revolution, being noted as a swift runner, and especially as an eloquent orator; derived his English name from a richly-embroidered scarlet jacket given him by a British officer; opposed the treaty of Fort Stanwix 1784; visited Pres. Washington,

from whom he received a silver medal; gave in 1809 to an agent of the U. S. government valuable information upon the hostile plans of the Ohio Indians under Tecumseh; visited Washington on the same subject 1810; was a useful ally of the U. S. during the war on the Niagara frontier 1812–14; visited New York and Washington 1829, on which occasion his portrait was painted by R. W. Weir. His last years were spent on the Seneca reservation near Buffalo, but he lost much of his influence on account of intemperance, and was once degraded from the chieftainship, but soon restored. He was an inveterate opponent of Christianity, of schools, and of missionaries. D. at Seneca Reservation Jan. 20, 1830. His *Life* was written by William L. Stone (Albany, 1867).

Red Land, tp., Bradley co., Ark. P. 997.

Red'land, tp., Hempstead co., Ark. P. 960.

Red Lead, or **Minium.** See LEAD, by H. WURTZ.

Red Lion, p.-v. and hundred, New Castle co., Del., on Delaware River. P. 2604.

Red'man (JOHN), M. D., b. at Philadelphia, Pa., Feb. 27, 1722; studied medicine at Edinburgh, London, and Paris, graduating at Leyden 1748; became eminent in his profession at Philadelphia; was one of the original physicians of the Pennsylvania Hospital and the first president of the College of Physicians. In 1759 he published a *Defence of Inoculation.* D. at Philadelphia Mar. 19, 1808.

Redman (WILLIAM W.), b. in the North-west Territory Dec. 14, 1799; entered the ministry in the Missouri conference in 1820, and was one of the pioneers of Methodism in Missouri and Arkansas. D. in Missouri Oct. 31, 1849. T. O. SUMMERS.

Red Oak, tp., Cedar co., Ia. P. 594.

Red Oak, p.-v. and tp., cap. of Montgomery co., Ia., on Nishnabatona River and Burlington and Missouri R. R., at junction of branch to Hamburg and Nebraska City, has 3 newspapers, several manufactories, and a rapidly-growing trade. P. 1315.

Red Oak, tp., Barnwell co., S. C. P. 1849.

Red Oak, p.-v., Ellis co., Tex. P. 2422.

Red Oak, tp., Brunswick co., Va. P. 3365.

Redon', town of France, department of Ille-et-Vilaine, on the Vilaine, carries on shipbuilding, manufactures of tiles and leather, and a lively trade in wax, honey, timber, iron, salt, and butter. P. 5943.

Redoubt' [It. *ridotto*, "reduced," "diminished"], a small fort or enclosed work (usually) without flanking defences, generally auxiliary to some larger work or defensive system. In permanent fortification the term is applied to small works or intrenchments *within* a larger member—*e. g.* "redoubt of the demilune," "of the re-entrant place of arms," etc. In this latter sense, however, the French more commonly use the word *réduit* (from Fr. *réduire*), of same essential meaning, but having a distinguishing intention.

Redpath (JAMES), b. at Berwick-on-Tweed, England, Aug., 1833; came with his parents to Michigan 1848; became a printer, newspaper correspondent, and editor; was long connected with the New York *Tribune*, for which he reported the border warfare in Kansas 1855–57; visited Hayti; became emigration agent of the Haytian government in the U. S., and afterward consul at Philadelphia; was a war-correspondent during the civil war; became superintendent of education at Charleston, S. C., where he founded colored schools and an orphan asylum, and established at Boston in 1868 a lyceum bureau. Author of *The Roving Editor* (1859), *A Handbook to Kansas Territory* (1859), *The Public Life of Capt. John Brown* (1869), *Echoes of Harper's Ferry* (1860), and a *Guide to Hayti* (1860).

Red Ridge, v., Tallapoosa co., Ala. P. 520.

Red River, the last great tributary of the Mississippi, takes its name from the color of the sedimentary matter with which it is freighted at all times except in very low-water seasons. It takes its rise in the great Stake Plain in the Pan-Handle of Texas. Its remotest drainage-slope is in lat. 34° 40′ N. and lon. 103° 2′ W.; its mouth in Mississippi River is almost exactly on lat. 31°. The region of its source is a rainless and naked plain, marked by no channels or hills, but by a few isolated water-holes, which from time immemorial have been designated by stakes to guide even the Indian traveller. The imperceptible slopes converge at about lon. 102° on the same lat., and then enter a cañon of more than 100 miles in length amid broken mountains, and of such depth (200 or 300 to 1000 feet) and such steepness as to be inaccessible, so far as known, except at the two extremities. This remarkable chasm has a varying breadth of 5 to 20 miles, said to have a soil of great fertility. It is owned and held by the Comanches and Stake Plain Indians, who have great strength and effectually guard it against white intrusion or visitation. On emerging from the cañon the river runs E., with few and very feeble tributaries, receiving the S. (or Prairie Dog) Fork at lon. 100° 35′, and the N. Fork and Pease River from left and right a few miles W. of lon. 99°. At about lon. 98°, trending nearly due E., Red River receives the Wichita, from the Copper and Red Land regions on the right, and the valley widens from 1 to 3 miles, which it bears onward to lon. 96° 30′, the margin of the more humid regions; and it receives the False Washita on the left from the fertile prairies of the Chickasaw Nation. Here the valley still widens, and, bearing slightly southward and passing the lower Cross Timbers, it sweeps through the finest upland rolling country—of the Choctaws on the left and the best counties in Texas on the right—down to the Great Bend at Fulton, lon. 93° 40′, lat. 33° 36′. Here Red River turns abruptly to the S., and spreads its valley to a breadth of about 10 miles. This breadth, of the most fertile alluvion, it preserves for 100 miles S. to the mouth of the Cypress and the extensive lakes on the right, and thence about 150 miles it bears S. E. to its mouth, in lat. 31° and lon. 91° 36′. By its tortuous route, greatly increased in length after its deflection S., it has a total length of about 1550 miles.

Area of Basin.—Red River drains a basin of 91,000 sq. m., of which the whole area, except that lying W. of lon. 99°, is habitable, nearly all cultivated, and, excepting districts of valuable pine forest, it is of the very highest degree of fertility.

Settlements.—Red River basin was first explored and occupied by the Spanish and French missionaries in the early part of last century. As early as 1720 there were considerable French settlements at Sicily Island, Natchitoches, and Campti. The Spanish priests came from Texas and Mexico to Nacogdoches and Natchitoches, nearly 100 years before the French settlements. American settlers made but small beginnings until after the transfer of Louisiana to the U. S. in 1803–04.

Elevations.—The plain on which Red River takes its rise is about 2450 ± feet above the sea. Its route through the great cañon, and thence to the mouth of the N. Fork and the Wichita, is through the Wichita Mountains, and its descent is precipitous, having a fall in these 400 ± miles of near 1500 feet. Thence it flows through a sandy bottom of cottonwoods and shifting banks down to the railroad, crossing below the mouth of Washita, where its elevation is 555 feet above the Gulf. Still, with a rapid descent of 1 foot per mile, it is navigable in high water thence to the crossing of the International R. R., at Preston. Here its elevation is 260 feet above the Gulf, and its descent and channel hence are such as to give good navigation during a large portion of the year. From here plantations line its banks, and it is of gentle descent to Shreveport, say 4 inches per mile, where again the elevation is known by railroad levels, and amounts to 182 feet. At Grand Ecore the elevation is estimated at 127.5 feet, and at its mouth, in lat 31°, its high-water elevation is but 50 feet above the level of the Gulf. The total length of the river may be estimated, as above, at 1550 miles.

The navigable channels may be stated thus: Red River proper in high water, 1246 miles, and its own tributaries, not including Washita, 700 miles; Washita proper, 600 miles, and its own tributaries, 800 miles; the total navigable channels reaching the Mississippi through the mouth of Red River amount to 3346 miles.

Area of Alluvial Basin.—From 3 miles above Fulton the expansion to some 9 miles of average breadth is preserved down to its confluence with the great alluvion of the Mississippi, having an area of 2022 sq. m. This area is flanked by hilly country of 50 to 100 feet elevation, these hills gently sloping down and disappearing in the alluvion on the margins of the two confluent basins of Concordia and Avoyelles.

Geology.—The cretaceous and lignite beds prevail on all the Red River tributaries, from the Wichita Mountains (which are primary granite and limestone) down to the vicinity of Shreveport; and from thence to the vicinity of Alexandria, the Tertiary beds, generally overstrewn by the Diluvial or Drift strata, occupy the whole Red River basin. Excepting iron, limestone for building, and the sulphates of lime or gypsum, very few minerals characterize this great valley.

Washita River enters Red River near its mouth, and has a basin of its own, which has been treated in the delta survey as a part of Red River basin. It rises in lat. 34° 40′ and lon. 94° 15′ W., very near to the Arkansas, and flowing 100 miles eastward, turns S. and then S. E., and keeping parallel with Red River, joins its waters in the middle of the confluent alluvion only 40 miles above its mouth. The Washita receives at the same point the Tensas from the Mississippi alluvion on its left, and Little (or

Ocatahoola) River on its right, and with a doubled volume and breadth flows, under the name of Black River, the last 70 miles of its tortuous channel in crossing about 25 miles of latitude. The extraordinary fertility of the Tensas and Black River valleys is a matter of note. The Wachita and its left tributary, the Bartholomew, from the very S. bank of Arkansas River, bound the great Mississippi delta on the W. down to the Ocatahoola.

Navigation.—The mouth of Red River at low water can be entered only by boats of 2 feet draught, but during about eight months of the year it may be entered by vessels of all draughts needed for this river and its tributaries. It has eighteen navigable confluent rivers, in addition to a number of bayous, like canals, navigable in high-water seasons.

The junction of Red with Mississippi River has been menaced with final closure for the past thirty-five years. In 1831 the bend of the great river into which it discharged was cut off by Capt. Shreve, and the Old River Lake has been filling by continual deposits from both rivers. Red River has continued, however, to cut its channel through these deposits to the Mississippi, and at the same time to force more and more of its waters down the Atchafalaya. This outlet-river leaves the same bend or Old River Lake, and discharges its waters into the Gulf by a much shorter channel. The increase of the Atchafalaya, but for the toughness of its bed, would soon engulf the whole of Red River, which seems at one period of its history to have flowed wholly in this direction. Such result would seriously embarrass the commerce of this great tributary, but would, at the same time, greatly relieve the tendency to crevasses and floods upon Mississippi River hence to the Gulf of Mexico. C. G. Forshey.

Red River, parish of N. W. Louisiana, on both sides of Red River, bounded E. by Black River and intersected by numerous streams, has a soil yielding abundant crops of cotton and corn. It has been formed since the census of 1870. Cap. Coushatta Chute. Area, 325 sq. m.

Red River, county of N. E. Texas, separated from Indian Territory by Red River, and bounded S. by Sulphur River, on the (unfinished) northern branch of Texas Pacific R. R., has a rolling surface and a soil of great fertility. Stock-raising is the chief industry, and Indian corn the staple product. Some lumber is sawed. Cap. Clarksville. Area, 872 sq. m. P. 10,653.

Red River, tp., Lafayette co., Ark. P. 2131.

Red River, tp., Little River co., Ark. P. 1233.

Red River, tp., Searcy co., Ark. P. 2040.

Red River, tp., Van Buren co., Ark. P. 516.

Red River, tp., White co., Ark. P. 713.

Red River, p.-v. and tp., Kewaunee co., Wis., on Green Bay. P. 957.

Red River of the North rises in Becker co., Minn., from Elbow Lake, 1680 feet above the sea. It flows S. and then W. as far as Breckenridge, Minn., the head of steamboat navigation, 953 feet above the sea-level. Thence it flows northward through a wide, level, and fertile plain, and is the boundary between Minnesota and Dakota. Crossing the U. S. boundary (where its elevation is 792 feet), it traverses Manitoba, and finally flows into Lake Winnipeg. Its length is 750 miles; total fall, 1072 feet.

Red Rock, p.-v. and tp., Marion co., Ia. P. of v. 255; of tp. 1334.

Red Rock, tp., Douglas co., Minn. P. 145.

Red Rock, tp., Mower co., Minn. P. 602.

Red′ruth, town of England, county of Cornwall, has 7919 inhabitants, mostly engaged in the business of the rich copper, tin, and iron mines of the vicinity.

Red Sea, or **Arabian Gulf,** is a long, narrow inlet of the Indian Ocean, between Arabia on the E. and Abyssinia, Nubia, and Egypt on the W., separated from the Mediterranean by the Isthmus of Suez, which is only 80 miles across, and communicating with the Indian Ocean through the Gulf of Aden and the Strait of Bab-el-Mandeb, which is only 14 miles broad. The entire length of the Red Sea is 1450 miles; its greatest breadth is 230 miles; its depth varies from 1054 fathoms in lat. 22° 30′ N. to 3 fathoms in the harbor of Suez. It is called in the Old Testament "the sea of *suph*," a sea-weed resembling wool. Why, in later times, it was called the Red Sea, writers are not agreed. This sea is not, as some have said, tideless. Herodotus (*Hist.*, ii. 11) reports "a flow and ebb of the tide every day." Recent scientific surveys have shown a tide of 5 to 7 feet at Suez, but much less to the southward. Much, however, depends upon the strength of the wind, which blows from the S. S. E. from October to May, and is strongest in February; and from the N. W. the rest of the year, and is strongest in June and July. Near its northern extremity the sea forks into two branches—one, the Gulf of Akaba, length 100 miles and breadth 15, occupies a depression which is the continuation southward of the valley of the Jordan and Dead Sea; the other, the Gulf of Suez, length 200, breadth 20 miles. In the Sinaitic isthmus, lying between these arms, is Mount Sinai. The Israelites (see Exodus) are supposed to have crossed in April the Gulf of Suez, near the existing town of that name, the sea at that time extending with small depth some 30 miles farther N. On account of the violence of its winds, and the great number of islands, shoals, and coral reefs which lie along its shores, the navigation of the Red Sea has always been considered very difficult; nevertheless, from the very earliest times it has formed one of the commercial highways of the world, being the shortest and most convenient road between Europe and India. After the discovery of the route around the Cape of Good Hope the traffic which first the Egyptians and Phœnicians, and then the Greeks, the Romans, and the Venetians, had carried on with India over the Red Sea, declined greatly, but only for a time, and recently the construction of the Suez Canal has once more led this commerce back into its old channel.

Red Snow is real snow tinted by the presence of *Palmella nivalis* and other red protophytes, microscopic algæ kindred to the plant already named. In 1819, Ross found banks of red snow on the E. shore of Baffin's Bay extending for miles, and in some parts no less than 12 feet deep.

Red′stone, p.-v. and tp., Fayette co., Pa. P. 1152.

Red Sulphur Springs, p.-v. and tp., Monroe co., West Va., situated on Indian Creek, in a valley of the Alleghany Mountains, 38 miles S. W. of White Sulphur Springs, is a fashionable watering-place, the water having a mean temperature of 54°. P. 1904.

Reductio ad Absurdum. See Logic, by William D. Wilson, LL.D., L. H. D.

Reduction, in chemistry, a term generally used as synonymous with deoxidation, as of a metallic oxide by heating with carbon or with hydrogen gas. It is, however, applied also generally to the conversion of any metalliferous ore to the metallic or reguline form; thus we speak of the reduction of galena, the sulphide of lead, to metallic lead, a process which is really the exact reverse of deoxidation, consisting substantially in the *oxidation* of the sulphur of the galena, which leaves the lead free to melt down to a regulus. The case is nearly similar in the reduction of cinnabar, the sulphide of mercury, to metallic mercury by distilling in a current of air, which both burns the sulphur to sulphurous acid gas and volatilizes the mercury. Reduction is often accomplished in the laboratory, at or near ordinary temperatures, in liquid media by the use of agents having a strong affinity for oxygen. Thus, ferrous solutions and oxalic acid will reduce gold from its solutions. Sodium amalgam will reduce many substances, etc. H. Wurtz.

Reduction to the Centre. In trigonometrical surveying fixed objects, as steeples, towers, and the like, are often used as stations. In such cases it is impossible to place the theodolite over the centre of the station. The instrument is then placed over a neighboring point whose position with respect to the true centre is known, and the angles subtended by the other stations are measured; the angles that are subtended by these stations at the true centre are determined by computation. The operation of making these computations is called *reduction to the centre*.

Red Vermil′ion, tp., Nemaha co., Kan. P. 775.

Red Wil′low, county of S. Nebraska, on the Kansas line, intersected by Republican fork of Kansas River, has been formed since the census of 1870, and has few inhabitants. Cap. Indianola. Area, 720 sq. m.

Red′wing. See Blackbird.

Redwing, p.-v. and tp., cap. of Goodhue co., Minn., on the river division of Milwaukee and St. Paul R. R., 40 miles S. of the latter place, contains 12 churches, 1 opera-house, a music-hall, 1 collegiate institution, 3 banks, 3 newspapers, 2 flouring-mills, 2 steam saw-mills, 3 lumber-yards, 2 sash, door, and blind factories, and 2 large manufactories of boots and shoes. Large quantities of wheat are exported from here, amounting in 1874 to 2,418,622 bushels. P. of v. 4260; of tp. (in 1860), 1250.

Charles L. Davis, Ed. "Argus."

Red′wood, the *Sequoia sempervirens*, a noble coniferous timber tree of California, second in size to the *Sequoia gigantea*, or big tree, alone among North American trees. It occurs in great forests upon the coast-mountains of California, and often attains a height of 275 feet and a diameter of 15 feet. It is extensively sawn for

building purposes. When fresh its wood is of a fine red color, but it slowly fades when exposed to light. (See SEQUOIA.) The redwood sometimes used by dyers is from *Adenanthera pavonina*, a large leguminous East Indian tree.

Redwood, county of S. W. Minnesota, on Minnesota River, and drained by Redwood, Sleepy Eye, and Big Cottonwood rivers, has a broken surface, partly prairie. Agriculture is the chief industry. Cap. Redwood Falls. Area, 865 sq. m. P. 1829.

Redwood, tp., Santa Clara co., Cal. P. 1353.

Redwood, p.-v., Alexandria tp., Jefferson co., N. Y., has 4 churches and a glass-factory established in 1833. P. about 600.

Redwood (ABRAHAM), b. in Antigua, West Indies, about 1710; was a Quaker; settled at Newport, R. I., and founded there the excellent library still known by his name, being one of the first in New England. His gift was £500, and the edifice was completed in 1750. D. at Newport Mar. 3, 1788.

Redwood City, p.-v., cap. of San Mateo co., Cal., on Southern Pacific R. R., 28 miles W. of San Francisco, has 5 churches, good schools, and 2 tanneries. It has connection by water with San Francisco Bay, and is an important shipping-point for redwood lumber. The climate is very healthful. P. 727.

DUNCAN MCPHERSON, ED. "SAN MATEO CO. GAZETTE."

Redwood Falls, p.-v. and tp., cap. of Redwood co., Minn., on Redwood River, has 1 newspaper and some manufactures. P. about 500.

Reed [A.-S., *hreod*], a name proper to certain tall woody grasses smaller than canes and bamboos. The common reed (*Phragmites communis*) of North America, Europe, and Asia is employed on the Eastern continent as thatch, as a material useful in clay walls and floors, etc. The more extensively grown reed of Europe is *Arundo donax*, the woody stems of which are used for a great variety of purposes, especially by the horticulturist and in making musical instruments, fishing-rods, canes, etc. The smaller cane of the U. S. (*Arundinaria tecta*) is often called a reed. Its chief use is in making stems for tobacco-pipes.—REED is also the vibrating tongue or spring, fixed in a narrow slit, which produces musical tones in many wind instruments, such as the melodeon. It was once made of the reed (*Arundo donax*), whence the name. (See REED INSTRUMENTS.)

Reed, tp., Will co., Ill. P. 2771.

Reed, tp., Seneca co., O. P. 1334.

Reed, tp., Dauphin co., Pa. P. 353.

Reed (ANDREW), D. D., b. in London, England, Nov. 27, 1788, educated at Hackney College; became in 1811 pastor of the Independent congregation at New Road chapel, London; removed in 1831 with his congregation to Wycliffe chapel, Stepney; visited the U. S. in 1834 as commissioner of the Congregational body of Great Britain; published *A Visit to the American Churches* (1836); founded several asylums for orphans, idiots, and incurables, and wrote several religious works. D. at London Feb. 25, 1862. (See his *Memoirs*, by his sons Charles and Andrew, 1863.)

Reed (CALEB), b. at West Bridgewater, Mass., Apr. 22, 1797; graduated at Harvard 1817; practised law at Yarmouth for several years; became in 1827 a partner with Cyrus Alger in his celebrated iron-foundry at South Boston, and was for more than twenty years editor of the *New Jerusalem Magazine*, one of the principal exponents in America of the teachings of Emmanuel Swedenborg. In 1821 he published *The General Principles of English Grammar.*

Reed (Sir CHARLES), F. S. A., son of Dr. Andrew, b. in London, England, in 1819; wrote his father's biography 1863; was elected to Parliament for Hackney 1872; visited the U. S. as delegate to the conference of the Evangelical Alliance 1873; is president of the Sunday-school Union of England and Wales, proprietor of the London *Daily News*, and chairman of the London school board, in which capacity he has taken a leading part in advocating the phonetic reform of the English language. He married in 1846 a daughter of Edward Baines, M. P., of Leeds.

Reed (DAVID), b. at Easton, Mass., Feb. 6, 1790; graduated at Brown University 1810; was for some years principal of the Bridgewater Academy; was licensed to preach as a Unitarian 1814, and founded at Boston (Apr. 20, 1821) the *Christian Register*, a prominent Unitarian organ which wielded a great influence in New England. He was one of the founders of the American Anti-Slavery Society in 1828, and remained at the head of the *Register* until 1866. D. at Boston June 7, 1870.

Reed (DAVID BOSWELL), M. D., b. at Edinburgh, Scotland, in 1805; educated at the High School of Edinburgh, and in medicine at the university of that city, where he was an assistant to Prof. Sir John Leslie; distinguished for his brilliant attainments while still a student: was speedily elected president of the Royal Medical Society and member of the Royal College of Physicians and of the Royal Society of Edinburgh; became instructor in chemistry in the university, teaching that science also to private classes; erected in 1833 the best class-room and laboratory in Edinburgh, and for seven years averaged 300 pupils annually; studied the subject of ventilation with great care; superintended the improvements in ventilation made in the House of Commons 1836, in the House of Peers 1839, and had charge of the ventilation department in the construction of the new Houses of Parliament 1840–45; afterward applied his principles to public buildings in Liverpool and other large cities; visited Russia for a similar purpose; settled in the U. S. 1856; was for some time professor of applied chemistry in the University of Wisconsin; became a resident of St. Paul, Minn.; became medical inspector to the U. S. Sanitary Commission 1863, and d. at Washington, D. C., Apr. 5, 1863. Author of many books and publications upon chemistry and ventilation.

Reed (EDWARD JAMES), b. at Sheerness, England, Sept. 20, 1830; educated at the School of Mathematics and Naval Construction at Portsmouth; became editor of the *Mechanics' Magazine;* became a recognized authority on naval construction and secretary of the Institution of Naval Architects; submitted proposals to the admiralty for the speedy and economical building of iron-clads; was appointed chief constructor to the navy 1866; resigned on account of dissatisfaction with the construction of turret-ships July, 1870, a few weeks only before the sinking of the turret-ship Captain; has since visited the leading dockyards of Europe; was elected to Parliament as a Liberal Feb., 1874, and has again (1876) been consulted by the admiralty upon plans for naval construction. Author of several treatises upon practical shipbuilding, iron-cased ships, and coast defence.

Reed (HENRY), LL.D., grandson of Col. Joseph, b. at Philadelphia, Pa., July 11, 1808; graduated at the University of Pennsylvania 1825; studied law in the office of John Sergeant; was admitted to the bar 1829; was appointed in 1831 assistant professor of English literature and also of moral philosophy in the University of Pennsylvania, and in 1835 professor of rhetoric and English literature; married a granddaughter of Bishop White; wrote the *Life* of his grandfather for Sparks's *American Biography;* edited with valuable prefaces and notes Wordsworth's *Poetical Works* (1837), Arnold's *Lectures on Modern History* (1845), Alexander Reed's *Dictionary of the English Language* (1845), Graham's *English Synonyms* (1847), Lord Mahon's *History of England* (1849), Gray's *Poetical Works* (1850), and C. Wordsworth's *Memoirs of William Wordsworth* (1851), and contributed essays and reviews to several literary periodicals. On his return from a visit to Europe he was lost in the steamer Arctic, Sept. 27, 1854. After his death his brother, William B. Reed, edited his *Lectures on English Literature* (1855), to which he prefixed a biographical sketch, *Lectures on English History as illustrated by Shakspeare's Chronicle Plays* (1855), and *Lectures on the English Poets* (1857), all of which were republished in England, and were widely appreciated on both sides of the Atlantic. Two lectures *On the History of the American Union*, delivered at the Smithsonian Institution, were also given to the press in 1856.

Reed (HOLLIS), b. at Newfane, Vt., Aug. 26, 1802; graduated at Williams College 1826; studied theology at Princeton; was a Presbyterian missionary in India 1830–35; pastor at Derby, Conn., 1838–45, and at New Preston 1845–51. Author of *God in History* (2 vols., 1849–55), *India and its People* (1858), *The Coming Crisis of the World* (1862), *Negro Question Solved* (1864), and other works. With his companion, Rev. William Ramsey, he published a *Journal of a Missionary Tour in India* (1836).

Reed (JOSEPH), b. at Trenton, N. J., Aug. 27, 1741; graduated at Princeton 1757; studied law under Richard Stockton, and afterward at the Temple, London, 1763–65; became deputy secretary of New Jersey 1767; went to England 1770; married there Esther, daughter of Dennis de Berdt, agent for Massachusetts; settled at Philadelphia 1771; was a member of the committee of correspondence 1774; president of the first provincial convention of Pennsylvania Jan., 1775; delegate to the Continental Congress in May; became aide-de-camp and secretary to Gen. Washington; was appointed adjutant-general 1776; declined the chief-justiceship of Pennsylvania Mar. 20, 1777, and the rank of brigadier-general, with command of all the cavalry forces, tendered him by Congress, but served

as a volunteer at the battles of Brandywine, Germantown, and Monmouth; was elected to Congress Sept., 1777; signed the Articles of Confederation in 1778; was elected president of the supreme executive council of Pennsylvania; was an earnest opponent of slavery and of the proprietary system of government; visited England for his health, but without beneficial result, 1784. D. at Philadelphia Mar. 5, 1785. Author of two political pamphlets printed in 1779 and 1783, the latter of which elicited a *Reply* from Gen. Cadwalader, containing strictures upon Reed's conduct. According to a report made by the Hessian officer Count Donop to the British general, Grant, Reed received a British protection in 1776. This allegation, adopted by Bancroft in his *History*, has been vehemently controverted in several pamphlets by William B. Reed, who has also published the *Life and Correspondence of President Reed* (2 vols., 1847), as well as a *Life of Esther Reed* (1853), his wife, that lady (b. in London in 1747; d. at Philadelphia Sept. 18, 1780) having taken an active part for the relief of the suffering soldiers at Valley Forge as president of a ladies' association formed at Philadelphia. (See also a *Life of Reed*, by his grandson Henry, in Sparks's *Am. Biog.*, 2d series, vol. viii.)

Reed (William Bradford), LL.D., grandson of Col. Joseph, b. at Philadelphia, Pa., June 30, 1806; graduated at the University of Pennsylvania 1822; accompanied J. R. Poinsett as private secretary on his mission to Mexico 1825; became a distinguished lawyer; was attorney-general of Pennsylvania 1838, and minister to China 1857–58; negotiated with China the treaty of June 18, 1858 (ratified Jan. 26, 1860). Author of numerous addresses, essays, and pamphlets upon historical, literary, and political subjects; was the biographer of his grandfather, Col. Joseph Reed, and of his brother, Henry Reed, and editor of their writings, and was a regular contributor to the *Quarterly Review* and N. Y. *World*. D. at New York City Feb. 18, 1876.

Reedbird. See Bobolink.

Reed'er, tp., Anderson co., Kan. P. 702.

Reeder, p.-v. and tp., Missaukee co., Mich. P. 130.

Reed'er (Andrew H.), b. near Trenton, N. J., about 1808; studied law, which he practised many years at Easton, Pa.; becoming an influential Democratic politician, was appointed by Pres. Pierce the first governor of Kansas Territory; was removed from that office July, 1855, for declining to exert his official influence against the Free-State movement; was elected delegate to Congress, and afterward U. S. Senator, under the Topeka constitution, which, however, was not ratified by Congress, and declined an appointment as brigadier-general 1861. D. at Easton July 5, 1864.

Reeder's, v., Newberry co., S. C. P. 2290.

Reed Instruments, the generic name of a large class of musical instruments, of which the accordeon, the melodeon, the harmonium, and reed-organs are the most important. The tone of these instruments is produced by means of a thin tongue of wood or metal lying within or over an aperture (technically called a *reed*), and vibrated by means of a current of air. Instruments of this class are described as having been found among the Chinese several hundred years since, but most of them are comparatively modern inventions. The first reed-organs were constructed in the U. S. about 1818; they were improved in 1821, 1825, and 1835, since which time the modifications have been too numerous for separate mention. The accordeon was invented in Germany about 1829; the harmonium, first constructed in France soon afterward, was much improved in 1841, and has acquired great popularity since the important improvements of Carhart and others in 1835. About this time the introduction of the exhaust bellows occurred, and the bending and twisting of the tongue of the reed, termed *voicing*, was developed. These two improvements have been the main features which have wrought such changes in the modern reed-organ, and enabled American-made instruments to find a market in all parts of the world. The annual production is more than 40,000 in the U. S.

Reed Plantation, tp., Aroostook co., Me. P. 54.

Reeds'burg, p.-v. and tp., Sauk co., Wis., on Baraboo River and Madison and Wisconsin line of Chicago and North-western R. R., has 1 newspaper, and is the principal hop-market in the U. S. P. 547.

Reed's Creek, tp., Lawrence co., Ark. P. 811.

Reed's Landing, p.-v., Wabasha co., Minn., on Lake Pepin (Mississippi River) and St. Paul and Chicago R. R. P. 782.

Reed's Mills (P. O. name of the v. of Hamden), Clinton tp., Vinton co., O., at junction of Portsmouth branch with the main line of Marietta and Cincinnati R. R. P. 384.

Reeds'ville, p.-v., Brown tp., Mifflin co., Pa., on Mifflin and Centre co. branch of Pennsylvania R. R.

Reedville, p.-v., Olive tp., Meigs co., O., on Ohio River. P. 129.

Reed'y, p.-v. and tp., Roane co., West Va. P. 964.

Reedy, tp., Wirt co., West Va. P. 489.

Reedy Church, tp., Caroline co., Va. P. 3138.

Reel'town, v., Tallapoosa co., Ala. P. 1200.

Reem's Creek, v., Buncombe co., N. C. P. 1121.

Rees (Abraham), F. R. S., b. at Llanbrynmair, Wales, in 1743; studied for the ministry at Hoxton Academy, near London; was tutor in that institution 1762–84; was pastor of Presbyterian churches in Southwark (1768) and Old Jewry (1783); president of Hackney College 1786–95; edited Chambers's *Cyclopædia* 1776–86, and superintended the preparation of *Rees's Cyclopædia* in 45 4to vols. (1802–19). D. June 9, 1825.

Reese (Chauncey B.), b. in Canastota, N. Y., 1837; graduated at the U. S. Military Academy, and promoted brevet second lieutenant of engineers July 1, 1859; on the outbreak of the civil war in 1861 was sent to Fort Pickens as assistant engineer in the defence of that work; from thence transferred to the defences of Washington in Nov., 1861; in the Virginia peninsular campaign rendered valuable service in constructing bridges, building roads, etc., as in the Rappahannock campaign at Chancellorsville; engaged at Gettysburg, at the siege of Fort Wagner, S. C., and as chief engineer of the Army of the Tennessee during the Atlanta campaign and subsequent "march to the sea" and through the Carolinas; lieutenant-colonel U. S. volunteers June–Aug., 1865; brevet major, lieutenant-colonel, colonel, and brigadier-general for services during the war; promoted to the rank of major in the corps of engineers in 1867. D. of yellow fever at Mobile, Ala., Sept. 22, 1870.

Reese (David Meredith), M. D., LL.D., b. in Philadelphia, Pa., in 1800; graduated in medicine at the University of Maryland 1820; became a prominent practitioner in New York City and physician-in-chief to Bellevue Hospital, and was for some years superintendent of public schools in New York City. D. in New York in 1861. He wrote much for periodicals on religion, politics, and science, edited the *American Medical Gazette* (1850 *seq.*), Chambers's *Educational Course* (in 12 vols.), Cooper's *Surgical Dictionary*, Neligan *On Medicines*, and J. Mason Good's *Book of Nature*, and author of *Observations of Yellow Fever* (1819), *Epidemic Cholera* (1833), *Phrenology known by its Fruits* (1838), a *Medical Lexicon* (1845), and other works.

Reeve, tp., Daviess co., Ind. P. 1676.

Reeve, tp., Franklin co., Ia. P. 704.

Reeve (Henry), D. C. L., b. in Norwich, England, in 1813, a relative of the celebrated family of the Taylors of that city; educated at the Norwich grammar school and at Geneva, Switzerland; became registrar of the privy council 1837, a post he still (1876) occupies, and succeeded Sir G. C. Lewis as editor of the *Edinburgh Review* 1855. Translator of De Tocqueville's *Democracy in America* (2 vols., 1835) and *France before the Revolution* (1856), and of Guizot's *Washington* (1840); edited Bulstrode Whitelock's *Journal of an Embassy to Sweden* (1855) and Greville's *Journal of the Reigns of King George IV. and King William IV.* (1874), and author of a series of essays reprinted from the reviews under the title of *Royal and Republican France* (1873). He is one of the eight foreign members of the Institute of France, elected in 1865.

Reeve (Isaac V. D.), b. in New York 1813; graduated from the U. S. Military Academy, and entered the 4th Infantry July, 1835; with the exception of two years on the Northern frontier, he was almost constantly on duty in the South, being actively engaged in several campaigns against the Seminoles in Florida, up to the commencement of hostilities with Mexico in 1846, when he was engaged with Gen. Taylor's army in the battles of Palo Alto and Resaca de la Palma, and with Gen. Scott from the siege of Vera Cruz to the capture of the City of Mexico, winning the brevets of major and lieutenant-colonel for gallantry; subsequently commanded various Indian expeditions, and in 1861 was stationed near San Antonio, Tex., where, by the surrender of Gen. Twiggs to the Texan insurgents, he was taken prisoner; exchanged in Aug., 1862, he served as mustering and disbursing officer at New York and in command of the camp at Pittsburg, Pa., for drafted men. In 1864 he became colonel of the 13th Infantry, and in 1871 was retired from active service.

Reeve (Tapping), LL.D., b. at Brookhaven, Long Island, in Oct., 1744; graduated at Princeton 1763; married a sister of Aaron Burr; began to practise law at Litchfield, Conn., 1772, and commenced there in 1784 the

celebrated Litchfield Law School, long the only institution of the kind in the U. S., which he conducted alone until 1798, and with Judge James Gould until 1820, educating many persons who became distinguished at the bar and in politics, especially in the Southern States. He was a resolute Federalist in politics; was judge of the supreme court of Connecticut 1788–1814, and originated the movement for more equitable legislation concerning the property of married women. D. at Litchfield Dec. 13, 1823. Author of *The Law of Baron and Femme, of Parent and Child, of Guardian and Ward, of Master and Servant, etc.* (New Haven, 1816; 3d ed., Albany, 1862), and of *A Treatise on the Law of Descent in the Several United States of America* (New York, 1825).

Reeves, tp., Marion co., S. C. P. 1815.

Refin′ing of Met′als. Some metals are met with in commerce nearly pure, but none are perfectly so.

Antimony.—The raw antimony obtained by smelting contains more or less iron, lead, arsenic, copper, and sulphur. From these it is purified in the large way by an oxidizing and scorifying fusion with nitre or antimonious oxide, sulphide of antimony, sulphate of soda and charcoal, or carbonate of soda. As it is largely used in the arts, antimony should be especially freed from arsenic. This can be accomplished by fusing 32 parts of antimony with 4 of nitre, fusing the resulting metal with 3 of nitre, and again melting this product with 2 parts of nitre.

Bismuth.—Commercial bismuth may contain lead, copper, arsenic, iron, and sulphide of bismuth. In the large way it is refined by fusion in crucibles with nitre, and stirring, which removes sulphur and arsenic; but to obtain the metal quite pure it should be dissolved in nitric acid, the saturated solution allowed to settle, the clear liquid poured into much water, and the resulting basic nitrate of bismuth washed, dried, and reduced to metal by fusion with one-tenth its weight of charcoal in a crucible.

Copper.—The impurities of commercial copper are—arsenic and antimony, making it more or less brittle, even when only traces are present; lead, sulphur, tin, suboxide of copper, iron, and zinc, all of which injure its malleability and ductility. In the large way they are removed by a powerful oxidizing fusion, generally in small reverberatory furnaces, by which some, as antimony, arsenic, lead, and zinc, are removed, partly by volatilization, and some, as lead, zinc, and iron, by scorification. To remove the excess of suboxide of copper formed during this operation, the melted metal is toughened by stirring with a pole of green birch or oak under a cover of charcoal. Perfectly pure copper can be obtained by the decomposition of pure sulphate of copper by a voltaic battery.

Gold.—Gold can be separated from silver by "quartation." The alloy should contain 3 parts (according to some authorities 2½) of silver and 1 of gold. It is granulated, and heated with nitric acid, the gold being left as an insoluble powder, which is washed, dried, and fused. Gold containing palladium is alloyed with 2½ parts of silver, and then both the foreign metals dissolve in nitric acid. A more economical and usual way of "parting" gold and silver is by dissolving the silver with strong sulphuric acid. The operation may be conducted in platinum, porcelain, or cast-iron vessels, the latter being usually employed. There should not be over 25 nor under 3 to 6 per cent. of gold in the alloy, which should also not contain over 10 per cent. of copper. The less copper the better, owing to the slight solubility of its sulphate in sulphuric acid. Over 0.25 per cent. of lead also retards the process of solution. The granulated alloy can be partly purified by repeatedly heating it to redness and boiling it with dilute sulphuric acid in leaden vessels. When ready for parting it is boiled with 2½ times its weight of sulphuric acid of 1.84 specific gravity; after four hours, more acid of the specific gravity 1.69 is added, the liquid boiled a few minutes, and allowed to stand. The clear liquid is drawn off, and the gold again boiled with strong acid, after which it is washed, dried, and cast into ingots. As little as 0.1 per cent. of gold can be profitably extracted. If platinum is present, some silver is retained, and must be separated by fusing the finely-divided gold with bisulphate of potash, and washing. Gold of .999 fineness can be obtained. Gold containing osmium and iridium is alloyed with 2 to 3 parts of silver to lessen its specific gravity. On melting, the osmiridium sinks to the bottom, and the purified alloy is carefully ladled off. Parting by aqua regia is practised on gold poor in silver. The solution of chloride of gold thus obtained is evaporated with excess of hydrochloric acid, then largely diluted with water to precipitate some chloride of silver, decanted from the latter, and metallic gold thrown down as a fine powder by adding sulphate of iron (oxalic acid or terchloride of antimony can also be used). If perfectly pure gold is wanted, this precipitate is boiled three times with fresh hydrochloric acid of specific gravity 1.1, washed, dried, and fused with an equal weight of bisulphate of potash in a Hessian crucible. F. B. Miller has invented a process of refining gold by passing chlorine gas through it while melted by means of a small clay tube. Chloride of silver is formed, which rises to the top, and is kept from volatilization by a cover of fused borax. The base metals volatilize as chloride, but most of the copper chloride remains with the silver. Gold of 0.991 to 0.997 can be obtained, and the method is successfully applied in England.

Lead.—The most frequent impurities are antimony, arsenic, copper, zinc, iron, and sulphur. Moderately impure lead can be purified by stirring the melted metal with a green birch pole and skimming it. In England lead containing copper and arsenic is *improved* by calcining in reverberatory furnaces with cast-iron hearths, throwing on a little lime and small coal, and skimming from time to time. Antimony is most difficult to remove, and requires the aid of a blast after the other impurities are mainly oxidized. Pure lead is obtained by igniting the pure nitrate and reducing the resulting oxide with black flux.

Mercury.—To obtain pure mercury from quite impure metal it must be redistilled in an iron retort, which may be made of one of the wrought-iron vessels in which it is shipped. After distilling, the mercury is heated to 50° C. (112° F.) with nitric acid, diluted with 2 volumes of water, for a day, then well washed and dried with bibulous paper. The treatment with acid alone will remove a moderate quantity of impurities, which are generally lead, bismuth, zinc, tin, and oxide of mercury.

Platinum.—The separation of platinum by the wet way from the metals usually accompanying it is a complicated chemical process, but Deville and Debray procure a malleable, ductile alloy of platinum, rhodium, and iridium, admirably adapted for chemical apparatus, by treating it in a small reverberatory furnace, with a bottom of fire-brick lined with clay. This is heated to redness; 2 cwt. of ore and as much galena added by degrees; a little glass and as much litharge as galena are added little by little, and the melted metal left at rest. Iridosmine settles, and the platiniferous lead is cautiously ladled off and cupelled. The platinum is then refined with the oxyhydrogen flame on a lime-bed.

Silver.—The impure silver from cupellation and "retorting" may contain lead, bismuth, copper, arsenic, antimony, sulphur, and nickel. It is usually refined in small reverberatory furnaces. At Freiberg the furnace-hearth is lined with new and old argillaceous powdered limestone or "marl." About 1 ton is charged, melted rapidly, a moderate blast turned on, the metal skimmed from time to time, marl thrown on to absorb the foreign oxides, and the silver when fine covered with charcoal and ladled out. It is from 0.996 to 0.998 fine. Refining in crucibles is done either in graphite crucibles, with charges of 50 to 100 pounds or more, or in cast-iron ones with still larger charges; 1 to 2 per cent. of nitre and glass or borax is added as a flux. Silver is obtained very pure for commercial purposes by dissolving standard silver in nitric acid, precipitating with chloride of sodium, reducing with zinc and sulphuric acid, and melting the washed and dried metal. To obtain perfectly pure silver this should again be dissolved in nitric acid, precipitated with hydrochloric acid, and the dry chloride fused in a clay crucible with half its weight of dry carbonate of soda. Silver precipitated on sheet copper by boiling it with a slightly acid solution of nitrate of silver, and digesting the washed silver with ammonia-water, is pure enough for ordinary purposes.

Tin.—Commercial tin is refined by melting it slowly on the hearth of a reverberatory furnace and collecting the melted tin in a basin, where it is stirred with poles of green wood and skimmed. After standing a while it is ladled off carefully, the upper part being purest. Perfectly pure tin can be obtained by cautiously pouring pure water upon a strong solution of tin in hydrochloric acid in a beaker, and then plunging a bar of tin into the liquids. Crystals of pure tin will form on the bar where the two liquids meet.

Zinc.—Commercial zinc may contain lead, iron, tin, copper, cadmium, arsenic, and antimony. It is purified at Swansea by melting it in cast-iron pots, stirring, skimming, and ladling off the top portions; the lead collects at the bottom. A similar operation is conducted by remelting it first in reverberatory furnaces slowly, and allowing it to run into a basin or *sump* at one end of the hearth. Perfectly pure zinc is obtained by igniting the pure carbonate, and distilling the resulting oxide from a porcelain retort with charcoal made from loaf-sugar, or by dissolving the carbonate in sulphuric acid and depositing the zinc by a voltaic current. Cadmium, when present in

somewhat large quantities in zinc, is best separated by the wet way. H. B. CORNWALL.

Reflec'tion [Lat. *re*, "again," and *flectere*, to "bend"] **of Light,** that bending of a light-ray from its rectilinear course in which the whole ray, both before and after bending, lies outside the deflecting body. When a light-ray falls upon an unpolished surface, it is irregularly reflected or scattered in consequence of the different inclinations of the innumerable facets of which such surfaces are composed, as may be seen under the microscope. Non-luminous bodies are made visible by the scattering of light from their surfaces. When a ray falls upon a perfectly smooth surface, it is regularly reflected, and a virtual image of the illuminating body is seen behind the reflecting surface. Most surfaces which reflect regularly also reflect irregularly to some extent. The two portions of a reflected light-ray, before and after bending, are called respectively the incident and reflected ray. If a perpendicular or normal be erected to the reflecting surface at the point of incidence, the angles made with this normal by the incident and reflected ray are called the angles of incidence and reflection. The law of reflection is: *The angles of incidence and reflection are equal, and lie in the same plane.* This plane is perpendicular to the reflecting surface, and the illuminating and illuminated points are mutually interchangeable. The intensity of reflected light varies with the nature and the position of the reflecting surface, the differences in the reflecting powers of various substances being greater for small angles of incidence than for large ones: only 0.018 of a beam of light falling perpendicularly on water is reflected, while about 0.666 of such a beam is reflected from mercury. When, however, the angle of incidence is $89\frac{1}{2}°$—or, in other words, the incident beam is almost parallel with the reflecting surface—these two substances reflect alike 0.721 of the whole incident light; but at no obliquity, however great, is the reflection of light which passes through a less highly refractive medium, and impinges upon the surface of a more highly refractive one, total. (For total reflection see REFRACTION OF LIGHT.)
S. B. HERRICK.

Re'flex [Lat. *reflexus*] **Ac'tion,** in physiology, applied to those involuntary movements caused by an impression or irritation conveyed to the spinal marrow by the afferent spinal nerves, in consequence of which an excitement or impulse is sent back by the reflex spinal nerves, producing the movements in question.

Reform', p.-v., Pickens co., Ala. P. 495.

Reforma'tion [Lat. *reformatio*], the name usually given to the religious revolution of the sixteenth century which divided the Western Church into the two sections known as Protestant and Roman Catholic. This movement was not an isolated event, but closely connected with the intellectual and social changes which marked the transition from the Middle Ages to the modern era of civilization. It was also long in preparation. The disaffection toward the papacy which disclosed itself in the rise of sects like the Waldenses, and within the Church in the reforming councils of the fifteenth century held at Pisa, Constance, and Bâle; the rise of radical reformers, forerunners of Protestantism, as Wickliffe and others; the spiritual doctrine of the Mystics; political opposition to the Roman see, dating from the old contests of the empire with the pope; and especially the influence of the revival of learning in promoting general culture, in hastening the downfall of scholastic theology, and in producing a diligent study of the Bible and of Christian antiquity,—are among the antecedents of Protestantism which deserve special mention. Under this last head the work of Erasmus is very important. Protestantism, as a religious system, had two main principles—viz. the exclusive authority of the Bible as the rule of faith, as opposed to the normal authority of the pope or the Church—a principle that involves the right of private judgment; and the doctrine of justification by faith alone, in contradistinction to salvation by works or human merit. Protestantism claimed for the individual a direct access to the blessing of the gospel, without the mediatorial intervention of the Church or priesthood.

I. *The Reformation in Germany.*—The movement began here by the posting of the theses of Martin Luther, an Augustinian monk and a professor in the University of Wittenberg, who also attacked the sale of indulgences, which in the hands of Tetzel and others was a source of flagrant abuses. A universal strife was kindled in consequence. Luther was excomunicated by Pope Leo X. in 1520, but he publicly burned the papal bull, with the book of canon law, which was almost equally obnoxious to him. By preaching and by numerous publications, with the aid of Melanchthon and other coadjutors, he gained numerous supporters among all classes. Political opposition to the encroachments of Rome seconded his efforts. At the Diet of Worms in 1521, however, he was put under the ban of the empire. Among his varied labors which contributed to build up his cause one of the most important was his translation of the Scriptures. His adherents were too powerful to be suppressed. The electors of Saxony were his staunch friends. At the Diet of Spires in 1529, when a majority declared against the Reformation, the "Protest" which gave rise to the name "Protestants" was signed by the elector of Saxony, the margrave of Brandenburg, the duke of Brunswick-Lüneburg, the landgrave of Hesse, the prince of Anhalt, together with fourteen cities, including Nuremberg, Strasburg, and Constance. At the Diet of Augsburg in 1530, in the presence of Charles V., the Protestants presented their famous Confession, but a decree was passed condemning their cause. The menace involved in this decree led to the formation of the Protestant Smalcaldic League. The execution of the Augsburg decree by Charles V. was long prevented by political complications, which often proved helpful to Protestantism. Especially was this true of the rivalship of Charles V. and Francis I. At length, in 1546, after the death of Luther, the Smalcaldic war broke out, which resulted disastrously for the party of reform, but their cause was restored after Maurice, duke of Saxony, turned against the emperor. The Peace of Augsburg (1555) was a virtual acknowledgment of defeat on the part of the emperor, and secured to Protestantism a legal recognition. After the terrible Thirty Years' war in the seventeenth century the Treaty of Westphalia (1648) once more established the legal privileges of Protestantism as one of the religions of the German empire. The final result was that Northern Germany was mostly Protestant, while Southern Germany, after the Catholic reaction and the labors of the Jesuits, became predominantly Roman Catholic.

II. *The Reformation in (German) Switzerland.*—The leader of the Protestant movement here was Ulrich Zwingle, who became pastor at Zurich in 1519. Imbued with the Erasmian culture, but a robust and fervent advocate of the distinctive doctrines of the Reformation, he was chiefly instrumental in inducing the city of Zurich to abolish the old system and become a separate Protestant Church (1524). Public disputations, as well as sermons from the pulpit, and books and pamphlets, were agencies employed in Switzerland, as elsewhere, for the dissemination of the Reformed doctrine. Bâle (1529), Berne (1528), St. Gall (1528), and Schaffhausen (1529) followed the example of Zurich. The ecclesiastical revolution was also a political one; the movement for reform in the Church was identified with republican principles and patriotic efforts for the improvement of public morals, and in opposition to the corrupting foreign influence which had drawn the Swiss away from their homes to serve as mercenary soldiers. As the consequence of dissensions between the Protestants and Catholic cantons, war broke out, and Zwingle himself fell in battle in 1531. The cause of Protestantism received a severe blow by its defeat in this struggle, but afterward, in a great degree, recovered its fortunes, especially after Geneva espoused the Reformed faith. The Zwinglians differed from the Lutherans on the doctrine of the Lord's Supper, the former considering it a mnemonic or memorial feast, intended to call vividly to mind the Saviour's death; the latter holding that while transubstantiation is to be denied, Christ is actually received in the sacrament, even by the unbelieving communicant. The division occasioned by this controversy, and by the vehement repugnance of Luther to the Zwinglian opinions, divided and weakened the Protestant power at a critical epoch.

III. *The Reformation in the Scandinavian Kingdoms.*—Protestantism spread northward, largely through the influence of Germans and of preachers sent forth from the great Protestant seminary of Wittenberg. Christian II., king of Denmark, first favored Protestantism, but afterward drew back from its support. Under Frederic I. (1523–33), by whom he was supplanted, the Reformation extended itself, and it acquired a legal establishment in Denmark under Christian III. The Lutheran doctrine and a constitution with bishops or superintendents, which Luther had approved, were accepted. Protestantism was introduced into Norway in 1537 in connection with the subjection of the country to Denmark. The Reformed doctrine was first preached in Sweden in 1519; it was favored by Gustavus Vasa (1523–60), and was formally adopted at the Diet of Westeras in 1527. The ecclesiastical property fell for the most part into the possession of the nobles. Subsequent efforts to restore Roman Catholicism proved abortive.

IV. *The Reformation in Slavonic Countries.*—Lutheranism was favorably viewed by the Hussites of Bohemia. Protestantism was strongly established in that country. The refusal of its adherents to join Ferdinand of Austria in

the Smalcaldic war brought upon them, especially after the defeat of the Protestants at Mühlberg, severe persecution. Toleration was continued only to the anti-Lutheran Hussites. Lutheranism early spread into Polish Prussia and Livonia, also into Poland. In this last country dissension broke out between the Lutherans and Calvinists, and further division was occasioned by the introduction of Unitarianism, which gained many adherents among the higher classes. The various evangelical parties formed a union of Sendomir in 1572. Sigismund II., the king, was favorable to the Reformed doctrine.

V. *The Reformation in Hungary.*—Numerous Germans were settled in this country, who brought in the Lutheran faith, and were aided in diffusing it by the Bohemian Brethren and by Waldenses. The new faith made rapid progress, especially in the cities and among the nobles. But the civil wars that arose, coupled with the doctrinal contests between Lutherans (mostly Germans) and Calvinists (mostly Magyars), checked its growth. It remained strong, however, until it was weakened and reduced by the labors of the Jesuits and the measures of the Catholic reaction.

VI. *The Reformation in Geneva.*—The pioneer in the work of introducing Protestantism into Geneva was William Farel, a Frenchman, who preceded Calvin, and by whose influence Calvin was induced to establish himself there (1536). The bishop of Geneva had been expelled and Protestantism legally accepted in 1535. The intellectual vigor, fine scholarship, and indomitable energy of Calvin, in connection with his systematic organizing genius, caused his name to become familiar and his influence to be powerfully felt, not only within the walls of the city, where his tenets were accepted, and where his will became, after long struggles with adversaries, predominant, but also in other countries, especially in France, his native land. He took the leading part in shaping the civil and ecclesiastical institutions of Geneva. His doctrine upon the Lord's Supper was intermediate between that of Zwingle and the theory of Luther, but it was one which the Zwinglian churches could accept. The two streams of Swiss Protestantism gradually mingled in one. Calvin asserted likewise the divine predestination and election—a doctrine on which the Reformers were at first united—in terms which went beyond the view which the Lutherans were inclined to adopt. His doctrines of the Lord's Supper and of election or divine "sovereignty" became the distinguishing features of Calvinism—a system which was defined with great clearness in Calvin's *Institutes of Theology*. These tenets, associated with the Presbyterian polity, which Calvin also founded at Geneva, were accepted by the Protestants of France, Scotland, Holland, and other countries. Thus, Protestants were divided under two great classes—the Lutherans and "the Reformed," this last term being specially applied to the adherents of the Swiss type of the Reformation. Numerous foreigners—most of them exiled from other countries for their faith—resorted to Geneva, many of whom were naturalized, and many others, having been instructed by Calvin, returned as missionaries to their own homes. Geneva became to the Romanic countries and to the lands which received Calvinism what Wittenberg was to the disciples of Luther and Melanchthon. The principal leader there, after Calvin, was his accomplished pupil, Beza.

VII. *The Reformation in France.*—A class of mystics, of whom Lefevre was the most conspicuous, and among whom were Margaret, sister of Francis I. and queen of Navarre, and Briçonnet, bishop of Meaux, sympathized with the doctrine of justification by faith, though they were not averse to the traditional doctrine of the sacraments. Humanism was favorable to reform, and Francis I., who was proud of being styled the "father of letters," encouraged innovation up to a certain degree when his interests prompted him to lend it assistance. On other occasions he was a cruel persecutor of Protestantism at home, even when, out of hostility to the emperor, he was giving help to Lutheranism in Germany. His vacillation was productive of great mischief. Yet Protestantism, mainly from the influence of Calvin and of Geneva, gained a foothold in France in his reign. His successor, Henry II., was inimical to the Reformed faith, especially after the Treaty of Château-Cambresis with Spain. Nevertheless, Protestantism in his reign made great progress. In 1558 it was estimated that there were 2000 places of Reformed worship scattered over France, and congregations numbering 400,000 organized after the German pattern. In 1559 they ventured to hold a general synod in Paris. The Huguenots, as they were called, became, by the force of circumstances, a political party. The family of Guise gained such ascendency in the government during the reign of the young Francis I., and eventually under Charles VIII., as to come into inevitable conflict with the great houses of Bourbon and Châtillon, and at the same time the Guises set themselves up as intolerant champions of the old religion. The consequence was that the political and religious elements of opposition coalesced. The Protestants found leaders in Condé and Coligny, who adopted their faith, and the latter of whom honored it by a signally pure and elevated career. Anthony of Navarre first espoused, but finally deserted, the Protestant cause. His heroic wife, Jeanne d'Albret, the mother of Henry IV., was their steadfast defender. The history of the Reformation in France would include a full narrative of the civil wars. The edict of St. Germains in 1562 granted to the Huguenots a measure of toleration. But the massacre of Vassy shortly after opened the long and bloody struggle which went on, with intervals of peace, down to the accession of Henry IV. and the Edict of Nantes (1598). The massacre of St. Bartholomew in 1572, when Coligny and thousands of his co-religionists were slaughtered, was due to Catharine de' Medici as its main contriver, and sprang out of the mingled motives of political, religious, and personal hostility. The Huguenots were always a minority of the nation, but besides the nobles who were attached to their side, they comprised a multitude of the sober and intelligent middle classes and of the inhabitants of towns. The Edict of Nantes, following upon the abjuration of Henry IV., reduced them to the condition of a stationary or declining party, but one furnished as a means of defence with political privileges of an extraordinary character, which they continued to hold until the time of Richelieu. There were times in the course of the sixteenth century when the Protestant cause seemed likely to triumph in France; its failure to achieve the victory in that country was the tragic event of the Reformation.

VIII. *The Reformation in the Netherlands.*—The inhabitants of the Low Countries were highly prosperous and intelligent. The contiguity of the country to Germany and France facilitated the incoming of Protestant opinions; merchants and emigrants brought them over from England. In 1523 two persons were put to death at Brussels as heretics—an event that called forth a stirring hymn from the pen of Luther. The persecuting edicts of Charles V. led to the destruction of a great number of Protestants in the Netherlands. Grotius makes the whole number who perished in this reign 100,000—probably an exaggerated estimate. Philip II., who was unpopular in this part of his dominions, set about the strict enforcement of the laws against heresy. The cruelties of the Inquisition, in connection with the evident purpose to destroy the liberties of the country and subject it to Spanish absolutism, provoked armed resistance. The hero of the great revolt, which was a struggle for political and religious freedom, was William of Orange. In the course of the protracted conflict a Protestant state grew up in the North under the lead of Orange, while the southern provinces finally submitted to Spain and retained the old form of religion. The Dutch republic confronted the whole power of Spain and achieved its independence. At first, Lutheranism had been introduced into Holland, but the Calvinistic type of doctrine and polity prevailed, and was incorporated in the ecclesiastical institutions of the country. The *Confessio Belgica* was composed in 1561, and was revised and adopted by a synod at Antwerp in 1566.

IX. *The Reformation in England and Scotland.*—The Lollards, a remnant of the followers of Wickliffe, were numerous in England at the beginning of the sixteenth century among the lower classes. The revival of learning prepared the ground for ecclesiastical change. The friends of the "new learning" had a spirited contest with the devotees of scholasticism. More, Colet, and Erasmus during his stay in England, exerted themselves in behalf of letters and against superstition. The writings of Luther found readers, especially among young men at the universities. Tyndale's translation of the Bible was eagerly perused, notwithstanding the efforts of the authorities to suppress it, and the martyrdom of its author. The Reformation in England had two distinct sources, which at times worked in conjunction with one another. The first was the moral and religious feeling, which was enlisted in favor of the Protestant movement. The second was the *quasi* political opposition to the foreign rule of the papacy, which was reinforced by the difficulties encountered by Henry VIII. in attempting to procure a divorce from Catharine of Aragon. The reluctance of Clement VII. to comply with the king's petition roused Henry to reduce the power of the clergy and to oblige them to declare him the head of the Church of England. Finally, he cut the knot by marrying Anne Boleyn without the papal permission in 1532. This was followed by the Act of Supremacy, which put an end to papal authority in England. In 1536 followed the act for abolishing the monasteries and confiscating their property. The king still professed the Cath-

olic dogmas. There was a Protestant and a Catholic party in the Church, the leader of the former being Cranmer, archbishop of Canterbury, a man of pure and upright intentions, but of a timid nature. The Protestants were led in the council by Thomas Cromwell, the king's vicegerent in ecclesiastical affairs. The Ten Articles (1536) were, on the whole, favorable to the Protestant side. But the bitter matrimonial experiences of the king, taken in connection with the Catholic rebellion in the North, led to the issuing of the Six Articles (1539), which were more in the Roman Catholic interest; and the same circumstances caused the fall of Cromwell (1540). Cranmer was saved from the vengeance of the opposing faction by the king's personal favor. On the death of Henry VIII. and the accession of young Edward VI. (1547) the Protestant party obtained complete control. In his brief reign, under the auspices of Cranmer and his associates, the Protestant Church of England received its constitution, liturgy, and creed. Evangelical theologians from the Continent filled the chairs of theology in the universities. Under Mary (1553–58), the successor of Edward, the old order of things, the papal supremacy included, was restored. Her matrimonial connection with Philip II. and subservience to Spain, and the popular sympathy excited by the martyrdom of Cranmer, Ridley, Latimer, and others, prepared the nation for the restoration of Protestantism under the auspices of Elizabeth in 1558. During her long reign the Protestant religion took firm root in English soil. The defeat of the Spanish Armada (1588) rendered it certain that the authority of the papacy could not be reinstated by foreign intervention. The conservatism of Elizabeth in matters of religion provoked into activity the Puritan sentiment, which was anxious to assimilate English Protestantism to that of the Continent, where numerous English exiles had lived during the preceding reign. The Puritans likewise demanded a greater independence for the Church in relation to the state than the Tudor love of power and a widespread feeling of repugnance to ecclesiastical control would allow. The result was the division of the Church of England into two great parties, whose contests fill many a page of English history for the century that followed the accession of Elizabeth.

In Scotland, at the outbreaking of the Reformation, the clergy were ignorant and vicious, and the Church was in possession of a great portion of the landed property of the kingdom. The evangelical doctrine, of which John Knox was the most effective apostle, gained a lodgment in the hearts of the people, and the co-operation of the nobles was founded partly in religious conviction and partly in the desire to appropriate to themselves the property of the Church. Protestantism in the Calvinistic and Presbyterian form was legally established by an act of the Scottish Parliament in 1560. The events of the reign of Mary Stuart proved that the new faith was too deeply rooted in the hearts of the middle class of the Scottish nation to be dislodged. The Presbyterian system was fully established in 1592.

X. The Reformation in Italy and Spain.—Protestantism in these countries had several peculiar characteristics. Its disciples were confined to the higher, cultivated classes, and the Reformed faith took no root among the people at large. Protestantism was also a thing of degrees. Many held the doctrine of justification in the sense of the Reformers, but felt little repugnance toward the old view of the sacraments and the hierarchical government of the Church. The societies of professed Protestants were secret. In Italy there was a widespread desire of Church reform, in which eminent Catholics—such as Caraffa, Contarini, and other members of the "Oratory of Divine Love"—participated. Some of them were subsequently leaders of the Catholic reaction, which aimed at the purification of morals and discipline, but at the same time crushed dissent and schism with an iron hand. In Naples, Venice, Florence, and other cities there were Protestant churches. Eminent preachers like Ochino and theologians like Peter Martyr privately espoused the Protestant faith. These were driven into exile, and Protestantism was extirpated in Italy by the instrumentality of the Inquisition, the *Index Expurgatorius*, and the other agencies of the strict and ascetic party which gained the ascendency in the Church, and which suppressed also the moderate evangelical Catholics of the school of Contarini. In Spain there were Protestant churches at Seville and Valladolid. The writings of Luther and of other Reformers were secretly introduced into the country, as they were in large numbers into Italy. But in Spain also the Inquisition, with its *autos da fe* (1559–60), did its work thoroughly. GEORGE P. FISHER.

Reformatories. See JUVENILE OFFENDERS, by REV. B. K. PEIRCE, S. T. D.

Reformed Church of America. This was known prior to 1867 as the Reformed Protestant Dutch Church in North America, a name which exactly described it, as *Protestant vs.* Roman; *Reformed—i. e.* Calvinistic in doctrine and non-prelatical in order; *Dutch*, as descended from Holland and inheriting its religious type. The first settlers in New Amsterdam brought with them the schoolmaster and the visitor of the sick, and soon after 1620 a church organization was formed. The emigration from Holland followed the Raritan, the Hudson, and the Mohawk rivers and their affluents, and at first was considerable, but after the English conquest in 1664 fell off rapidly. Still, the Hollanders held the ground they had taken, and everywhere multiplied ministers and churches. Their subsequent growth was hindered by three great causes—too great tardiness in relinquishing the Dutch language in public worship; a bitter controversy among themselves on the question whether they should act independently of the mother-Church in supplying their pulpits; and the waste of the Revolutionary war, whose chief scenes of conflict in the Middle States lay in the territory occupied by the Dutch. But after the return of peace the denomination consolidated its institutions and set to work repairing the desolations of the past. It increased its funds for educational purposes, enlarged its corps of theological professors, prosecuted in various directions missionary enterprises at home, and also engaged in the same work abroad—at first, in connection with other denominations, afterward independently. At the present time it numbers 510 churches, 550 ministers, and nearly 80,000 communicants, who are organized into 34 classes, 4 particular synods, and 1 General Synod. The strength of the denomination lies at the East, but four classes have been formed among the sixty or eighty thousand Hollanders who within thirty years have sought a home in Michigan, Illinois, and Wisconsin.

The Church is eminently confessional. It owns five creeds—the Apostles', the Nicene, the (so-called) Athanasian, the Belgic Confession, and the Canons of Dordrecht. It requires the Heidelberg Catechism to be taught in families and schools, and also to be regularly explained from the pulpit on the Lord's Day. A short compendium of this catechism is the standard of doctrine for all who seek full communion; and ministers are required to pledge themselves in writing not to promulgate any change of views they may make without previously consulting the classis to which they belong. There is a Liturgy, which is for the most part optional, but the forms for the administration of the sacraments, of ordination, and of church discipline are of imperative obligation. Nor is any psalmody allowed to be used unless it has been approved by the General Synod.

The affairs of each congregation are managed by a consistory, consisting of elders and deacons chosen for two years, but in such a way that only one-half go out of office at once. The elders, with the pastor, receive and dismiss members and exercise discipline; the deacons have charge of the alms. Both together are trustees of the church, hold its property, and call its minister. Ex-members of this body constitute what is called the "great consistory," who may be summoned to give advice when necessary. The minister and one elder from each congregation in a certain district constitute a classis, which supervises spiritual matters in that district. Four ministers and four elders from each classis in a larger district make a particular synod, with similar powers. And representatives from each classis, proportioned in numbers to the size of the classis, constitute the General Synod, which has supervision of the whole, and is a court of the last resort in judicial cases.

Rutgers College, founded in 1770 in New Jersey, and Hope College (1865), Michigan, are controlled by members of this Church. The Theological Seminary at New Brunswick, N. J., has four professors and a library of 30,000 volumes. Foreign missions are maintained in Japan, in Amoy, China, and in the Madura district, India. There are 16 missionaries, 29 churches, 1600 communicants, and the annual outlay is about $70,000. The Board of Domestic Missions aids in sustaining nearly a hundred churches and expends about $40,000. The Board of Education aids between eighty and ninety students in the various stages of preparation for the ministry, and expends about $30,000. A Board of Publication has existed for twenty years and done considerable good work, but of late has been much embarrassed financially. The salient characteristics of the Church are zeal for doctrine, for order, and for a learned ministry, unyielding attachment to its own views and usages, and a large charity for all other Christians.

T. W. CHAMBERS.

Reformed Episcopal Church. There have always existed in the Protestant Episcopal Church two different parties or schools of thought, popularly known as the High Church party and the Low Church or Evangelical party. But during the ten years previous to the formation of the Reformed Episcopal Church—as the originators of that movement still claim—a change took place

in the policy of the High Church party, which finally led to a separation. In the fall of 1873 a meeting of the Evangelical Alliance was held in New York City, in which a few clergymen of the Episcopal Church participated. But their course in so doing, and in joining with ministers of other denominations in a communion service, drew on them the severe animadversion of many of their brethren; and the settled discontent then culminated in the formation of a separate organization.

On Dec. 2, 1873, a small number of clergymen and laymen, under the presidency of Rt. Rev. George David Cummins, D. D., previously assistant bishop of the Protestant Episcopal Church in Kentucky, assembled in the city of New York, and proceeded, after deliberation, to pass the following resolution: "That we whose names are appended to the call for this meeting, as presented by Bishop Cummins, do here and now, in humble reliance upon Almighty God, organize ourselves into a Church, to be known by the style and title of 'The Reformed Episcopal Church,' in conformity with the following Declaration of Principles, and with the Rt. Rev. George David Cummins, D. D., as our presiding bishop: I. The Reformed Episcopal Church, holding 'the faith once delivered unto the saints,' declares its belief in the Holy Scriptures of the Old and New Testaments as the word of God and the sole rule of faith and practice; in the creed 'commonly called the Apostles' Creed;' in the divine institution of the sacraments of baptism and the Lord's Supper; and in the doctrines of grace substantially as they are set forth in the Thirty-nine Articles of Religion. II. This Church recognizes and adheres to episcopacy, not as of divine right, but as a very ancient and desirable form of church polity. III. This Church, retaining a liturgy which shall not be imperative or repressive of freedom in prayer, accepts the Book of Common Prayer as it was revised, proposed, and recommended for use by the General Convention of the Protestant Episcopal Church A. D. 1785, reserving full liberty to alter, abridge, enlarge, and amend the same, as may seem most conducive to the edification of the people, 'provided that the substance of the faith be kept entire.' IV. This Church condemns and rejects the following erroneous and strange doctrines as contrary to God's word: *First*, that the Church of Christ exists only in one order or form of ecclesiastical polity; *second*, that Christian ministers are 'priests' in another sense than that in which all believers are 'a royal priesthood;' *third*, that the Lord's table is an altar on which the oblation of the body and blood of Christ is offered anew to the Father; *fourth*, that the presence of Christ in the Lord's Supper is a presence in the elements of bread and wine; *fifth*, that regeneration is inseparably connected with baptism."

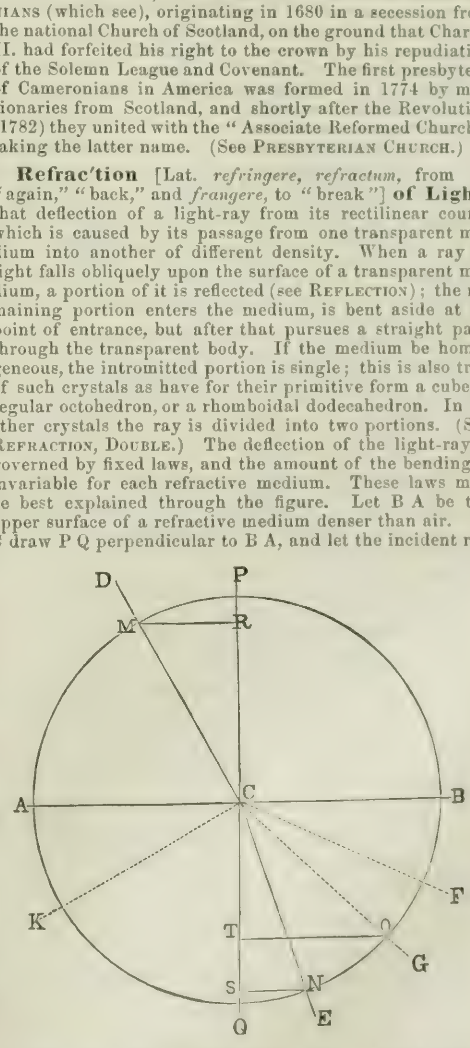
The members of the new Church then completed their organization by the appointment of officers and committees, and the adoption of provisional rules, and proceeded to elect the Rev. Charles Edward Cheney, D. D., of Chicago, as a missionary bishop.

The new Church grew gradually and steadily. Its leading men proceeded to revise the Book of Common Prayer, and this work was finally accomplished and the revised book adopted at the second General Council held at New York in May, 1874. At this time it also adopted its constitution and canons. The third General Council was held at Chicago in May, 1875, at which the articles of faith of the Church were adopted. At the present date (July 1, 1876) this Church has three bishops—Bishop Cheney, Bishop William R. Nicholson, D. D., of Philadelphia, and Rev. Edward Cridge of Victoria, British Columbia, the latter of whom is not yet consecrated. Bishop Cummins died very suddenly June 26, 1876. The Church has about seventy parishes and mission-stations, and is doing considerable work among the freedmen of South Carolina. Its strength is slowly but constantly increasing. A number of its ministers have come from the Methodist Church, and some from the Presbyterian, attracted by its order and liturgy. This Church is not bounded by any national or territorial divisions, nor are its parishes limited within any geographical lines. It has extended into Canada, and has a number of flourishing parishes in the maritime provinces. It has established a close federative union with the Free Church of England, and has two newspapers. The revised Book of Common Prayer allows liberty in extemporaneous prayer. The use of this book is obligatory at morning Sunday services, and optional at other times.

This Church repudiates the doctrine of the apostolic succession, but recognizes officially the orders of other Christian churches as equally valid with its own, considering the test of a Church's legitimacy to be the purity of its faith and the divine blessing on its work. In the words of its 24th Article, "This Church values its historic ministry, but recognizes and honors as equally valid the ministry of other churches, even as God the Holy Ghost has accompanied their work with demonstration and power." The bishop in this Church is simply *primus inter pares*, a presbyter, with the right to perform certain ecclesiastical acts—not a father, but an elder brother. The bishops in the council, which is the supreme legislative power, do not sit as a separate house, but vote with the presbyters. This Church rejects the hierarchical system, and all that is technically known as the sacramental theory. It has no earthly altar, priest, or sacrifice. Its position as to the Lord's Supper is fully set forth in the 27th Article, from which the following is an extract: "We feed on Christ only through his word, and only by faith and prayer; and we feed on him whether at our private devotions or in our meditations, or on any occasion of public worship, or in the memorial symbolism of the Supper." It is claimed that this Church has advanced a step beyond any other in making it obligatory upon every minister, in celebrating the Lord's Supper, to extend an invitation to all who love the Divine Lord and Saviour Jesus Christ to participate. In administering the elements the minister is directed to say to all the communicants kneeling around the table, "The body of our Lord Jesus Christ, which was given for you, preserve your bodies and souls unto everlasting life!" and then, when delivering the bread to each, "Take and eat this *bread* in remembrance that Christ died for thee, and feed on him in thy heart, by faith, with thanksgiving." A similar change from the Protestant Episcopal form is made in delivering the cup. The baptismal service contains no statement of the regeneration of the recipient. Baptism is merely the means whereby children and adults become members of the visible Church. HERBERT B. TURNER.

Reformed Presbyterians, a religious body in Scotland and the U. S., often called COVENANTERS or CAMERONIANS (which see), originating in 1680 in a secession from the national Church of Scotland, on the ground that Charles II. had forfeited his right to the crown by his repudiation of the Solemn League and Covenant. The first presbytery of Cameronians in America was formed in 1774 by missionaries from Scotland, and shortly after the Revolution (1782) they united with the "Associate Reformed Church," taking the latter name. (See PRESBYTERIAN CHURCH.)

Refrac'tion [Lat. *refringere, refractum*, from *re*, "again," "back," and *frangere*, to "break"] **of Light,** that deflection of a light-ray from its rectilinear course which is caused by its passage from one transparent medium into another of different density. When a ray of light falls obliquely upon the surface of a transparent medium, a portion of it is reflected (see REFLECTION); the remaining portion enters the medium, is bent aside at its point of entrance, but after that pursues a straight path through the transparent body. If the medium be homogeneous, the intromitted portion is single; this is also true of such crystals as have for their primitive form a cube, a regular octohedron, or a rhomboidal dodecahedron. In all other crystals the ray is divided into two portions. (See REFRACTION, DOUBLE.) The deflection of the light-ray is governed by fixed laws, and the amount of the bending is invariable for each refractive medium. These laws may be best explained through the figure. Let B A be the upper surface of a refractive medium denser than air. At C draw P Q perpendicular to B A, and let the incident ray



C D meet B A in C. The medium below C being denser than the air above it, the ray C D is bent toward P Q, mak-

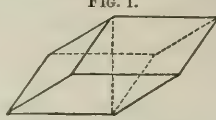
ing D C E the refracted ray, P C D the angle of incidence, and Q C E the angle of refraction. To determine the amount of the deflection about C as a centre, describe a circumference cutting the incident and refracted rays in M and N, from which points draw M R and N S perpendicular to P Q. M R is the sine of the angle of incidence, and N S the sine of the angle of refraction. (See SINE.) Whatever the angles themselves be, or whatever the obliquity of the incident ray, it is found that for each refracting medium the sines of these angles bear to each other an invariable proportion. The *index of refraction* is the numerical expression for this proportion. When a light-ray passes from air into water, for instance, the proportion of the sines is 13358 — to 10003 —, or very nearly that of 4 to 3. The refractive index is therefore in this case expressed by the fraction $\frac{4}{3}$, or more exactly by the decimal 1.33582. Direct experiment, as well as the general law that *illuminating and illuminated points are convertible*, determine that if the ray passes from the more refractive medium, water, into the less refractive, air, the deflection will be from the normal P Q, and the refractive index will be $\frac{3}{4}$, the reciprocal of the index in the reverse case. The laws of single refraction are: (1) The angles of incidence and refraction lie in the same plane, which is normal to the surface separating the media, at the point of incidence. (2) The sine of the angle of incidence is equal to the sine of the angle of refraction multiplied by a constant quantity, which is invariable for each medium. The ray on entering the more refractive medium is bent toward the normal, and in entering the less refractive medium is bent from the normal by the same amount; the ray can therefore always return by the path of its arrival, the refractive index being in the one case the reciprocal of what it is in the other.

Looking at the figure, it will be seen that any ray, however oblique, which falls upon A B from the air above, will be refracted toward P Q. The reverse is not, however, invariably true. If a ray passes upward through the water, at certain angles refraction is impossible. Let the ray G C, following the law of the sines, just graze the surface of the water B A after being refracted from P Q; then any ray which enters the water between G and B from the direction F, as F C, cannot be refracted; for the portion after bending at its proper angle would be within the water, where no change of direction would be possible. The ray which cannot be refracted is, therefore, totally reflected. *Total reflection* at times causes the bottoms of very shallow ponds to be invisible to an eye at a certain angle from them. Every ray of scattered light, by which objects upon the bottom would become visible, reaches the surface of the water at an angle of total reflection, cannot emerge, and is turned downward again.

From what we have seen—viz. that the indices of refraction are reciprocals when the ray of light passes from one medium into another, and *vice versâ*—it is manifest that when a ray passes through a medium with parallel faces, as a pane of window-glass, its course after emergence is parallel to the original direction. All the rays which go to make up the image upon the eye of an object so viewed, therefore, assume their relative positions, and the proportions are perfect, though the whole object is slightly displaced, the amount of displacement being dependent upon the thickness of the glass. An object viewed through imperfect glass, where the faces are not strictly parallel, has its proportions altered, because the emergent rays which go to form it are not parallel, but diverge, or converge, or cross each other, at all sorts of angles. It will be found that the distortion becomes more striking as the eye recedes from the glass, the divergencies being more noticeable at a distance. When the faces of a refractive medium are perfectly smooth, though not parallel, the displacement of the object viewed is very great, though the proportions are perfectly retained. (See PRISM.) Most optical instruments are dependent upon refraction, and are constructed in accordance with its laws. When refraction takes place from one transparent medium into another in close contact with it, such as two liquids which are superimposed, but do not mix, or a solid and a liquid that wets it, the direction of the ray is the same as though a thin film of air were between them; and the relative refractive index is equal to the quotient of their absolute refractive indices. If the first medium be water, and the second plate-glass, whose indices are respectively $\frac{4}{3}$ and $\frac{3}{2}$, the relative index out of water into glass will be $\frac{3}{2} \div \frac{4}{3}$, or about $\frac{9}{8}$. (See LENS, MICROSCOPE, TELESCOPE, ABERRATION (SPHERICAL), etc. For the different refrangibilities of each colored ray in the spectrum see PRISM, ABERRATION (CHROMATIC), LENS, SPECTRUM ANALYSIS, UNDULATORY THEORY, and OPTICS.) The refractive index of air (1.0003, that of the luminiferous ether being taken as unity), though so small that in ordinary experiments it may be neglected, nevertheless produces some remarkable phenomena, even the change in the index produced by rarefaction and condensation in adjacent masses of air giving rise to many curious appearances. (See MIRAGE.) By aërial refraction the heavenly bodies suffer displacement to the eye of the observer; this is *nil* at the zenith, and at its maximum on the line of the horizon. (For history see OPTICS; for theory see UNDULATORY THEORY; for natural phenomena see RAINBOW.) Heat is refracted according to the same laws as light. S. B. HERRICK.

Refraction, Double (see REFRACTION OF LIGHT), that case of refraction in which the intromitted portion of the light-ray is divided, at its deflection, into two rays, each of which pursues a different rectilinear course through the medium. Double refraction takes place in all transparent media except those bodies specified as singly refractive—viz. homogeneous bodies uniform in density, non-crystalline, or isometrically crystallized. (See REFRACTION.) At the point of entrance both rays into which the incident ray is divided are bent—one, the ordinary ray, being refracted in the plane of incidence and according to the law of the sines; the other, the extraordinary ray, except in special cases, deviating from the plane of incidence more or less as the inclination of this plane to the faces of the crystal varies, and being governed by the law of extraordinary refraction—a law much more complex than the law of the sines. (See UNDULATORY THEORY OF LIGHT.) It is only in the crystalline mineral commonly called Iceland spar (calcite), which occurs in large and beautifully-transparent rhombs, that the phenomenon in question is conspicuous enough to be detected by ordinary observation. In these crystals the two refracted rays into which a single incident ray is divided are so widely divergent as to produce two separate and distinct images of any object seen through them. Fig. 1 shows the form of one of these rhombs.

FIG. 1.



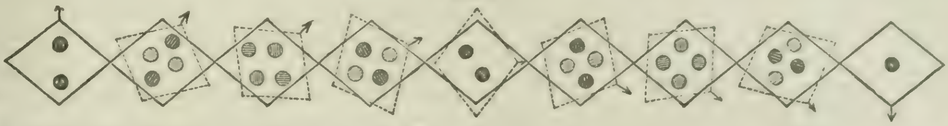
The angles of the plane faces are 101° 55′ and 78° 5′; the faces are inclined to each other in the angles 105° 5′ and 74° 55′. Three of the obtuse angles of the rhomboidal faces meet to form each of two equal and opposite solid angles, and the straight line connecting these solid angles is the crystalline axis of symmetry. From the relation (to be presently explained) of this axis to the property of extraordinary refraction within the crystal, this axis is also called the optic axis. But by optic axis is to be understood not one particular line determinate in position, but any line having the determinate direction of the axis in the figure. The rhomb, if fractured, breaks in planes parallel to the original faces, and innumerable minute rhombs may thus be formed, each one having its own axis. So, if the obtuse angles of the large crystal be truncated and replaced by planes perpendicular to the axis, a ray impinging at a determinate incidence on one of those planes will be affected in the same way at whatever point it meets it. If the incidence is perpendicular, the ray will proceed undivided and without deflection; in other words, in the direction parallel to the axis there is no double refraction in Iceland spar. If the other angles and edges of the rhomb be cut away and replaced by planes themselves parallel to the axis, a ray of light falling upon any one of these lateral planes in any plane of incidence will undergo double refraction, the energy of the manifestation varying with the position of the plane of incidence and of the ray in the plane. The most striking effects are observed when the plane of incidence is perpendicular to the axis; they diminish as this plane approaches coincidence with the axis; they are least when this coincidence is exact, and disappear altogether when, after such coincidence, the angle of incidence becomes 90°. For convenience, any plane coincident with (or parallel to) the axis is called a principal plane; any plane perpendicular to the axis, a conjugate plane. The index of refraction of the ordinary ray is 1.654 in every plane; that of the extraordinary, when at its minimum, which occurs in the conjugate plane, is 1.483. From this value it increases, as the plane of incidence and the angle of incidence in the plane are varied, until, in the principal plane and at the incidence 90° upon a surface normal to the axis, it becomes 1.654, equal to the ordinary index, and the two rays become one. In the conjugate plane, therefore, the two rays are most widely divergent; and they are both in the same plane of refraction, which is coincident with the plane of incidence. Both also for different incidences follow the law of Snellius, commonly called "the law of the sines." In other planes, however, or in any plane if the surface on which the ray is incident is oblique to the axis, the extraordinary ray departs from the plane of incidence and refraction which contains the ordinary ray; except only in the case in which the plane of incidence is also a principal plane of the crystal. As the natural faces of the crystal

are oblique to the axis, this circumstance gives rise to certain anomalous appearances when objects are observed through one of these.

If, for example, a natural rhomb of Iceland spar be placed so as to cover a portion of a straight black line drawn upon a sheet of white paper, two images of the line will in general be seen by an eye situated vertically over the crystal, of which one—that of the ordinary ray—will be continuous with the portion of the line seen outside the crystal, while the other—that of the extraordinary ray—will be discontinuous and laterally displaced. By rotating the crystal about the vertical, this second image may be made to change its place, and two positions will be found, differing in azimuth 180°, in which it will apparently coincide with the first, which remains motionless; but the two are nevertheless perceptibly different in distance from the eye, the ordinary image being nearest. If instead of the line there be merely a dot upon the paper, one image of the dot will appear to be in the vertical, and the other aside from the vertical; and as the crystal is rotated this one will revolve around the first, which remains at rest. This latter seems always nearest.

Reversing the experiment, let a slender cylindrical beam of common light fall, in a darkened apartment, at perpendicular incidence upon the rhomb, the emergent rays being received upon a screen. There will be two equal images,

FIG. 2.



one of which, if the rhomb be turned in azimuth, will revolve around the other, which latter is in the prolongation of the incident beam. If a second rhomb, equal and similar to the first, be applied to this conformably, so that the two may be equivalent to one of double thickness, the distance of the two images upon the screen will be doubled; but if the position of the second rhomb be reversed in azimuth, the rays separated by the first crystal will be reunited by the second, and a single image only will appear upon the screen, and will be in the line of the incident beam. If the two crystals are crossed on each other, there will still be two images, but neither of them will be in the prolongation of the incident beam; the ordinary ray of the first rhomb becoming the extraordinary of the second, and *vice versâ*. But if the azimuth of the second rhomb as related to the first is oblique, both the beams emergent from the first will undergo a second division by double refraction in the second, and four images will appear on the screen. At azimuths 45°, 135°, 225°, and 315° all these four images are equally bright. At all oblique azimuths the two members of each pair differ in intensity, each in turn varying from the maximum of brilliancy to absolute extinction. Fig. 2 shows these successive phases, beginning on the left, where the rhombs are supposed to be conformably placed, and proceeding by differences of $22\frac{1}{2}°$ of azimuth to the right, where the rhombs are reversed upon each other and the images are all reunited in one.

A ray of light which has undergone polarization by reflection (see POLARIZATION), when incident upon a doubly refracting crystal, deports itself in all respects as does light which has been modified by double refraction; that is to say, in a principal plane or in a conjugate plane it is refracted without being divided, but in every other azimuth it is separated into two rays, whose relative intensities vary with the azimuth. From this and from other evidences it is demonstrated that the effect of double refraction is always to polarize light.

Iceland spar belongs to a crystallographic system of three axes, two only of which are equal. The third, which is the axis of perfect symmetry, is that which joins the obtuse angles of the rhomb. It has been seen that a ray incident perpendicularly upon one of these truncated vertices, and coincident in direction with the axis, is not doubly refracted; but that if the incidence be oblique in whatever plane, double refraction occurs, the extraordinary index being less than the ordinary, and the extraordinary ray being therefore more distant than the other from the normal, which is the axis. If the incident ray be revolved about the normal, the angle of incidence remaining unchanged, the refracted rays will describe the surfaces of two cones having a common vertex, the surface described by the extraordinary ray being external to the other. This effect has been fancifully ascribed to an influence emanating from the axis, by which it would seem that this ray is repelled; and as an attractive force is naturally regarded as positive, repulsion must be esteemed negative. From this conception the term negative has been applied to all crystals of one axis of perfect symmetry in which the index of extraordinary refraction is less than that of the ordinary. Crystals in which the extraordinary index is the greater are called, on the other hand, positive. Of these, quartz is the most remarkable, for the singular optical properties of which see POLARIZATION.

Double refraction occurs in all transparent media when in a state of tension or strain, temporary or permanent, as in glass stretched, compressed, bent, or unequally heated, in indurated jellies, gums, resins, etc. etc. The whole subject of double refraction is so closely associated with polarization that the one cannot be considered without the other. (For many of the most remarkable phenomena of double refraction, therefore, see POLARIZATION; and for theory see UNDULATORY THEORY OF LIGHT.)

S. B. HERRICK.

Refraction, Index of, a term used to denote the abstract number expressing the constant ratio between the sine of the angle of incidence and the sine of the angle of refraction in a given substance; or the numerical quotient of the former divided by the latter. The indices of refraction afford a convenient means of comparing the refracting powers of different media. In the following table these indices are given for some of the more commonly-occurring or more interesting transparent bodies:

Indices of Refraction.

FLUIDS. Substance.	Index.	SOLIDS. Substance.	Index.
Water	1.336	Tabasheer (Vellore)	1.111
Acetic acid	1.396	Ice	1.309
Ether	1.366	Cryolite	1.346
Alcohol	1.371	Fluorspar	1.435
Oil of turpentine	1.476	Quartz (amorphous)	1.453
Naphtha	1.475	Camphor	1.492
Linseed oil	1.485	Calcite (ord. ray)	1.654
Castor oil	1.489	" (extr. ray)	1.488
Florence oil	1.490	Glass (plate)	1.500
Honey	1.495	" (crown)	1.525
Canada balsam	1.540	" (flint)	1.576
Peru balsam	1.600	Selenite	1.530
Carbon bisulphide	1.678	Lead chromate	2.974

The varieties of crown, plate, and flint glass are very numerous, and these are equally various in refracting power. The indices of those most commonly met with are given above. All these determinations suppose the ray to pass from the air to the medium. The index of refraction of air itself, when light enters it from a vacuum, is 1.000294; by which number the index of the table must be multiplied in order to obtain the absolute refracting power of the medium.

F. A. P. BARNARD.

Refraction of Sound. A beam of sound—regarded as any very small segment of an advancing spherical wave-front—moves normally in a radial line, but it is bent from its rectilinear course whenever it undergoes an unequal acceleration or retardation, necessarily turning toward the side of least velocity and from the side of greatest velocity. In other words, the direction of acoustic impulse is always *perpendicular* to the wave-front of sound, whether it continues as an expanding spherical surface, or, by reason of unequal velocity, becomes in any way deformed.

There are four ways in which sound-waves may be subjected to an unequal disturbance of velocity, and the sound-beams become thereby "refracted." First, by variation of *elasticity* in the medium (sound moving more swiftly as the square root of the elasticity, the density being the same); second, by variation of *density* in the medium (sound moving more slowly as the square root of the density, the pressure being the same); third, by variation of motion or *current* in the medium (sound travelling by convection faster with the wind by a small percentage according to the velocity of the same, and *vice versâ*); and fourth, by variation of *temperature* in the medium (sound moving more swiftly in a heated atmosphere in proportion to the square root of the absolute temperature). The effect of heat on a gas is to increase its elasticity if confined, and to diminish its density if unconfined; in either case equally accelerating the waves of sound.

(1) Perhaps the only practical example of acoustic refraction by differences of *elasticity* is furnished by the passage of sound from water into air or from air into water. Sound moves more swiftly through liquids (and still more so through solids), not in consequence of their greater density, but in opposition to their density, and by virtue of their far greater energy of resilience or elasticity, measured in intensity, not in quantity. The concentric sound-

waves sent upward by a submarine explosion to the level surface of the water there suffer a large amount of internal reflection, with a reverse curvature, giving the sound-beams the same amount of divergence downward that they previously had upward. A portion of each of the sound-waves, however (with greatly diminished amplitude of vibration), is propagated into the air. These have their convex fronts very much flattened, by reason of being reduced to less than one-fourth of their previous velocity. The radii of these deformed surfaces, representing the directions of the sound-rays, are thus bent or refracted upward (or toward the vertical) at the surface of the air, and have a focus of divergence much more distant than the position of the origin of the sound-waves. In the case of an aërial sound, as the discharge of a gun, the descending sound-waves are largely reflected upward from the surface of the water; but a small portion of the impulse passing this plane, the convex wave-fronts, acquiring suddenly more than four times their previous velocity, are hurried into greatly-increased convexity, and the sound-rays are refracted toward the horizon, with a divergence representing a much lower or nearer focus than the origin of the sound. Those sound-rays which by refraction would coincide with the horizontal plane or water-surface would necessarily suffer total reflection.

(2) The refraction of sound resulting from differences of *density* was first demonstrated by Mr. Carl Sondhauss (in 1852) by means of a convex lens of carbonic acid gas confined in an envelope of collodion film. The ticking of a watch was heard, with the lens interposed, most distinctly at a focal point where it could not be heard on the removal of the lens. (*Poggendorff's Annalen*, 1852, lxxxv. 381.) In this case the wave-front on entering the convex surface of the lens is so far retarded by the denser gas (commencing at the axis of the lens) as to have a concave form impressed upon it, and on emerging from the second surface of the lens in reversed order becomes still more concave by being accelerated first at the outer annulus. The normals of these concave waves converge to a focal point.

(3) The refraction of sound by inequality of *wind* was first suggested by Prof. Stokes in 1857. (*Rep. Brit. Assoc.*, 1857, xxvii., Abstracts, p. 22.) Winds, being ordinarily more retarded near the earth than aloft, would act unequally upon the concentric sound-waves advancing against them, by retarding the upper portion of the wave-fronts more than the lower portion. Being thus tilted backward more and more as they advanced against the wind, these wave-fronts would have their lines of impulse, representing the acoustic beams, bent gradually upward from the surface, so as to leave a sound-shadow at no great distance on a plane. On the contrary, sound-waves advancing in the direction of the wind would, for the same cause, have their fronts more tipped forward above than below, and the line of acoustic effect would be bent downward, bringing continuously some of the upper sound-beams to the observer's ear at great distances. This explains why sounds are usually heard with so much better effect and to so much greater distance in the direction of the wind than in opposition to it. In those exceptional cases where the upper wind is moving with less velocity than the lower wind, sound will be heard to a greater distance against the wind. Prof. Henry in 1865—without knowledge of the theory—made the two capital observations that a sound-signal could be heard against the wind at the masthead of a vessel after having ceased to be audible on deck, and that the speed of the clouds as indicated by their shadows was several times that of the sensible wind.

(4) The refraction of sound from differences of *temperature* was first pointed out by Prof. Reynolds in 1874, who showed that during the heat of a still summer's day, when the lower air had a higher temperature than the upper air, loud sounds could be heard to but short distances, but that in the evening, when the lower air became cooler, the same sounds were heard distinctly several times the former distance. (*Proceed. Roy. Soc.*, 1874.) It is well known that the difference of sound-velocity due to the temperature is about 1 foot for 1° F. Hence, when the lower strata of air are the warmest (as is usually the case), the advancing wave-fronts are accelerated below, causing the sound-beams to curve upward, as in the case of adverse winds. This explains why the sound of waterfalls is heard so much farther and more distinctly at night than during the day, even in the most silent of rural districts. When the lower strata of air are colder than the upper (as more rarely occurs), the advancing sound-waves are tipped forward above, bending downward the sound-beams, and thus greatly favoring audibility at a distance. This explains the facility with which sounds (as of conversation, etc.) can sometimes be heard to unusual distances in Arctic regions. (See also ACOUSTICS.) W. B. TAYLOR.

Refrig'erants [Lat. *refrigerans*, "cooling"], a term sometimes used in medicine to designate collectively certain medicines given in fever which produce a grateful feeling of relief from the distress of the febrile symptoms. Such are cooling drinks in general—solutions of potassium salts, as the citrate or nitrate; effervescing draughts, acid mixtures, and solutions of purgative salts. The term has no proper scientific signification. EDWARD CURTIS.

Refrigeration. See FREEZING, ARTIFICIAL, by PRES. F. A. P. BARNARD, S. T. D., LL.D.

Refrigeration of the Earth. If the earth possessed no heat excepting that derived from solar radiation, we should expect to find at no great depth, on descending below its surface, a limit to the variation resulting from the yearly alternation of the seasons, and a region of uniform temperature representing the annual mean. Below this neutral line we should expect to find a uniform continuation of this mean temperature to whatever depth we penetrated, as this condition alone could be one of stable thermal equilibrium. This, however, is not the fact observed. Beneath the line of invariable temperature (about 50° F. or 10° C.), ascertained to be at a depth of from 50 to 100 feet, according to the latitude or the surface condition, we find in every part of the earth explored a steady increase of heat downward, differing considerably in different localities or according to geological formations, but showing no relation to terrestrial latitude. This rate of thermal increase has been generally estimated as on the average about 1° F. to every 50 feet (1° C. to 27½ mètres); and at the depth of about 10,000 feet (3048 mètres) the temperature of boiling water is ordinarily reached.*

The earth is therefore a cooling body. And a natural question is, Whence the origin of its interior heat? The heat derived from chemical and mechanical action, to which much importance has been attached by some, may be neglected as quite insignificant. The heat (like the light) received from the stellar depths bears so small a proportion to that derived from the sun that it may also be entirely neglected, excepting in very precise investigations. The fanciful hypothesis that our internal store of heat might possibly have been derived from a long presence of our solar system in a considerably warmer region of space is so entirely arbitrary that, but for the name of its propounder, the distinguished Poisson,† it would deserve no attention.

This warmer temperature of a cosmical region can mean nothing more than the nearer approach of heating bodies in space. But the present form and relation of our planetary orbits very clearly establish the fact that *since the original evolution of the planets themselves* our solar system has not been near enough to any star or cluster of stars to affect its general temperature by an appreciable amount. Sirius is estimated to have an illuminating (and therefore presumably a heating) value about 400 times that of our sun. Supposing that our system had ever approached Sirius within four times the distance of Neptune, then the amount of heat received by the earth from that blazing star would be but the thirty-sixth part of that received from our own smaller sun—a wholly insufficient amount to affect sensibly the average temperature of the interior, while under the condition supposed the planetary orbits would be utterly deranged and their organisms destroyed. Nor would the case be materially changed by substituting a cluster of smaller stars, or the Milky Way itself, as the source of heat.

No satisfactory conception, therefore, presents itself but that the phenomenon observed represents a residuum of aboriginal heat, mechanically derived from the action of gravitation. The manifest result of igneous action in the lowest Archæan rocks—the shrunken condition of the earth's superficial crust, evidenced in its contortions, corrugations, and enormous tangential thrusts capable of raising and upholding mountain-chains miles high—the very proportions of our flattened globe, so precisely representing those of a rotating liquid spheroid,—all conspire with cumulative force to impress the conviction that our planet was at one time a fused and incandescent mass. Nor is this conviction weakened by the contemplation of our own sun and the innumerable host of luminous bodies in space, all radiating heat in some proportion to their light, and all therefore cooling bodies.

* The constant increase of temperature inward, coupled with the fact of the comparatively small aggregate specific gravity of the globe (about six times that of water), has naturally inspired a belief that its central heat must be very high, even beyond that of fusion. The mathematical discussions of Mr. W. Hopkins and of Prof. W. Thomson appear to show that for the phenomenon of "precession" a degree of rigidity in the earth's mass is required not compatible with any considerable region of fluidity. The question of central fusion thus stands undecided.

† *Théorie mathématique de la Chaleur* (Paris, 1835).

Fourier, whose classic mathematical investigation in the *Théorie analytique de la Chaleur* is still authoritative after the lapse of nearly two-thirds of a century, has shown by a beautiful theorem the law of heat-distribution in a cooling body. He has also shown the extreme slowness with which the chilled radiating surface of any very large mass is affected by the decline of its interior heat. He has satisfactorily proved not only that the internal heat has exercised no sensible effect on the surface or climatic temperature of the earth for millions of years past, but that from its present known ratio of conduction through the upper rocks, whatever be the estimate of its central intensity, its continuous escape through, and radiation from, the surface does not raise the permanent temperature of that surface more than one-seventeenth of a degree F. or one-thirtieth of a degree C. In other words, whether the crust of the earth were filled with the glowing coals of a heated furnace or packed with the ice of a refrigerator, it would be very difficult for our most delicate instrumental measurement to ascertain the difference, unless by descent into a mine.

As a practical phenomenon, therefore, the indefinite cooling of our planet cannot have the slightest importance for us, excepting in its collateral effects of the continuous disturbance of geographical contours by the slow but inevitable contraction of the radius and the ceaseless displacement of both absolute and relative levels. It is in the retrospect of this great action (continued, doubtless, through so long a period) that the subject of the earth's cooling presents the most interesting topic of contemplation and suggestion. Through how many millions of years has this cooling process been going on? And what clues, if any, does it offer to the possible range of geologic chronology?

Sir William Thomson, by a fine application of Fourier's theorem, assuming certain probable values for the ratio of conductivity of ordinary rocks—their temperature of fusion and the ratio of existing heat-differences downward—arrived at the conclusion that "we may with much probability say that the consolidation cannot have taken place less than 20,000,000 years ago, or we should have more underground heat than we actually have; nor more than 400,000,000 years ago, or we should not have so much as the least-observed underground increment of temperature." (*Trans. R. S. of Edinb.*, vol. xxiii.; also *L. E. D. Phil. Mag.*, Jan., 1863, vol. xxv. p. 5.) Prof. Thomson regards 100,000,000 years as the most probable value of the time elapsed since a terrestrial crust was formed; and shows that for the last 96,000,000 years the ratio of descending increment has only been diminished to one-fifth, or from 10 feet to the degree F. to 50 feet for one degree.

To the practical geologist a hundred million years appear utterly inadequate to permit the slow submarine deposit of 20 or 25 miles of stratified rock, including the innumerable unregistered intervals which certainly occurred in the progress of such deposition. To the experienced palæontologist no less insufficient does the time appear for the slow and solemn march of life upon our planet. And yet it is impossible to detect any flaw in the stern logic of this application of Fourier's theorem. It is true that the physical constants involved are but approximately ascertained; but, even doubling their coefficients, we shall not probably extend the time since telluric congelation to more than 1,000,000,000 years. This, therefore, would appear to be an extreme limit within which the whole of our geologic history must have been recorded.

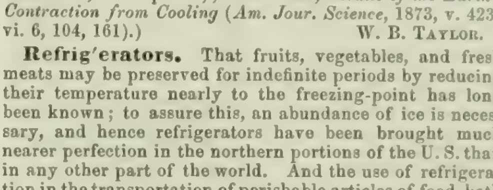
The refrigeration of the earth has no connection whatever with the "glacial epoch." That great cosmical winter is but a phase of external climate, dependent, as Mr. Croll's theory has rendered so probable, on the planetary relations of eccentricity of orbit, compounded with the precession of the equinoxes. And through the ages of the past the glacial epochs have recurred in grand procession as curious illustrations of changes—not in the average temperature of the earth's surface, but—in the local distribution of its constant supply.

But if our earth is thus shown not to have had its average exterior temperature affected in any appreciable degree by its inner heat for so many millions of years, there is a source of slow decline in the great controller of climate itself; for the sun, to whom alone we are indebted for our entire supply of sensible warmth, is himself a cooling body. And though we are unable to determine at what period in the condensation of a gravitating mass the amount of heat radiated from its surface reaches a *maximum*, there are suggestions for supposing that our sun has passed that epoch, and that millions of years ago (possibly in the Jurassic period of the Mesozoic ages) its culmination was reached, and that cooler Cainozoic climates may be the witness of a fading sun. (See Fourier, *Theory of Heat* (*Ann. Chim. et Phys.*, 1816, iii. 350); *Secular Cooling of the Earth* (*Ann. Ch. et Ph.*, 1820, xiii. 418); *Théorie analytique de la Chaleur* (4to, Paris, 1822); *Remarks on the Temperature of the Terrestrial Globe*, etc. (*Ann. Chim. et Phys.*, 1824, xxvii. 136 and 236); *Theory of the Movement of Heat in Solid Bodies* (*Mem. Acad.*, 1824, iv., and 1826, v.); Laplace, *Diminution of the Length of the Day by the Cooling of the Earth* (*Ann. Ch. et Ph.*, 1820, xiii. 410); Poisson, *Distribution of Heat in Solid Bodies* (*Ann. Ch. et Ph.*, 1821, xix. 337); *Théorie math. de la Chaleur* (4to, Paris, 1835); *Temperatures of the Solid Portions of the Earth*, etc. (*Comptes rendus*, Jan., 1837, iv. 137); Dr. Gustave Bischof, *Natural History of Volcanoes and Earthquakes* (*Edinburgh New Phil. Jour.*, 1839, xxvi. 25, 347); W. Hopkins, *Researches in Physical Geology* (*Phil. Trans. R. S.*, 1839, cxxix. 381; 1840, cxxx. 193; 1842, cxxxii. 43); J. D. Forbes, *Account of Some Experiments on the Temperature of the Earth at Different Depths*, etc. (*Trans. Edinburgh Royal Soc.*, 1849, xvi. 189); *Inquiries about Terrestrial Temperature* (*Trans. Ed. R. S.*, 1861, xxii. 75); Sir William Thomson, *Secular Cooling of the Earth* (*Trans. Ed. R. S.*, 1862, xxiii.; *L. E. D. Phil. Mag.*, Jan., 1863, xxv. 1; Thomson and Tait's *Treatise on Nat. Phil.*, vol. i. p. 711); J. D. Dana, *Results of the Earth's Contraction from Cooling* (*Am. Jour. Science*, 1873, v. 423; vi. 6, 104, 161).)

W. B. Taylor.

Refrig'erators. That fruits, vegetables, and fresh meats may be preserved for indefinite periods by reducing their temperature nearly to the freezing-point has long been known; to assure this, an abundance of ice is necessary, and hence refrigerators have been brought much nearer perfection in the northern portions of the U. S. than in any other part of the world. And the use of refrigeration in the transportation of perishable articles of food, both by rail and steamer, promises to initiate a most important change in this branch of traffic. There is but little doubt that a few years hence the fruits of California and the fresh beef of Texas and the West will be brought to Eastern markets almost wholly in refrigerating cars; and the movement, already successfully begun, to transport such articles to foreign ports will soon reach an extent now little anticipated. Although refrigerators for preserving perishable food were really of American origin, the first hint appears to have been given from the ventilation of the British Houses of Parliament by means of a fan-blast forced over masses of ice, which cooled the air; for this contact of the air with the ice itself is essential to the simultaneous drying and cooling of the air requisite in an effective refrigeration. This, so far as the knowledge of the writer extends, was first shown in a refrigerator in the car patented in 1855 by J. B. Barry. In this a driving-

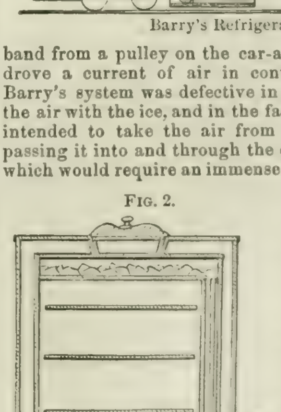
Fig. 1.



Barry's Refrigerating Car.

band from a pulley on the car-axle operated a fan, which drove a current of air in contact with a mass of ice. Barry's system was defective in the very slight contact of the air with the ice, and in the fact that he appears to have intended to take the air from the external atmosphere, passing it into and through the car, and thence out again; which would require an immense quantity of ice, even if the air-current was advantageously directed thereto. Previous to this, however, several refrigerators had been constructed in which the refrigerating chamber was cooled by the radiation, so to speak, of cool air from an ice-box through the sheet-metal sides or bottom of an ice-receiver. A primitive form of this is shown in the Union refrigerator of Job & Gold, patented thirty-two years ago. In 1848, Tough & Craddock patented another on the same principle, but in which the ice was placed in a sheet-metal cylinder which exposed a greater refrigerating surface than the one previously mentioned. In 1846, T. B. Smith patented a refrigerator

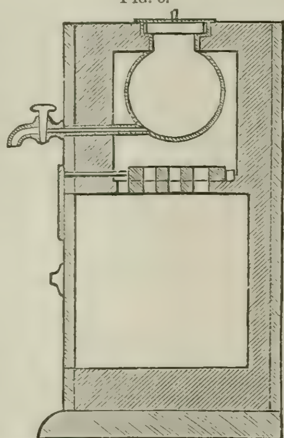
Fig. 2.



Job & Gold's "Union Refrigerator."

in which he proposed to connect two or more apartments (one of them provided with an ice-box) by means of tubes having valves, so that the cold air could be supplied to or shut off from one or more of the apartments, in order that the opening of one could not affect the temperature of another. It will be observed that in the apparatus of Job & Gold, Tough & Craddock, and of Smith, an outlet is provided at the bottom of the ice-box to drain off the water resulting from the melting of the ice. This is essential to all refrigerators using ice, the presence of the water in contact with the ice diminishing its refrigerating power.

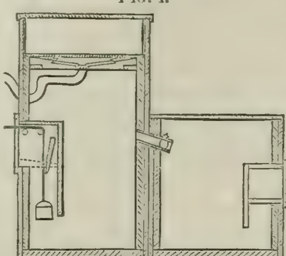
Fig. 3.



Tough & Craddock's Refrigerator.

In 1849, J. Lentell made a refrigerator in which he provided for the automatic circulation of the air within a closed chamber by the differences in its density. The air, cooled by contact with the sheet-metal bottom of the ice-box, descending at the centre of the refrigerating chamber, and becoming heated as it approaches the bottom of the chamber by contact with the articles to be preserved, is of course somewhat rarefied, and, descending at the sides of the chamber, is again brought in contact with the refrigerating surfaces; its surface is enlarged in this device by making the bottom of the ice-box of a deeply-corrugated form, in connection with the contact of the air with the ice. This natural circulation, so termed, of the air in a closed chamber, changed in its density, became the foundation of one of the most important improvements in refrigerators ever made, the invention of Fairbanks, afterward patented to Lyman, and hereinafter fully referred to.

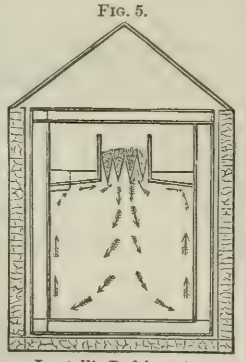
Fig. 4.



Smith's Refrigerator.

The circulation of air through a chamber, but *not* over and over again within it, was shown in the patent of William Mootry in 1855. In this apparatus the air entered through openings at the top, passed downward in contact with the cold sides of the ice-box, and being thus made denser, descending by its own gravity through the refrigerating chamber, and thence out through holes in the bottom of the latter. It is proper to explain in this connection that the preservation of fruits, vegetables, and meats depends not only upon a reduction of temperature, but upon a high degree of dryness in the refrigerated air; for if the cold be moist, a slime will gather upon the perishable articles, and in a short time destroy their flavor. When air is brought in contact with the ice, the moisture is condensed from the air upon ice, and carried off with the water through the drip-pipe. On the other hand, when the air is brought in contact with cold metal, the vapors are also deposited, but remain in the shape of moisture on the walls, floors, etc., with which the air is continually brought in contact, and which is therefore more or less reabsorbed. In practice, therefore, it is found that, as regards utility, metal refrigerating surfaces bear no comparison with the surfaces of the ice itself. The use of absorbents of moisture, such as sulphuric acid or bitumen, containing a large percentage of chloride of sodium, has been proposed, but none of them appears to have given satisfaction to meat-packers and others practically engaged in storage or preservation of perishable articles of food.

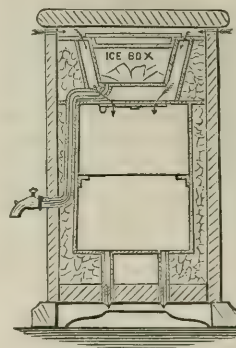
Fig. 5.



Lentell's Refrigerator.

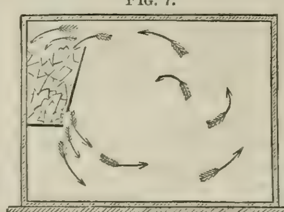
Somewhere about the year 1846, Thaddeus Fairbanks filed an application for a patent for a refrigerator, which consisted simply of an ice-box elevated at some little distance above the floor of the refrigerating chamber, and with an opening at the lower portion of its front. The chamber was closed against access of external air; the confined air of the chamber in contact with the ice became heavier, and, descending, displaced the air at the bottom of the chamber, which, being thus forced upward, passed to the top of the ice-box, and, in its turn becoming cooled, became denser, and, descending, of course thereby established a continual natural circulation of the air within the chamber. As has frequently occurred in the treatment of valuable inventions by the patent office, this application was rejected on grounds afterward shown to be frivolous. But Fairbanks subsequently abandoned his application; and an abandoned application, comprising merely the drawings and description neglected in the dusty archives of the office, being very properly held to be no valid basis for the rejection of an application subsequently made by another inventor in good faith, a patent covering the same ground was granted in 1852 to Azel S. Lyman. This last-named patent has been the subject of much litigation, and has called forth decisions that bear an important part in more recent interpretations of the patent laws. Lyman's apparatus showed substantially the same device as Fairbanks's, but he extended a partition from the bottom of his ice-box nearly to the floor of the refrigerating chamber, thereby, as he claimed, ensuring the more effective descent of the cold air to displace the warm, and consequently a more uniform and efficient circulation of the air confined in the closed chamber. Lyman also provided a slatted bottom to the ice-box, which facilitated the passage of the cool air therefrom; and he also devised certain special means ensuring the rapid drainage of the water resulting from the melting of the ice out of contact with the same. It is manifest that the degree of drying and refrigeration of the confined air will be in proportion to the quantity of ice employed, and that, owing to the relatively slow circulation of the air, a much larger proportion of ice will be needed than if the circulation were forced; hence, the most effective, practically, of refrigerators are those in which the air-blast is driven forcibly through and in contact with the ice. This use of a forced air-current, moreover, enables finely-broken ice, cheaper than that in large lumps, to be used; hence greater economy is secured. In a suit involving the question of the relative economy of ice in the two systems it

Fig. 6.



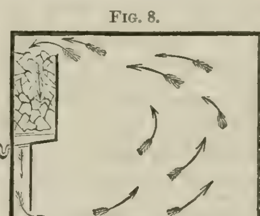
Mootry's Refrigerator.

Fig. 7.



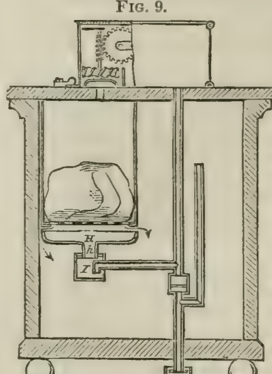
Fairbanks's Refrigerator.

Fig. 8.



Lyman's Refrigerator.

Fig. 9.



Fuller & Reichart's Refrigerator.

was stated by a sworn expert that the same results could be obtained from 2500 pounds of ice with a forced circulation as was provided by 9500 pounds with the other; the cost of the finely-broken ice was stated to be not more than one-third that of the large lump ice.

The use of a forced circulation of air in contact with the mass of ice within a chamber closed against access of external air is shown in the patent of Fuller & Reichart, 1868. In the same year W. Bray patented a refrigerator, the gist of which he describes as the forming or producing of a current of air within the provision-chamber; that is to say, the refrigerating chamber by means of a rotary fan or other mechanical device is so arranged as to force the air through an ice-box or other vessel surrounded by a freezing mixture, and also through a vessel containing charcoal or other absorbent, moisture, acid, or noxious gases. The use of a charcoal or equivalent filter for the air in connection with the ice-box, however, is hardly new, as something of the kind was projected by Lyman in his patent, previously referred to; but the utility of such a filter is not apparent.

The patent of L. Schulze, dated 1873, describes an ice-

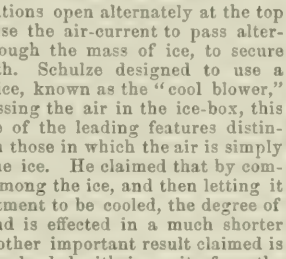
FIG. 10.

Ice-box of Schulze's Refrigerator.

box having vertical partitions open alternately at the top and bottom, so as to cause the air-current to pass alternately up and down through the mass of ice, to secure greater contact therewith. Schulze designed to use a powerful air-forcing device, known as the "cool blower," with the idea of compressing the air in the ice-box, this compression forming one of the leading features distinguishing his device from those in which the air is simply driven through or over the ice. He claimed that by compressing the air in and among the ice, and then letting it escape in a room or apartment to be cooled, the degree of cold is much greater, and is effected in a much shorter time and less space. Another important result claimed is that returned air which is loaded with impurity from the rooms or articles through or over which it has passed, the part being compressed into ice-chambers, has all noisome odors condensed and removed from the water which results from the ice as it melts. This makes it generally unnecessary to use any other means of purifying the air. It is perhaps to be doubted whether this system is as useful as it is ingenious. The air compressed in contact with the water would be more likely to absorb moisture, and the advantages resulting from the direct contact of air with ice would be lost. This apparatus, it should be mentioned, belongs to that class in which the water is conducted from the ice-box by tubes to be distributed to different buildings or apartments.

Another refrigerator, which departs measurably from the principles herein laid down as most advantageous, is that of Allegretti, patented in 1872, which is so constructed that ice or a cooling mixture wholly or substantially surrounds the entire refrigerating chamber, and provision is made for access to such chamber without exposing the ice or cooling mixture to the air. It does not appear that there is any circu-

FIG. 11.



Allegretti's Refrigerator.

lation of the air within the refrigerating chamber, or that the moisture would be eliminated from the air. By this apparatus, however, articles may be frozen, and kept in such frozen condition for an indefinite period of time. If, as has been frequently stated on apparently good authority, the keeping of organic substances in a frozen condition for an indefinite period of time impairs their flavor and nutritious qualities, this method may be defective, but it affects the merits no more nor less than belong to the congelation of the materials sought to be preserved.

To return to the forced circulation of air through an ice-box and closed refrigerating chamber, modifications of this principle are shown in the patents of J. J. Bate of 1874 and 1875. In one of these, a patented refrigerating car, the ice-box is provided with inlet and outlet pipes by which the efficient distribution of the cooled air throughout all parts of the chamber is provided for. In another the forced current is passed horizontally through the bottom of the ice-box, the ice being fed downward by its own gravity as fast as melted from its contact with the air. By this means a more uniform refrigeration of the air-inlet is secured, inasmuch as the quantity of ice in contact with the air remains the same, irrespective of the total quantity in the ice-box. The same inventor—one of the pioneers in the export of American fruits, meats, etc. in refrigerating vessels to foreign ports—has devised various other modifications relating to this class of refrigerators.

There is another class of refrigerators from which much has been hoped, but thus far very little gained, in which it has been designed to use ice-making machinery to secure the requisite reduction of temperature. The use of an ice-making machine to cool air in breweries, etc. was projected in Germany and applied to practical use a number of years ago; about 1870, Tellier, the inventor of the ice-making machine that bears his name, arranged a system of tubes made cold by the ice-making machine, and through which the air was forced. He simply applied the device in place of the ice-box of Fuller & Reichart. In 1872, Prof. Vander Weyde, a chemist of New York City, provided a similar system of tubes, cooled by the same agency, in a closed chamber, but depending upon the natural circulation, so termed, of the air, arising from the increase in density as the air came in contact with the refrigerating tubes. In 1875, C. H. Chennock of Brooklyn, N. Y., arranged an ice-making machine in connection with a chamber surrounding the refrigerating chamber and filled with water in such manner that the operation of the machine should freeze the water and form a solid mass of ice around the refrigerating chamber. The use of an ice-making machine in connection with the refrigerator seems plausible, and in many places it would appear to indicate greater economy than the use of ice, as this operation involves substantially the substitution of coal for ice. But owing, perhaps, to a lack of thorough trial of the system, its results thus far do not appear to have been better than those arising from the use of the ordinary refrigerators.

In the construction of a refrigerator it is manifest that economical results can be secured only by causing the confined air of a closed chamber to pass over and over again in contact with the refrigerating surfaces or material, inasmuch as the reduction of temperature of a constantly-renewed current of comparatively warm air would involve an excessive waste of ice. Moreover, the walls must be rendered so nearly non-conducting that practically no heat from the external atmosphere will be communicated through them. It is better, therefore, to make refrigerating chambers with walls filled in with boiler-felt or a similar non-conductor. The felt is probably as good as any other material for the purpose so long as kept dry, although various substitutes have been offered, among others a filling composed of paper cases or boxes, in order to provide absolutely dead air between the inner and outer walls.

Although this article embraces the salient features in the construction and *modus operandi* of refrigerators, many minor inventions have been omitted for lack of space, upward of 300 patents having been granted in the U. S. upon this class of apparatus. JAMES A. WHITNEY.

Refuge, Cities of. See CITIES OF REFUGE.

Refu'gio, county of S. Texas, on the Gulf of Mexico, bounded N. E. by Espiritu Santo Bay and San Antonio River, S. by Aransas River and Copano Bay, and traversed by Blanco River, has a low, level surface, largely prairie, and a fertile soil. The chief industries are cattle-raising and beef-packing; agricultural products, corn and sweet potatoes. Cap. Refugio. Area, 700 sq. m. P. 2324.

Refugio, p.-v., cap. of Refugio co., Tex., on Blanco River. P. 1053.

Regalbu'to, or **Ragalbuto,** town of Sicily, province of Catania, on a hill commanding a view of Etna. It stands near the left bank of the Salso, on the road leading from Catania, through Castrogiovanni, to Palermo, and was once a stronghold of the Saracens, who were driven out by Roger of Sicily, after which it was united to the diocese of Messina. P. 9450.

Regaldi (GIUSEPPE), b. at Novara in 1809; began the study of jurisprudence in the University of Turin, but failing in his first examinations he became disgusted, and, having heard the improvisatore Giustiniani, resolved to rival him. From 1836 to 1856 his course was a continual triumph; he improvised in all the principal cities of Italy, in France, in Switzerland, in Germany; visited Greece, Asia Minor, Mount Lebanon, and Egypt, and there gathered fresh inspirations. Many illustrious French and Italian

poets have written verses in his honor; among others, Lamartine. The creative impulse of improvisation having abated, he occupied himself in polishing his earlier verses and in composing new ones; a volume of these was published at Florence in 1874, and he has also written notes of his travels in prose; he was appointed professor of history in the Lyceum of Parma; then in the University of Cagliari, and finally, in 1866, in the University of Bologna.

Rega'lia [Lat., "royal," plural], the emblems of royalty, especially those used at coronations. Nearly all the British regalia, except those for Scotland, were destroyed during the Commonwealth, and most of those at present used date from Charles II.'s time.

Regat'ta [It.], used by the Venetians to signify a grand fête in which the gondoliers contested for superiority in rowing their gondolas. The term is now applied to all rowing or sailing matches indiscriminately, and especially to contests between yachts.

Regelation. See APPENDIX.

Regensburg. See RATISBON.

Reggel'lo, town of Italy, province of Florence, consisting of several small compact villages, one of which was strongly fortified by Florence in 1385. P. 11,000.

Reg'gio di Cala'bria [Gr. *Rhegion;* Lat. *Rhegium*], one of the most ancient and distinguished cities of Southern Italy, province of Reggio, situated near the right bank of the torrent Calopinace, on the seashore, in lat. 38° 7′ N., lon. 15° 40′ E. It lies S. E. of Messina, and commands a magnificent view of the Sicilian coast and of the mountain-range crowned by the fires of Etna. The Castor and Pollux, with St. Paul on board, waited there for a S. wind one day in Feb., 61 A. D. The town is compactly built on a gently-rising hill, and one broad street runs along the shore. Everything here is comparatively modern, as the earthquake of 1783 spared not a single house, but some of the churches are highly respectable architecturally, and possess fine pictures. Reggio, whose ancient name is said to signify "rending," and to refer to a physical convulsion which sundered Sicily from the mainland before the historic period, is believed to have been colonized by the Chalcidians, with whom were joined exiles of the Messenians about 723 B. C. It was the connecting link between Greece and her Magna Græcian colonies, and flourished accordingly. It was long and wisely governed by the code of Charondas, a Pythagorean, fragments of which are preserved by Stobæus, and which evince a strong and elevated religious sentiment. (For the legislation of Magna Græcia see Heyne, *Opusc. Acad.*, vol. ii.) Toward the end of the fifth century B. C., Reggio lost its republican organization, and in 387 B. C. fell, after a glorious defence, into the hands of Dionysius the Elder, tyrant of Syracuse. Under the Romans it rose again to wealth and magnificence. According to tradition, St. Paul himself formed the first Christian church here, and placed it under the pastorate of one of his own personal disciples, St. Stephen. The subsequent ecclesiastical history of Reggio is also of importance in the annals of the Church. In 410 A. D. it was burned by Alaric, and in 549 the renovated city was taken by Totila. Early in the eleventh century it was sacked by the Pisans, but, though constantly and cruelly suffering from the disasters common to all the large towns of Italy during the anarchy of the Middle Ages, yet it was an opulent and flourishing city in 1783, when a terrible earthquake laid it literally in the dust. Since then it has been only partially rebuilt, nor has it escaped being severely shattered by more recent earthquakes. There is at present some manufacturing activity here and a small maritime trade. P. in 1874, 35,250.

Reg'gio nell' Emi'lia, city of Italy, chief town of the province of the same name, situated in a most fertile plain, in lat. 44° 39′ N., lon. 10° 39′ E. Reggio is a walled town; the streets are broad, and many of them flanked by porticoes; the churches are imposing, and contain some precious objects of art, the solitary remnants of former riches. Here, over an altar in St. Prospero, once stood the world-renowned *Nativity* of Correggio, known as *La Notte*, now the glory of the Dresden gallery. Of the libraries of Reggio, once so celebrated, only about 70,000 volumes remain. The theatre of Reggio belongs to the first class of Italian theatres. The town has recently purchased and opened to the public a small house which was for a long time occupied by Ariosto, whose mother was born here. The Museum of Natural History is very interesting, and the Academy of Fine Arts deserves a visit. Outside the town there is a large asylum for the insane, said to be the best establishment of the kind in Italy. Reggio was a city of Cisalpine Gaul, but its origin is unknown, though it was probably founded or colonized under Æmilius Lepidus, from its name *Regium Lepidi* or *Forum Lepidi.* Frequent mention is made of *Regium* (*Forum Lepidi*) by Latin writers as a town of importance. Though, according to tradition, Christianity was preached here as early as 60 A. D., yet there is no evidence of the appointment of a bishop before the beginning of the third century. The town suffered severely from barbarians, from the exarchs of Ravenna, and afterward from the Guelph and Ghibelline factions. In the twelfth century, like so many other Italian communes, it formed itself into a commonwealth, and long maintained its independence. In the thirteenth century it was one of the prominent seats of mediæval learning. From the fourteenth to the nineteenth century, however, Reggio, with its neighboring towns, was generally under the dominion of the Este and Austro-Este house. In 1860 it united itself to the kingdom of Italy. Reggio is the commercial centre of a rich province, and there is considerable industry in the town itself. Sailcloth, leather, carriages, brooms, etc. are manufactured here on a large scale. P., including suburbs, 50,000.

Reg'giolo, town of Italy, province of Reggio nell' Emilia, about 7½ miles E. of Guastalla. The citadel, erected in 1242, still stands to recall the domestic factions and foreign assaults from which it suffered for ages. It is now a prosperous agricultural town. P. 6000.

Reg'iment [from Lat. *regere*, to "guide," "rule"]. The regiment of army organization has been compared to a *family*, over which the colonel exercises the paternal authority. It is, as its name denotes, a unit of administrative and governmental, rather than a tactical unit; which attribute belongs more properly to the *battalion* of infantry, the *battery* (or company) of artillery, and the *squadron* of cavalry. (See ARTILLERY, CAVALRY, INFANTRY.) In the British service the whole artillery *personnel* constitutes *one*, the Royal Regiment of Artillery. To regimental officers above the rank of captain the distinctive designation of *field* officers attaches; of which are, besides and inferior to the *colonel*, the lieutenant-colonels and majors. The lieutenant-colonel commands the regiment in the absence or disability of his superior, the duties of field officers being auxiliary to those of the colonel, and occasionally to command portions of the regiment, etc. J. G. BARNARD.

Regiomonta'nus (JOHANN MÜLLER), b. at Königsberg in Franconia June 6, 1436; studied mathematics under Purbach at Vienna, and astronomy at Padua; lived for some time at the court of Matthias Corvinus of Hungary, afterward at Nuremberg, and was invited to Rome in 1474 by Pope Sixtus IV. in order to reform the calendar. D. at Rome July 6, 1476—some say by the plague, others that he was assassinated by the sons of George of Trebizond, in whose writings he had demonstrated some glaring errors. His *Ephemerides ab Anno 1475–1506* (continued by Bernhard Walther) made him very famous among astronomers. Among his numerous other works are *De Reformatione Calendarii* (1489) and *De Triangulis Omnimodis* (1533). (See Alex. Ziegler, *Regiomontanus* (Langensalza, 1874).)

Registration. See RECORD OF CONVEYANCES, by PROF. J. N. POMEROY, LL.D.

Regnard' (JEAN FRANÇOIS), b. at Paris in 1655; travelled, after finishing his studies, in Italy; was captured by Algerine pirates, and not ransomed until after a captivity of two years; made a journey of exploration to the Arctic Ocean; visited Germany and Hungary; settled in 1684 at Paris; wrote comedies for the Théâtre Italien and the Théâtre Françaïse. D. in 1709. By French critics he is considered their best comic play-writer, next to Molière, and some of his plays, *Le Joueur* (1696), *Les Ménechmes* (1705), *Le Légataire universel* (1708), are still performed. Best edition of his collected works by Alfred Michiels (2 vols., Paris, 1855).

Regnault' (HENRI VICTOR), b. at Aix-la-Chapelle July 21, 1810; studied at the École Polytechnique of Paris; was appointed professor of chemistry at that school in 1840, in physics at the Collége de France in 1841; chief engineer of mines in 1847, and director of the porcelain-works of Sèvres in 1854. The first work of his which attracted attention was his *Action du Chlore sur l'Éther chlorhydrique* (1840), but his physical researches, especially concerning heat, gained for him his great reputation. In 1848 he received the Rumford medal from the Royal Society of London for his *Experiments to determine the Laws and the Numerical Data which enter into the Calculation of Steam-engines.* His celebrated investigations in verification of the law of Mariotte and Boyle were communicated in vols. xxi. and xxvi. of the *Mémoires de l'Académie des Sciences.* His *Premiers Éléments de Chimie* (1850), an abridgment of his *Cours Élémentaire de Chimie* (1847–49), has been translated into several languages.

Regnault (Jean Baptiste), b. at Paris Oct. 17, 1754; led for some time a roving life as a sailor, and visited both Africa and America; entered in 1771 the studio of the painter Bardin, whom he accompanied to Rome; gained in 1774 the great medal for his *Alexander and Diogenes;* became a member of the Academy in 1782, subsequently professor in the School of Art, and stood by the side of David at the head of the French school of painting till his death, Oct. 29, 1829. Among his most celebrated pictures are *Perseus and Andromeda* (1782), the *Education of Achilles* (1783), and *Cupid and Psyche* (1829).

Regnier′ (Mathurin), b. at Chartres, France, Dec. 21, 1573; was educated for the Church; accompanied Cardinal Joyeuse in 1593 to Rome, and returned with the duke de Béthune, French ambassador; was appointed canon of the cathedral of Chartres in 1609. D. in Rouen Oct. 22, 1613. In spite of his ecclesiastical position, he led a very dissipated life, but acquired, nevertheless, the surname *le Bon,* on account of his kind and pleasant manners. His *Satires,* sixteen in number, bear the same character; they are coarse, but full of humor, witty and striking, but free from all malignity. Best editions by Barthélemy (1862) and L. Lacour (1867).

Reg′ular Cler′gy [from *regula,* a monastic "rule"], in the Roman Catholic Church, ordained clergy who live under a monastic rule, as distinguished from the secular clergy or ordinary parish priests, and other clergy free from monastic rules. The regular clergy may, however, be appointed to act as parish priests, and frequently assist the seculars.

Reg′ulus [Lat.], a term handed down from the ancient chemists, meaning a mass of metal reduced from its oxide or other ore in a furnace or a crucible. Such metal is said to have been converted into the *reguline* condition.

Regulus (Marcus Atilius), belonging to an old plebeian family in Rome; was consul the first time in 267 B. C., and the second in 256. In this year, the ninth of the First Punic war, Regulus and his colleague, L. Manlius Vulso Longus, transferred the war from Sicily to Africa, and even after the return of Manlius with his part of the army, Regulus achieved great successes against the Carthaginians, and compelled them to sue for peace. Fortune turned, however, when Xanthippus, a Lacedæmonian general, was put at the head of the Carthaginian army. Regulus was defeated, his army was routed and nearly destroyed, and he himself was taken prisoner and carried to Carthage. Here he was detained for five years, but in 250, fortune having once more turned against Carthage, he was sent to Rome with a Carthaginian embassy, in order to support the envoys in negotiating a peace. In Rome, however, Regulus set aside every regard for himself and his fate, and, considering the proposed peace disadvantageous to his country, exercised all his power to dissuade the senate and people from accepting it. He succeeded, and returned to Carthage. The stories of his subsequent execution by the Carthaginians under horrible tortures are generally considered fables, but his lofty self-sacrifice for the good of his country made his name one of the most celebrated in Roman history, and gives an idea of what it was that made Rome the ruler of the world.

Rehobo′am [Heb., "enlarger of the people"], son and successor of Solomon. His mother was Naamah, an Ammonite. His accession, about 975 B. C. (Usher) or 990 B. C. (Hales), was the signal for the revolt of the ten tribes and the dismemberment of the kingdom. He d. at the age of fifty-eight, after a reign of seventeen years.

R. D. Hitchcock.

Reho′both [Heb., "streets," "open places," "ample room"], the name of three biblical sites: (1) In Gen. x. 11, one of the four Assyrian cities founded either by Asshur or, as most modern interpreters understand the passage, by Nimrod. It may afterward have become a part of Nineveh. (2) In Gen. xxvi. 22, a well dug by Isaac, recently identified with an ancient well, now filled up, 12 feet in diameter, in the wady *er-Ruhaibeh,* about 20 miles S. of Beersheba. Robinson and Smith found the wady in 1838, but did not see the well. (3) In Gen. xxxvi. 37, the city of an early Edomite king named Saul, described as being "by the river"—*i. e.* the Euphrates.

R. D. Hitchcock.

Rehoboth, p.-v. and tp., Bristol co., Mass., on Palmer's River, has 6 churches, 2 cotton, 2 saw, 2 grist, and 3 shingle mills. Agriculture is the leading industry. Nearly 5000 acres are covered by two vast cedar swamps, in one of which is a curious cave underneath Annawon Rock, so called from one of the principal Indian leaders in King Philip's war, captured there Aug. 28, 1676. (See Leonard Bliss's *History of Rehoboth,* Boston, 1836.) P. 1895.

Rehoboth, p.-v., Clayton tp., Perry co., O.

Rehoboth, p.-v. and tp., Lunenburg co., Va. P. 1570.

Rei′chenbach, town of Germany, kingdom of Saxony, has a large cotton-spinning mill and manufactures of woollens, hosiery, nankeens, laces, and damask. P. 10,198.

Reichenbach, town of Prussia, province of Silesia, on the Pailbache, has manufactures of woollen, linen, and cotton fabrics, oil, and tobacco, and an active trade in corn and hemp. P. 5824.

Reichenbach (Karl), Baron, b. at Stuttgart, Germany, Feb. 12, 1788; studied at the University of Tübingen, where he formed a secret association for the foundation of a new German state in one of the South Sea Islands, which awakened the suspicion of the French police and brought the author for a time into prison; devoted himself afterward to the study of natural science, and achieved considerable practical results by his ironworks and beet-root-sugar factory in Blansko, Moravia, and also some scientific triumphs by his discovery of different useful compounds, such as creosote and paraffine, but became most widely known by his singular half-mystical works on a new natural force which he called *Od—Physikalisch-physiologische Untersuchungen über die Dynamide des Magnetismus* (3 vols., 1849), *Odisch-magnetische Briefe* (1852), both translated into English; *Der sensitive Mensch und sein Verhalten zum Ode* (1854). D. at Leipsic Jan. 19, 1869.

Rei′chenberg, town of Bohemia, on the Neisse, is one of the most important manufacturing places of the Austrian empire, linen, woollen, and cotton stuffs of various kinds being made here extensively, besides leather, shoes, hats, firearms, gold and silver ware, and musical instruments. P. 22,394.

Rei′chenhall, a small town of Bavaria, on the Saale, contains very rich salt springs, from which more than 12,000 tons of salt are produced annually.

Reichstadt, Duke of. See Napoleon II.

Reid (David S.), b. in Rockingham co., N. C., Apr. 19, 1813; was admitted to the bar 1833; served in the State legislature 1835–42; was a member of Congress 1843–47; governor of North Carolina 1851–55; U. S. Senator 1856–61, and a delegate to the "Peace Congress" of Feb., 1861.

Reid (James), b. in North Carolina Apr. 5, 1795; joined the Virginia M. E. conference in 1815, and labored extensively and successfully in Virginia and North Carolina; did much to promote the cause of education in North Carolina, and in 1872 was elected superintendent of public instruction for the State, but died before entering upon the office; was a patriarch of the North Carolina conference at the time of his death. D. in North Carolina Nov. 8, 1872. T. O. Summers.

Reid (John Morrison), D. D., b. May 30, 1820, in New York; graduated at the University of the City of New York in 1839, and at Union Theological Seminary, New York City. He was admitted to the New York M. E. conference in 1844, and has preached in Western Connecticut, on Long Island, and in New York City; in 1858 became president of Genesee College, N. Y.; in 1864 was chosen editor of *The Western Christian Advocate* at Cincinnati, O.: in 1868 was made editor of the *North-western Christian Advocate,* and in 1872 a corresponding secretary of the M. E. Missionary Society.

Reid (Mayne), b. in the N. of Ireland in 1818; came to the U. S. 1838; visited New Orleans; ascended Red and Missouri rivers in quest of adventure; travelled through most of the States; settled at Philadelphia, where he devoted himself to literature; was a volunteer in the Mexican war, and distinguished at Chapultepec, where he was wounded, and has since been a voluminous and popular writer in London and New York, chiefly of romances of American adventure. Among his books are *The Rifle Rangers* (1849), *The Scalp-Hunters* (1850), *The White Chief* (1855), *The Quadroon* (1856), *Osceola* (1858), *The Maroon* (1862), and *The Castaways* (1870). A collective edition of his works has appeared in New York (15 vols., 1868).

Reid (Samuel Chester), b. at Norwich, Conn., Aug. 25, 1783; entered the U. S. navy as midshipman at an early age; commanded the privateer brig Gen. Armstrong in a two days' engagement with the boats of three British men-of-war in the port of Fayal, Sept. 26 and 27, 1814, resulting to the British in a loss of 250 killed and wounded, while the privateer was scuttled by Reid with a loss of only 2 killed and 9 wounded. The violation of neutral waters by the British led to a prolonged diplomatic controversy, finally decided by Louis Napoleon as arbitrator adversely to the American complaint. Capt. Reid was soon afterward appointed sailing-master in the navy; became warden of the port of New York, where he regulated

the pilot-boat service and erected signal telegraphs at the Battery and the Narrows. He was also the designer of the present U. S. flag. D. in New York City Jan. 28, 1861.

Reid (Thomas), b. at Strachan, in Kincardineshire, Apr. 26, 1710. His father was a minister, and his first instruction he received at home and in the parish school of Kincardine. In 1722 he was sent to Marischal College in Aberdeen, from which he graduated in 1726, and occupied a position as college librarian and studying mathematics and philosophy, until in 1737 he was appointed minister at New Machar in Aberdeenshire. His parishioners are said to have opposed his appointment very strenuously, and he had so little confidence in his own powers that he never himself composed the sermons which he preached, but used such as were published by English divines, especially Tillotson and Evans. Nevertheless, his life as a minister at New Machar turned out to the satisfaction of all. In 1740 he married, and in 1748 he published his first philosophical essay, *On Quantity*, in the *London Philosophical Transactions*—a criticism of the manner in which the mathematical terminology was used at that time in metaphysics and morals, especially by Hutcheson. In 1752 he accepted the position of professor of philosophy at King's College, Aberdeen, where he had to teach mathematics, natural philosophy, and moral philosophy; but in 1763 he moved to Glasgow as the successor of Adam Smith in the chair of moral philosophy. Here he published his *Inquiry into the Human Mind on the Principle of Common Sense*, in 1764, and read at the meetings of a philosophical society several papers, such as *Examination of Dr. Priestley's Opinion concerning Matter and Mind* and *Physiological Reflections on Muscular Motion.* In 1781, however, he resigned his office in order to devote himself exclusively to philosophical studies, and published *Essays on the Intellectual Powers of Man*, in 1785, and *Essays on the Active Powers of Man*, in 1788. D. Oct. 7, 1796. Originally, he was a disciple of Berkeley, but David Hume's *Treatise upon Human Nature*, published in 1740, showed him at once to what consequences idealism might lead, and roused him to independent speculation. In opposition to Hume's skepticism he tried in his *Inquiry into the Human Mind on the Principle of Common Sense* to establish a series of fundamental truths independent of experience and indisputable as primitive facts of the consciousness. On the Scottish school of philosophy, and more especially on the study of psychology, he exercised a considerable influence.

Reid (Whitelaw), b. at Xenia, O., Oct. 27, 1837; graduated at Miami University in 1856; after acting for a year or more as superintendent of the graded schools at South Charleston, O., bought the Xenia *News*, editing it for two years; joined the Republican party at its birth, speaking for Fremont; his newspaper was the first one in the West, outside of Illinois, to advocate the nomination of Mr. Lincoln; took an active part in the campaign; in the winter of 1860–61 went to Columbus as political correspondent for three daily newspapers; at the close of the session became city editor of the Cincinnati *Gazette;* at the outbreak of the civil war went to the front as war-correspondent of that journal; served on the staff of Gen. Morris in West Virginia with the rank of captain; at the close of the first West Virginia campaign returned to Cincinnati, and wrote for the *Gazette* until the beginning of the second campaign, and went again to the front, on the staff of Gen. Rosecrans; wrote letters under the signature of "Agate;" witnessed the entire battle of Pittsburg Landing, and his description of it gave him distinction among army correspondents; in the spring of 1862 went to Washington; was appointed librarian to the House of Representatives, and acted as correspondent of the Cincinnati *Gazette*, his despatches being duplicated for various other journals; was present at the battle of Gettysburg, and his description, written on the field, was a vivid narration of that engagement; in 1865 accompanied Chief-Justice S. P. Chase on a tour of the South, undertaken by the latter at the request of Pres. Johnson for the secret purpose of studying the condition and interests of the white and black races, and published *After the War, a Southern Tour;* during the next two years engaged in cotton-planting in Louisiana and Alabama, and published *Ohio in the War;* in 1868 returned to the Cincinnati *Gazette* and became one of its leading editors. Soon afterward Horace Greeley renewed his offer—made first in 1862—of a position on the *Tribune.* The invitation was accepted, and in 1869 he became managing editor. Upon the nomination of Mr. Greeley for the Presidency in 1872, Mr. Reid became editor-in-chief, and when the former died in the fall of that year he became proprietor as well as editor of the *Tribune.* J. B. Bishop.

Reid (Sir William), F. R. S., b. at Kinglassie, Scotland, in 1791; served as an officer of engineers in the Peninsular and American wars; was at Waterloo; became governor of Bermuda 1838, of the Windward Islands 1846, and of Malta 1851; was an active promoter of the British universal exhibition of 1851, knighted in that year, and became major-general in 1856. In 1848 he was chief engineer at Woolwich. He published several valuable essays on meteorology. D. in London Oct. 31, 1858.

Reids'ville, p.-v., cap. of Tatnall co., Ga.

Reidsville, p.-v., Rockingham co., N. C., on Richmond and Danville R. R., has 3 churches, schools, 1 weekly newspaper, 4 warehouses, and 15 tobacco-factories. Business, manufacturing tobacco. P. about 2000. Ed. "News."

Rei'gate, town of England, in Surrey, 23 miles S. of London, carries on a considerable trade in fuller's earth and sand used in the manufacture of glass. Its church contains several costly monuments. P. 15,916.

Reign of Terror, in the first French Revolution, may be said to have begun Jan. 21, 1793. On that day Louis XVI. was executed and the Committee of Public Safety instituted. It lasted till July 27 (9 Thermidor), 1794, when Robespierre was guillotined and the committee broken up.

Reil'ly, tp., Schuylkill co., Pa. P. 1890.

Reima'rus (Hermann Samuel), b. at Hamburg Dec. 22, 1694; studied at Jena and Wittenberg; travelled in Belgium and England; was appointed rector in Wismar in 1723, and professor of Hebrew and mathematics at the Gymnasium of Hamburg in 1727. D. Mar. 1, 1765. Author of the famous *Wolfenbüttelschen Fragmente*, which Lessing published in 1777.

Rein'deer [Icelandic, *hreindyr*], *Tarandus rangifer*, a species of the family Cervidæ, found in the northern parts of both hemispheres. The form is clumsier than that of the ordinary deer; the nose broad, covered with hair, and without a naked muffle; antlers are developed by the female as well as the male: these are very unsymmetrical, those of one side being more developed than those of the other, and are provided with an antero-basal snag, which is palmated at the end; the hoofs are spreading and adapted for progression over the snow; the young is uniformly colored, as in the adult, and not spotted, as in the young of most deer. In the Old World, especially in Lapland and some parts of Siberia, the species has been domesticated, and is raised for the milk afforded by the female as well as for purposes of draught. In Lapland it feeds especially upon a species of lichen. In the Glacial epoch the species extended much farther S. than at present, remains having been found as far southward as Italy in Europe and the Middle States in North America. Theodore Gill.

Rein'deer Moss, the *Cladonia rangiferina*, a lichen most abundant in arctic regions, where it forms the principal winter food of the reindeer. It is of a silvery-white color, even in summer. It is also used as an article of human food after having been boiled in reindeer's milk. It contains the nutritious lichenine, a form of starch. The reindeer digs it from beneath the snow with its horns, nose, and feet. It abounds in damp woods under evergreens in all the Atlantic States down to lat. 43°, and along the mountains much farther S.

Rein'er City, v., Porter tp., Schuylkill co., Pa., on Summit Branch R. R. P. 116.

Rein'kens (Joseph Hubert), b. at Burtscheid, near Aix-la-Chapelle, Mar. 1, 1821; studied theology at Bonn; took holy orders; was appointed professor at Breslau in 1857, but was suspended by the bishop of Breslau as one of the leaders of the Old Catholic movement; was consecrated bishop in 1873 by the Jansenist bishop of Deventer, and acknowledged by the German government as bishop of the Old Catholic Church. He wrote *Papst und Papstthume, Ueber päpstliche Unfehlbarkeit* (1870), *Die päpstliche Decrete vom 18. Juli, 1870* (1871), etc.

Reis'siger (Karl Gottlieb), b. at Belzig, near Wittenberg, Jan. 31, 1798; educated at Leipsic; studied music at Vienna, Munich, and in Italy; appointed director of music in 1826, subsequently chapel-master at Dresden, where he d. Nov. 7, 1859. Several of his operas, *Adèle de Foix, Der Schiffbruch der Medusa*, and especially his melodrama *Yelva*, were received with applause; his songs and his oratorio *David*, are more widely known. He was acknowledged to be one of the best leaders of his time.

Reis'terstown, p.-v., Baltimore co., Md. P. 479.

Relaps'ing [Lat. *relabi, relapsus*, "to fall back"] **Fev'er,** also known as **Famine Fever,** and, technically, as **Febris Recurrens.** Its nature is undetermined—by some regarded as a form of typhus, by others as due to malaria. It occurs only at intervals of some years, and then during seasons of privation and insalubrity, attacking chiefly the lower classes, ill fed and

housed. It has been so prevalent in crowded communities, as Liverpool, as to be regarded an epidemic and contagious disease, but careful study connects it with dietetic and telluric causes, prevailing in the form of a non-contagious endemic. Its formative or incubating stage is from four to ten days; rarely it is spontaneous in its development. Its onset is sudden; the patient, having been perfectly well at the time, is able to fix the exact time of the attack. It begins with an abrupt and severe rigor, or chill with nervous tremor, and immediate sense of extreme weakness. There is sharp frontal headache, pain in the back and limbs; then follow flushed face, thirst, dry tongue, high pulse, and a steady ascent of body heat. The facial expression and temperature are characteristic. The mind is unaffected, and the conscious face, with the sunken but clear and full eyes, wears a pitiable, helpless, appealing look. The complexion has a bronzed hue, and may be slightly jaundiced. The temperature steadily ascends during four or five days to 105°, 106°, 107°, 108° F.—an unusual fever heat unaccompanied by brain symptoms or danger of death. Physical examination may detect enlargement of the liver and spleen; the urine may contain not only albumen and urea in excess, but blood and casts indicative of acute congestion of the kidneys. The fever and extreme depression last from five to seven days, when, with some critical evacuation, as profuse perspiration, diarrhœa, or urination, a sudden abatement and rapid convalescence sets in. Appetite and strength are slowly returning, and the invalid is about, when, on the fourteenth day from the first attack, he is seized by a second or relapse resembling the first. Very rarely, a third, fourth, and even a fifth relapse, occurs. Relapsing fever, however severe, is rarely fatal. During the epidemic in New York the cases were in the general hospitals with other patients, and no evidence of contagion followed. The treatment during the active period is essentially antiphlogistic and expectant—cooling drinks, gentle saline laxatives, sponging, light diet; during convalescence, free use of concentrated liquid diet, tonics, especially liberal use of quinine and brandy.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Rel'ative Rank, of officers in the army and navy of the U. S.

Army.	Navy.
General	Admiral.
Lieutenant-general	Vice-admiral.
Major-general	Rear-admiral.
Brigadier-general	Commodore.
Colonel	Captain.
Lieutenant-colonel	Commander.
Major	Lieutenant-commander.
Captain	Lieutenant.
First lieutenant	Master.
Second lieutenant	Ensign.

The officers of the marine corps are of rank corresponding to that of those of the same titles in the army.

Release', in law. This is either the act of giving up a claim or right to the person against whom the claim or right exists, or the relinquishment of an interest or right to one who has possession of property or some estate in it. It may be considered under two general divisions: I. As to the surrender of a mere right of action in the law of contracts or torts; II. As applicable to the law of real estate.

I. A release of a mere right of action may take place by express words or by operation of law. The rules of law require a consideration (see Consideration) for a release of this variety. This rule may be satisfied without any actual consideration by executing a written instrument under seal, since that mode of execution precludes all inquiry into the consideration. Much stress is laid by law-writers on the use of particular words where the design is to acquit the releasee wholly from any obligation to the releasor. The word "claims" is recommended by Lord Coke as being as comprehensive a term as can be employed. The word "demands" is one of significance, and may usefully be selected. The courts construe a release with reference to its purpose, and though words of a general nature may be used, they will be confined in their effect to the true scope and object of the transaction. It is quite common to commence an instrument of release with a recital setting forth the specific result to be accomplished. If in such a case words of a general nature follow, their meaning will be restricted to the specific intent of the parties, as shown in the recital. A release by operation of law is one where, without any express design to discharge a claim, a party has so conducted himself that it is in point of law deemed to be extinguished. An illustration is found in the case where a creditor releases one of two joint debtors. The ordinary consequence of such an act would be to release the other.

II. The subject of release is of much importance in respect to the law of real estate. Releases have been arranged by law-writers into five classes: (1) where they pass an estate, (2) where they pass a right, (3) where they operate by way of enlargement of an estate, (4) cases of extinguishment, (5) cases occurring by way of feoffment and entry. Each of these cases will be best understood by an illustration.

(1) This case is illustrated by that of a conveyance from one joint tenant to another. (See Joint Tenancy.) As each joint tenant in contemplation of law owns the whole estate, a conveyance by his co-tenant prevents the operation of the rule of survivorship, and gives the grantee the entire estate. The word "heirs" need not be used in this case, though it is indispensable in the absence of a statute in other cases to convey a fee.

(2) This consists in passing a right to one who has a defeasible estate. Thus, if an owner is disseised (see Disseizin), and his estate divested so that he has only remaining a right to sue, he may release this right, and the disseisor would thus become absolute owner in fee.

(3) Release by enlargement is exhibited in a case where a landlord gives up to a tenant in possession his own or so-called reversionary interest. In this case there is an existing relation between the parties known as "privity," and the tenant must have an estate in the land which is susceptible of being enlarged.

(4) Instances of a release by way of extinguishment are of an easement (see Easement), such as a right of way released to the owner of the land, or of a rent charged upon it relinquished to the owner. These are incorporeal rights belonging to one person and exercised over the land of another, and are capable of being extinguished by this form of release.

(5) An instance under this head is that of one of two or more disseisors receiving a release by the rightful owner of his claim. In this case he becomes owner in fee to the exclusion of his companion.

It is common in this country in all of these cases to make use of an ordinary deed, either with or without covenants as the parties may prefer. If no covenants are introduced, the instrument becomes a mere quit-claim deed or simple release. It is usual in a release of a wife's claim of dower to require a private examination before a magistrate or other official person, separate and apart from her husband, whereby she acknowledges that she executes the conveyance freely and without fear or compulsion of her husband. The officer makes a record of the acknowledgment, which must comply with a prescribed form. This release can only be resorted to in favor of some one having an interest in the land—*e. g.* the grantee of the husband—and he should unite with the wife. A release cannot be made to the husband. However, an agreement can be made before marriage creating a jointure (see Jointure), which will preclude a woman after marriage from claiming dower. These technical rules do not apply to a widow, and she can make a release of her rights to dower before it is set apart to her by the modes usually adopted in conveyances. In determining whether a transaction amounts to a release, reference need only be had to its effect, and the classifications above given are only useful from that point of view.

T. W. Dwight.

Relig'ion [Lat. *religio*], in the widest reach of the word, comprehends all frames of feeling, all forms of faith and acts of worship, to which man is impelled by his fears or drawn by his hopes toward superhuman beings and powers or their visible representatives. It originates in his nature and circumstances, and is as early in its manifestations, as constant in its character, as universal in its influence, as any sentiment or principle of action marking the history of man. Wonder, born of ignorance, fear, and weakness unite to produce veneration. The sense of dependence, the awe of power, the curiosity of a being to whom effects suggest causes, the play of imagination natural to man—above all, the suggestion of the existence of spirits greater than his own to a being who feels himself to be a spirit,—these are sufficient to account for the general phenomena of man's religious history. Outward Nature, with her illimitable sky, her sun and moon, planets and stars, her oceans and mountains, her dark forests full of weird voices, her monsters of sea and land with their roar and hiss—earthquakes, volcanoes, eclipses, fountains springing up in deserts, rivers running under ground, caves and cataracts, the change of the seasons, life and death,—these from the earliest times have prompted in man or forced upon him a faith in creative, mastering, invisible, or superhuman beings and powers, evil and good, demons and angels, for whom he has felt a shuddering reverence, a cowering dread, and an awestruck desire to propitiate their favor or their mercy. Conscience, the most important permanent factor in religion, is obviously weakest in the infancy of the sentiment. The exploration of the globe by modern curiosity under new conditions of locomotion

has laid open as contemporaneous facts the feelings and habits of races and tribes at different stages of development, answering generally to what may be supposed to have been the successive stages of the race in its natural religious history, so that anthropologists are not left wholly to inferences from imagined conditions to imagined results for their knowledge of the past. The study of comparative religion goes on now as the study of comparative philology goes on—not by guess and hypothesis, but by direct inquiry into positive facts lying open to competent scholars willing to take the pains to observe them. It is affirmed, as a part of this testimony, that tribes have been found among the lowest of known survivals of savage humanity in which religion either as a sentiment or as a custom is unknown. If the reported fact were verified, it would afford one of the strongest cases in which the exception proves the rule. Yet, as we not seldom find in the midst of the more advanced civilization not only individuals, but families and even neighborhoods, where both superstition and religion have ceased to have any apparent existence, it is not inconceivable that tribes may have existed, or may still exist, so nearly brutal in their habits and feelings as to be below the influence of either hopes or fears drawn from the inward nature or the usual and characteristic ideas and tendencies of humanity. We mainly study language not in the brogues and gibberish of tribes isolated and left behind, but in the tongues of historical peoples who have inherited the language of ancestors that have been in the line of one of the great branches of human progress, if not a part of the main stream. It is enough to say of religion that from a very low, if not the lowest, stage of known and recorded history, it has been a characteristic experience; that it seems inconceivable that man should advance many steps beyond the more intelligent brutes without developing a sentiment of religion; and it is certain that this sentiment has grown with the growth and strengthened with the strength of his more strictly human faculties. It covers a space in man's history not exceeded by that of any other interest. Religious prepossessions and customs have been a principal cause of the coherency of tribes and nations—have influenced man's choice of and submission to rulers, largely shaped his social and domestic customs, been his first impulse to the careful observation of natural phenomena, and his leading inspiration in the first and in the last endeavors of art. The path of the world's progress is retraceable to antehistoric times in the ruins of temples, shrines, and altars. Religion offers a clue—which is only exceeded in interest by that of language, itself a history of religion—into the deepest and darkest recesses of the past. A comparison of the mythology of ancient peoples develops the evidence of an extraordinary sameness in the religious needs and religious customs of humanity, due in part to like causes and conditions producing like effects; in part to survivals of early common traditions among widely-scattered peoples with some portion of their past in common; in part to conquest or invasion of weaker by stronger races, or more commonly of violent hordes occupying the country of races of more advanced thought and nicer feelings, who have conquered their conquerors by communicating their laws, customs, and faith to those who had taken away their political independence.

The characteristic feature of the present era is the adoption among all leaders of science and thought of the idea of unity in human fortunes and interests. The boundaries between ancient and modern history, or the classical and the romantic in literature and art, are nearly obliterated. One key, a common human nature in a common surrounding of terrestrial and celestial influences, is applied to all ages and races, and has opened gates that were thought permanently closed. Perhaps nothing has been more humane and helpful to the race than the falling of the fences that long separated religions from each other as having no common root and no common sap. In place of superstitions we now have mythologies; for *false* religions we now have imperfect developments of a common sentiment of religion; and the most advanced have, with the most backward, a more or less complete sense of the provisional or partial character of their forms of faith and worship. With a recognition of the superiority of some religions over others, when measured by a sense of the highest wants of man yet known to us and of the best civilization yet reached, there is an equal sense of the wisdom of the providential law which has accommodated religions, sentiments, and customs to the needs and capacities of different races and different regions, and a pause in the indiscriminate desire to force even better religions upon peoples who have not through commerce and culture yet reached a level on which they can advantageously be seen and felt. Thus, Christian missionaries have adopted commercial, educational, and social instrumentalities as necessary preliminaries for the successful teaching of their faith, and with much advantage to their cause.

To admit that the religious sentiment is an original, a universal, or a characteristic experience of humanity is to confess its vast importance and essential beneficence; but it is unscientific to assume that it is any less liable to abuse, exaggeration, or perversion than any other great sentiment or passion of the race. In proportion to their significance and indispensableness, human feelings are liable to be turned against the interests they are ultimately designed to nourish. If religion has been the nurse of imagination, the fountain of poetry, the cement of nationalities, the spur of spiritual speculation, the anchor within the veil which has held the vessel of our common fortunes with its head toward an unseen futurity, it has been also the fountain of debasing terrors, devastating hatreds, obstinate prejudices, paralyzing fatalism, narcotic dreams, and delirious fancies. Like the imagination, without which it cannot exist—the power by which man makes the future present and realizes the unseen, the most creative of human endowments, and the most prophetic among the elements of reason—religion is equally capable of illuminating the understanding or clouding its light; of stimulating the conscience or of inflaming it; of making the passions its useful servants or its mischievous emissaries. Like the beneficent sun, which draws pestiferous miasmas from the swamp and fruits and flowers from the drained hillsides, religion is wholesome or noxious in its influence according to the condition of the other faculties and the proportion in which other elements are present and operative in those whom it visits. The uncandid effort to escape this testimony of history by making a distinction among religions, as if a single one had any exemption from the rule, is now very generally abandoned. There is no one of the chief religions of the world which has not been found capable of sustaining or producing samples of exalted forms of human character, or of being either perverted or used to justify the fiercest cruelties, the most abject debasements, and the most injurious passions. It is now plain that religion is elevating or debasing, inspiring or intoxicating, favorable to real progress or retarding to it, according as it unites itself with other elements—with knowledge or ignorance, truth or falsehood, self-control or self-abandonment, civilization or barbarism, peaceful habits or warlike propensities, coarse tastes and brutal customs or refined feelings and softened manners. No form of religion, however primitive and crude in its original beginning, has ever failed to be interpreted and used for wholesome purposes when it has fallen into cultivated hands; and no form of religion, however pure and lofty its source, has ever failed to be corrupted and made tributary to lust, rapine, and ambition when it has fallen into the hands of ignorance, sensuality, and self-seeking. Polytheism in all its varied shapes seems the necessary form of earlier religion. Pure theism, scientifically speaking, is as impossible a beginning in religions as monarchy in government among scattered tribes, each with its own chief. As families were successively lost in tribes and *gentes*, and these in the *gau* or shire, and these again in the little kingdoms which were finally absorbed into great nations under a common government, so, inevitably, the imagined gods of the groves or caves or fountains, and of the separate interests and pursuits of earlier humanity, lessened or lost their places as men by acquaintance and comparison took more comprehensive views of space and events, saw better the connections of things, felt more the force of common laws and a common nature, and observed more order and less caprice in the seasons and the elements.

The independent development of social or personal morality has had a great influence on religion. The religious and the moral sentiments have neighboring but independent roots. It is not respect for right, nor a sense of justice, nor a love of excellence that first starts religion, but awe of power, the fascination of mystery, the dread of the unknown, and the indulgence of a terrified but exalted fancy. The conscience, now scientifically regarded as the least-suspected witness for the existence of a future life and of a personal God, was not the original guide to faith in the invisible. It was more the fear of power than the sense of wrong or the suggestion of an arbiter of duty. But whatever feeble function Conscience may have had in the early history of religion, her power in shaping and purifying faith and improving the form of religion cannot well be exaggerated. Nor can the power of purified and enlightened religion in improving morals be any more easily overstated. Positive religions must probably be rated in value by the declining proportion which the purely religious impulse of worship, dread, and awe bears to the less strictly religious element of moral obligation, the love of justice, respect for human rights, and personal purity. So long as the gods or the supreme god were considered as free from the obli-

gation of justice, truth, purity, and were chartered libertines in caprice, it is difficult to see how social or personal morality could have derived any strength or encouragement, any sanctity or support, from their worship; and until morality had developed itself in human experience, in its tendency to produce self-respect, peace, and order in society, it is hard to imagine how any pure conception of the gods or the chief divinity could have been possible to humanity. It is fortunate for the permanent interests of man that faith and morals have independent roots in his nature, and each original and permanent resources of power. It is not always that the most religious have been the most moral, or the most moral the most religious, for morality and religion are in a manner rivals, as well as allies, and each tends to hold its separate court and maintain its own sovereignty. It is, however, in the struggle of these two independent factors that the finest powers of both are developed, morality purifying faith, and faith exalting morality. Each has its own danger—one, the tendency to use only its wings; the other, only its feet. Together they walk the earth or soar into the skies. The virtues and graces of the most advanced humanity come at last to pass only as hints and suggestions of the holiness and mercy and grace of the gods, while the moral and spiritual ideals thus attained rebuke and exalt the practical actual morals of society and its purest leaders.

The vast function of personal genius, religious and moral, independently of all disputes about inspired men and inspired founders of religions—a topic on which in an article on religion in its universal form it would be impertinent to dogmatize—is now generally recognized. That individual men and women have had here and there, by birth and original constitution or by special inspiration, a genius for religion beyond their times and above their circumstances, and have been able to command the reverence and faith of disciples and to lift up by their own single souls the general level of the generation or race to which they belong, is certain. Excepting Brahmanism there is no great religion which has not had a personal founder.

Scientifically speaking, the prospects of a universal religion are much increased by the discernment of the common bond among all religions and the recognition of the basis of a common nature and common tendencies: for what has been taken up or imagined, not in caprice or by accident, but in the interest of human wants and needs, may again be laid down under an improved sense of these needs and wants when man is put into possession of the means of a better supply. So long as religions were considered capable of classification only into true and false, divine and human, nothing was possible but a conflict between them—a surrender on one part, a victory on the other. This does not seem to be the method of progress among the sects of the religion of Jesus. They do not conquer each other, but coalesce by a perception and adoption of what is good and helpful in each other's thought or experience; by meeting at points common to all, or by a common advance, or by uniting higher up than the plains on which their old battles were fought; and their method seems to be the type of the method likely to be pursued by the religions of the globe in their tendencies toward unity. As civilization seems to be slowly returning to the long-stationary seats of its earliest appearance, so it is indicated that the religion of the more civilized portions of the race will return, perhaps to find unexpected allies and increased breadth and power, to the regions near where it started. Other things being equal, the sceptre of power and influence in the world has never gone with quantity, but always with quality. It is not Chinese myriads that threaten universal empire, but the sway of the few smaller nations that have understood and conquered the elemental forces of nature and made living literature and high civilization.

It is in vain to offset the prospects of the ultimate spread of a religion which has won the love and trust of all highly-civilized peoples—though its roll may now contain less than a quarter of the population of the globe—with the dead weight of the religions which still hold so vast a majority in the effete or less energetic or unprogressive regions of the earth's populations. Apart from all supernatural assistance, Christianity, by the necessity of its more comprehensive, humane, and practical character; its power to assimilate social and political experience; its singular independence of race, place, and time; its hold on the past, its grasp on the future; the beauty and eloquence and historical value of its records; its survival and pacification of the strifes it has engendered, and its exceptional power to profit by its most trying experiences; the key it offers to the significance of other religions, and the hospitality with which it receives what survives their wreck; its identification with a civilization that is steadily claiming the whole world for its area,—by all these signs and claims Christianity shows itself to have the only fair chance ever yet possessed by any faith of becoming the religion of universal humanity.

The several modes of religious belief and worship are treated in this work under their appropriate heads. We add for convenience a tabular view of the adherents of the principal religions, reckoning the whole population (according to Prof. Schem):

Population of the globe	1,350,200,000
Greek Church	69,692,700
Six other Oriental churches	6,500,000
Roman Catholics	195,000,000
Protestants	97,139,000
Mohammedans	160,000,000
Boodhists	340,000,000
Other Asiatic religionists	260,000,000
Pagans	200,000,000
Jews	6,000,000

H. W. BELLOWS.

Religious Amendment to the Constitution of the U. S. It is a fact well known that the Constitution of the U. S. contains no acknowledgment of God as the ultimate Source of all legitimate civil authority, nor of the Scriptures as the supreme rule of national conduct, nor of the Lord Jesus Christ as Governor among the nations. A considerable number of Christian citizens have always considered this omission a prime defect in our otherwise admirable national charter, and at least one entire religious denomination—the Reformed Presbyterian—has for this reason refused to incorporate with the government. To remedy this defect is the avowed object of the "Religious Amendment" or "Christian Amendment" (or, as it is now more broadly designated, the "National Reform") movement. Its purpose, summarily stated, is to secure such an amendment to the Constitution as shall be an appropriate recognition of God, and at the same time furnish a constitutional guaranty for the existing religious elements of our national life. The advocates of this movement disavow all desire or intention of uniting Church and State; indeed, they are among the most strenuous opposers of such a union. They maintain that the proposed reform is so entirely unsectarian, of so broad and catholic a character, and that the proposed amendment so accurately defines the relation of the state to God, as to preclude the possibility of a union of Church and State so long as it should remain an integral part of the Constitution. This movement being the determined foe of "secularism" in all its protean forms, assumes a profoundly interesting and practical aspect as the defender of all the religious elements of our national life, now so openly and persistently assailed. It takes a determined stand in favor of the Christian Sabbath, the employment of chaplains in Congress, the army, navy, and other public institutions, the continuance of the oath as essential to the administration of justice, the maintenance of the "Bible in the public schools," the preservation of the law of Christian marriage, the appointment of days of fasting and thanksgiving under appropriate circumstances, etc. The advocates of this amendment ask nothing new; only the preservation of that which already exists. "We propose the adoption of no new principles and no radical change of customs. We propose only to recognize as a fundamental principle in the national written Constitution that which has been a universally-recognized principle of national life from the first. We aim not at change, but at conservation. We want to preserve through all coming time, and consistently carry out in all departments of law, the hitherto universally-admitted fact that Christianity is an element in the common law of the land." (*Speech of the Rev. A. A. Hodge, D. D., before the Pittsburg National Convention of 1874.*)

Reasons enforcing the Amendment.—Numbering as it does among its advocates many of the most profound thinkers of the country, this reform movement is based on fundamental principles, and urged by arguments drawn from every department of human thought connected with the science of government. A brief outline of the argument is all that can here be attempted.

I. Government is a divine and not a merely human institution. "There is no power but of God; the powers that be are ordained of God. Whosoever, therefore, resisteth the power, resisteth the ordinance of God." This doctrine, so clearly enunciated in Scripture, is in entire accordance with the deductions of reason. The state is an organic unity, an organism, not an organization—an organic unity composed of parts, and as these parts cannot determine the whole, the nation must proceed from a power higher than itself. The same view is confirmed by reference to the power with which the state is invested. "The state is a power claiming and exercising supreme jurisdiction over a certain portion of the earth. Here it acknowledges no superior unless it be God. It is the sovereign arbiter of life and death. It fixes the civil status; it regulates the social action; it determines, either directly or permissively,

either wholly or partially, according to its sovereign pleasure, the rights, duties, and relations of all human beings within its territorial sway;" and again, "It is, however, enough for us here to present the picture of an omnipotent earthly power, a power of life and death, claiming unlimited and illimitable control over millions of human beings, now existing, over generations yet unborn—determining, in fact, how they shall be born." (*Essay*, by Prof. Tayler Lewis, LL.D., read before the convention in Cincinnati, 1872.) It is urged that an institution wielding a power so vast must be amenable to the higher law of a higher power, and that this should find expression in the written Constitution.

II. Philosophical writers on the science of government make a distinction between the providential, real, and vital constitution and the verbal or written constitution. The former is the foundation of the latter, and that which gives it validity and vitality. The written constitution should therefore embrace and recognize all the more potent elements of the national life. But among these elements, in the U. S., Christianity occupies a foremost place. It pervades and permeates our institutions; it is the preservative element, the inspiring soul of the nation, and therefore has a right to recognition in the fundamental law, not as a compliment, but as a right, not as a theory, but as a fact and a necessity.

III. It is maintained that the U. S. is a *Christian* nation—not a pagan nation, nor a Mohammedan nation, nor an infidel nation, nor a nation indifferent to all religions, but a *Christian* nation. In proof of this position reference is made to our past history, as well as to the present administration of our government. "The fact that our government always has been connected with Christianity as it never has been connected with any other religion is so patent a fact of history as to need only to be stated. The men who came to this country and originally settled it were for the most part Christians. They acknowledged Almighty God and Christ and the Bible. The Christian religion was the religion by whose teaching they sought to regulate all their affairs. This connection between Christianity and the administration of our government still exists. Christian ministers are employed by the government in public institutions as chaplains; prayers are offered in our State legislatures and in the halls of Congress; the Bible is in our schools and the oath in our courts of justice." (Rev. D. McAlister, *Address at the N. Y. Convention 1873.*)

IV. Neutrality in religion on the part of the government is impossible. It must be for Christianity or against it. "Byron puts a truth in Satan's mouth: 'He that has not bowed to God has bowed to me.'" Professed non-religion sooner or later manifests itself as irreligion. Government is brought into contact with religion at too many points to admit of neutrality. The demand of secularism for the abolition of every religious feature of our national life demonstrates the utter impossibility of neutrality. Theistic or atheistic the nation must be from the necessary conditions of its existence.

V. Our present condition necessitates a movement of this kind. Vast numbers of persons holding secular, infidel, and socialistic theories of government have come to us, and are disseminating the poisonous leaven of their principles; political corruption of the most appalling character pervades almost every department of our public administration; the great question of education is before the nation as it never has been before, and its character as religious or irreligious must soon be determined. These and similar facts demand a constitutional guaranty for our religious institutions.

History of the Movement.—At a large meeting for prayer and Christian conference held in the town of Xenia, O., Feb. 3, 1863, and composed of delegates from eleven States, a paper embodying most of the fundamental principles of the movement was presented by John Alexander, Esq., and favorably considered. An association was subsequently formed. Various meetings were held in different parts of the country. The first general convention was held in Allegheny City, Pa., Jan. 27, 1864. *The Christian Statesman*, the special organ of the movement, was started in 1867. The first truly national convention was held in Pittsburg in 1870, the second in Philadelphia in 1871, third at Cincinnati in 1872, fourth at New York in 1873. The fifth was held in Pittsburg in 1874, and was by far the largest and most influential of the series, being composed of more than 1000 delegates from most of the States in the Union. The sixth national convention will be held in June of the present year (1876) in the city of Philadelphia, during the Centennial celebrations.

Organization.—Hon. Felix R. Brunot of Pittsburg, Pa., is president; Rev. D. McAlister of Walton, N. Y., is general secretary; Rev. T. P. Stevenson of Philadelphia is corresponding secretary; Rev. W. W. Barr, Philadelphia, is recording secretary; and Samuel Agnew, Esq., of the same city, treasurer. The society numbers among its vice-presidents many of the most eminent names in law, theology, science, and literature in the country.

Literature.—*The Christian Statesman*, published in Philadelphia, is the organ of the society. The proceedings of a number of the large conventions have been published in pamphlet form, and contain the addresses of the ablest advocates of the movement in full. Among works bearing directly or indirectly upon the questions discussed in the progress of this reform may be mentioned *The Nation*, by R. A. Mulford; *The American Republic*, by O. A. Brownson; *Divine Aspects of Human Society*, by Bishop Huntington; *The Oath*, Rev. D. X. Junkin, D. D.; *The Constitutional Convention*, by Judge Jamison; *Political Fallacies*, by Rev. George Junkin, D. D. Articles in various reviews by Dr. McIlvaine, Prof. Tayler Lewis, Prof. Charles Hodge, D. D., Hon. Prof. Seelye, discuss either the general or particular phases of the movement. J. R. W. SLOANE.

Religious Amendment to the Constitution. The argument in support of the proposed amendment necessarily assumes the following premises: That the supreme providence of God is exercised over all human affairs; that nations are organic societies possessing a distinct moral character; that by virtue of this moral character they rest under obligations toward God in addition to the obligations of their collective members, and that for a violation of such obligations penalties are incurred. These assumptions must be made, because the act of divine recognition which it is insisted should be performed is to be in every sense a national act, without any reference to the opinions, beliefs, or conduct of the individual citizens, and its necessity is wholly independent of such opinions, beliefs, and conduct. If the foregoing facts are accepted as true, still they do not support the argument, but on the contrary furnish its complete refutation. If the state is a moral entity, possessing a moral character, capable organically of doing right and wrong, the quality of its acts must depend upon their intrinsic nature, and not upon their outward appearance; it will be judged by what it really *is*, not by what it professes to be. The story of the Jewish people, as detailed in the Holy Scriptures, gives a conclusive answer to the inferences drawn by the advocates of the proposed measure from the moral quality and attributes of the state. That history shows that God, in his dealings with nations as with individual men, looks at the substance and not at the form. Public acknowledgments of him, professions the most absolute of accepting him as the supreme Ruler and Governor, even the establishment of his worship as the only national religion, are of no avail—on the contrary, they are an offence—unless the laws are enacted, the government is administered, and the people live in conformity with those principles of righteousness, holiness, and justice which find an expression in his divine law. The theory which underlies the advocacy of the suggested amendment presupposes that the relations of God toward all political societies are the same as those which he sustained to the Jews, although the Scriptures expressly declare that they were a peculiar people and that their condition was anomalous. We shall, however, for the present concede that the assumption is well founded, and admit that in the chronicles of that strange race are disclosed the essential obligations of nations to the Almighty and the universal methods of his providence toward them. What was the nature of the moral duties imputed to the Jewish commonwealth? For what and whose faults was it condemned and punished? The state was always identified with the people who composed it, as well as with the rulers who governed it. The duties of the people, not as an organic unit, but as a collective mass of individuals, and the duties of the rulers, also considered as persons, were treated as the national obligations. For the wrongful acts and omissions of people and rulers alike the direst punishments were inflicted, which fell equally on all classes of citizens, the guilty and the innocent. The entire history, from the Exodus and the first wanderings in the desert to the rejection and death of our blessed Saviour, demonstrates beyond the possibility of doubt that whatever of a moral character inheres in the state as a political society, whatever of a moral quality is attributed to its acts, is inseparable from the individuals who compose it, and depends upon the acts and defaults done by them or by those who represent them in administering the government. If all the people of a particular state—officials and private citizens—regulated their conduct in accordance with true Christian principles; if they all faithfully discharged their duties as Christian men; if all the laws were so framed and the government was so administered as to promote justice and equity; and finally, if all the intercourse with foreign powers was based upon the golden rule of Christian ethics,—that people and

state would be Christian, and any formal assumption and announcement of the Christian character could add nothing to the reality. But if the reverse of this pleasing picture be true—if a people are guided by no ethical principles in their personal conduct; if they habitually violate all public and private moral duties; if the laws are contrived to sustain wrong and injustice; if oppression, fraud, and corruption pervade all branches of the government,—it is plain that the most formal and explicit recognition of the divine sovereignty by such a state, the acknowledgment in its organic law of the entire Christian creed, could not in the slightest degree alter its moral and religious status—could not be other than a solemn mockery. These are, of course, extreme cases, but they show that, upon the very assumptions made by the advocates of the proposed measure, and upon the very theory of the divine providence which they maintain, the amendment of the Constitution can of itself work no change in the national character, no alteration in its moral quality, no effect upon its relations with the Deity. There must be something far more than this empty show; and when that required condition is attained, the mere profession is useless. To suppose that God would be pleased by such an empty form consciously enacted by the government, and that his favor would be propitiated by it, is a conception of him so low and grovelling as to be hardly less than blasphemous.

There is another ground, however, solid, rational, and truly Christian, upon which we prefer to place the matter, and to finally rest the case. Christianity first introduced into the world the true notion of religion. In defining the proper functions of the Church it also determined those of the State; it fixed their respective limits and marked out independent domains in which each may act without encroaching upon the other. This grand revelation, lost sight of when the early Church became triumphant, and hidden through many succeeding centuries, has reappeared in our own day; and the revival marks a distinct epoch in the progress of Christian civilization. In all ancient communities religion formed a part of the state. Laws, institutions, the very social fabric, were based upon it, and the Jewish commonwealth was not an exception to the universal principle. Religion was everywhere and at all times a matter of the state—of state policy and of state craft. With Christianity first came the conception that religion is chiefly concerned with the relations between the individual man and his Creator. To preserve its truths and to perpetuate its benefits a society was established having no connection whatever with the state, wholly independent and voluntary—the *Church*. The people of the U. S., in framing their organic law, returned for the first time in many centuries to this original and authentic plan, and placed the nation and the Church in exactly the same relations to each other in which they were left by Christ himself and his apostles. According to this system, the state cannot be fairly described as a godless society, since it forms an essential part of the divine order as truly as does the Church. It is appointed, however, to accomplish certain specific purposes, which it can best subserve by leaving to the Church alone the care and the propagation of the religious truths which were primarily confided to its sole custody. In this manner the State and the Church correlate each other, each fulfilling its own ends and acting within the sphere assigned to it by Divine Providence. The State gives to the Church all that it needs—protection and security, the support of equal laws, the power to develop its own resources, and the opportunity to accomplish with perfect freedom its high mission. On the other hand, the Church, as the depository of sacred truths, reacts upon the State; its teachings pervade and influence society, mould the characters of citizens, and elevate all legislation and administration to the lofty standard of Christian ethics, until the national jurisprudence becomes the expression of Christian thoughts and principles reduced to the form of practical rules for the regulation of human conduct. In this manner alone can the state, considered as an organic unit, be properly termed Christian. At the same time this absolute freedom granted to the Church, this releasing it from all legal connection with the civil authority and from all subjection to the civil power, necessarily involves a like freedom given to all other forms of religious belief—to Jewish, Mohammedan, and pagan creeds, and even to the denial of all beliefs. All these conflicting forces meet within the body politic; they are all left equally free to promulgate themselves, and thus the triumph of the truth is made certain. Such, in brief, is the theory upon which the U. S. has acted in constructing its organic law and its subordinate legislation; it is the theory upon which the relations of the primitive Church to the Roman empire were constituted; it is the theory which is being widely accepted by the wisest statesmen, jurists, and divines of Europe; and it is the theory which the advocates of the proposed amendment would now abandon. The history of Christendom from the time of Constantine to the present day shows in the clearest light the workings of the opposite principle, and its disastrous effects both upon the Christian Church and the religion which it was intended to perpetuate, and upon the State and the civil and political rights which it was designed to secure. The complete separation of these two societies, the absolute freedom with which each is left to fulfil its own special mission untrammelled by the other, was perhaps the greatest benefit conferred by the founders of this republic upon humanity. An alteration of the national Constitution, by incorporating with it the religious amendment, would be the surrender of a grand principle—a principle which has proved to be alike essential to the highest interests of religion and of the civil government.

JOHN NORTON POMEROY.

Religious Liberty. See LIBERTY, RELIGIOUS, by PRES. J. L. M. CURRY, S. T. D., LL.D.

Religious Orders. See MONACHISM, by T. M. POST, S. T. D.

Rel'iquary [Lat. *reliquiæ*], in Roman Catholic churches, a case or shrine, often of costly materials and highly adorned, and containing the relics of some saint.

Remain'der [Lat. *remanere*, to "remain back"], in law. This is a technical expression to designate a future estate in land, created at the same time and by the same transaction as a prior estate, called a particular estate. An illustration is found in the following case: An owner of land grants it to A for a period measured by his life, and at the same time grants the residue of his interest to B. The former is said to have a particular estate, and the latter a remainder. It will be observed that the two estates in the case supposed, taken together, constitute the entire interest in the land. A remainder can only be an estate which remains after the grant of a prior estate less than the whole interest of the grantor. It accordingly follows that when the entire estate has thus been granted by way of remainder or otherwise no further estate can be created *by way of remainder*, although it might be sustained upon some other theory. Thus, if an owner should devise his land in fee, and further provide that if the devisee should die without issue surviving at his death the property should belong to B, the provision in favor of B would be void considered as a remainder, though it would be upheld for the purpose of effectuating the testator's intention, and be valid as a so-called "executory devise." Remainders are divided into two principal classes—vested and contingent. A remainder is said to be *vested* when the *right* to the future enjoyment is fixed, though the possession is postponed. It may be vested in right even though it never come into possession. Thus, if A have an estate for life, and B have a succeeding estate for his life, the remainder in B's favor is vested, though he may die before A, and thus never come into actual possession. A convenient test of a vested remainder has been suggested. Suppose that the prior estate should instantly terminate, is the person claiming the remainder entitled to immediate possession? If so, the remainder is vested; otherwise, it is contingent. A contingent remainder, therefore, is one where the *right* itself is not yet fixed and certain. An instance is found in the case of a remainder given to an unborn or unascertained person, or made to depend upon an uncertain event. Thus, if an estate were given to A for his life, and if B should survive C, then to B for his life, it is plain in this case that while all the parties named live the right of B is contingent and uncertain. If C dies during the life of A, leaving B surviving, the latter's right becomes fixed and the remainder is vested. A contingent remainder may thus become a vested one, and may subsequently become an estate in possession. The rules of law favor vested rather than contingent remainders, and a construction of doubtful words will be made in this spirit. Contingent remainders are subject to a number of technical rules which cannot be satisfactorily explained within the compass of this article. Some of them have been abrogated in a number of the States of this country. This is particularly true in the State of New York and a number of the States following its radical legislation in respect to real estate. In fact, the word "remainder" in that State has largely lost its original accurate meaning. The statute permits an executory devise as above referred to to be called a remainder in fee. It is quite doubtful whether any real advantage is gained by such a confusion in nomenclature. The common-law learning of remainders is subtle and highly technical, and at the same time severely logical. Distinctions are frequently made to turn upon the particular kind of instrument employed in creating the estate. A single instance may be mentioned. In a strict common-law deed no future estates can be created except the rules governing remainders are

followed. On the other hand, if other deeds are resorted to, such as are derived from the doctrine of uses and the statute regulating them (see USES), then future estates not complying with the law of remainders may be created, termed "springing and shifting uses," corresponding to "executory devises" in a will, and which need no particular estate to precede them. Such barren distinctions may profitably be abolished by statute. The law should require the same rules to be followed in all cases, without reference to the instruments employed. The law of remainders is solely applicable to real estate, future interests in personal property being assimilated to "executory devises." (Consult for further information Fearne on *Remainders* and the textbooks on real property.) T. W. DWIGHT.

Rembang′, the name of a Dutch residency of Java, East Indies, comprising an area of 2600 sq. m., with 631,668 inhabitants, of whom about 10,000 are Chinese. A peculiar feature of the island of Java, and especially of the residency of Rembang, is the black tiger. The capital, Rembang, on the flat, hot shore, in lat. 6° 40′ S. and lon. 111° 10′ E., has 15,000 inhabitants and some shipbuilding.

Rem′brandt van Ryn (PAUL HARMENS), b. at Leyden July 15, 1607, the son of a well-to-do miller; was first intended to become a scholar, but felt more inclination for the art of painting; studied under Jacob van Swanenburch at Leyden and Pieter Lastman at Amsterdam; produced in 1628 his first excellent picture, a portrait of his mother; settled in 1630 at Amsterdam; married Saskia van Ulenburgh in 1634; was soon recognized as the first master of the Dutch school, and gathered a great number of disciples around him, at the same time that his pictures and etchings commanded very large prices, but suffered his domestic affairs to fall into disorder, especially after the death of his wife in 1642, and when in 1656 he concluded a second marriage, and was compelled to pay his son his maternal heritage, he was declared a bankrupt and his collections of arms, vases, cameos, etc. were sold at auction; after which he lived in gloomy retirement, and d. Oct. 8, 1669. Of his pictures, comprising portraits, landscapes, historical and genre pieces, the most remarkable, the *Night-Watch, Nicholas Tulp*, etc., are still in Amsterdam and the Hague, but excellent specimens are found in all the larger galleries of Europe—the *Family of Tobias* in the Louvre, the *Sacrifice of Abraham* in the Hermitage at St. Petersburg, *Moses destroying the Tables of the Law* at Berlin, *Samson's Wedding* at Dresden, the *Blinding of Samson* in Schönborn at Vienna, etc. His peculiar manner, however—that wonderful blending and contrasting of light and shade in which forms of meanness and ugliness receive a poetical consecration without losing their striking expressiveness—may be enjoyed almost to the same extent in his numerous etchings, of which many—the so-called *Hundred Guilders*, the *Windmill*, the *Descent from the Cross*, etc.—are widely known. His *Life* has been written in French by C. Vosmaer (2 vols., the Hague, 1868).

Remey (GEORGE C.), b. Aug. 10, 1841, in Iowa; graduated at the Naval Academy in 1859; became a lieutenant in 1861, a lieutenant-commander in 1865, a commander in 1872; was in several engagements on the rivers of Virginia and South Carolina in 1861 and 1862, and commanded the naval battery on Morris Island from Aug. 23 to Sept. 8, 1863, when he was taken prisoner in a night-attack on Fort Sumter. Highly commended for "gallantry, skill, and judgment." FOXHALL A. PARKER.

Remi, SAINT. See REMIGIUS.

Remig′ius, the name of three eminent French ecclesiastics: (1) (St. Remi) the bishop of Rheims, who in 496 baptized Clovis, the founder of the French monarchy. He was b. at Laon in 437, became bishop in 459, and d. Jan. 13, 533. (2) The archbishop of Lyons, who sided with Gottschalk in the great anthropological controversy of the ninth century. He became archbishop in 853, and d. after 875. (3) A Benedictine monk of Auxerre, who was at the head of the bishop's school at Rheims in 882, and d. about 900. He wrote commentaries on the Psalms, the last eleven of the Minor Prophets, and the Epistles of St. Paul.
R. D. HITCHCOCK.

Rem′ington, p.-v., Carpenter tp., Jasper co., Ind., on Indianapolis and Chicago division of Pittsburg Cincinnati and St. Louis R. R., has 1 newspaper. P. 390.

Remington Rifle. See SMALL-ARMS, by GEN. P. V. HAGNER, U. S. Army.

Remiremont′, town of the German empire, province of Lorraine, at the foot of the Vosges, on the Moselle. It has manufactures of woollen and linen fabrics, paper, and laces, and an active trade in corn, hemp, cattle, and cheese. P. 5668.

Remit′tent [Lat. *remittere*, to "send back"] **Fe′ver,** a non-infectious, non-contagious fever of malarial origin, but differing from intermittent fever in that it has no prolonged intermission or apyrexial period. Although there is at no period of the twenty-four hours a complete cessation of fever, there is daily a perceptible or marked abatement or diminution of the elevated temperature and associated symptoms. This period is termed the remission. The characteristics of this fever vary with the country and season in which it occurs. The ordinary autumnal remittent, the bilious remittent of England and the U. S., is comparatively mild. Reversely, the remittent of intensely malarial regions, as the borders of the Mediterranean, the Isthmus of Panama and of Suez, the African jungles, and of Bengal, is severe and fatal. When the invasion of the disease is mild there will have been a precursory period of *malaise*, languor, mental inaptitude, and sleepiness. When violent in its onset, often no such warning symptoms have pre-existed, but the initiatory chill has been speedily followed by intense delirium, changing to coma, internal congestions, and death. Such "congestive," "pernicious," "fulminating," or lightning-like attacks are rare in temperate climates. Usually, remittent fever is ushered in by a distinct chill or by general chilliness and sense of cold down the back. There is headache, giddiness, mental dulness, and confusion, a sense of oppression and lassitude; soon there is delirium. The face is flushed, the pulse full and frequent, the tongue dry and furred, the skin intensely hot, the temperature rising as high as 105° F. In the bilious form there are nausea and vomiting, pain at the epigastrium, with tenderness on pressure. Frequently, the fever thus runs at its height, without modification, during sixteen or eighteen hours, when the remission begins. Such a period of fever is accompanied usually by symptoms indicative of congestion of important internal viscera. Thus, with the first fever-period pulmonary congestions have been denoted by labored breathing, thoracic oppression, and livid face. With the remission these secondary congestive signs abate. The remission usually begins toward morning, though in grave cases postponed and irregular, succeeding a febrile period of twenty-four or even thirty-six hours. The remission may last from an hour or two to eight or twelve, the attack being mild in proportion as remissions are definite and prolonged. The return of fever may have a mild precursory chill, the temperature again rises, and new congestive symptoms develop, perhaps of the liver, as shown by hepatic pain and tenderness and vomiting of bile. Thus, in successive febrile periods various internal viscera are the seat of a determination of blood—the ovaries and uterus often, as shown by metrorrhagia. The duration of remittent fever may be seven, fourteen, or twenty-one days, seeming to observe a law of septenary crises. It may terminate abruptly in resolution by sweating, or lose its distinctive type and run into a low, typhoid fever. The person convalescent presents a noticeably dusky complexion, a depression of the health and strength for many months, and inactivity of the liver, with liability to jaundice. Percussion often demonstrates enlargement of the liver and spleen. In fatal cases autopsy reveals a characteristic "bronzing" or pigmentation of the liver and spleen. The treatment of this fever should keep in view to quickly shorten the exacerbations or febrile periods and relatively lengthen the remissions. Cold and effervescing draughts and saline aperients should be given at once and repeatedly, and the period of remission utilized by the free exhibition of quinine to anticipate and lessen the gravity and duration of the next period of fever. In critical cases quinine to act certainly must be administered in full doses hypodermically—ordinarily, in large repeated doses by the mouth. Congestion of special organs, the brain, lungs, liver, demands local measures, leeching, cupping, blisters, warm and anodyne fomentations. The usual antiphlogistic agencies are indicated, and supporting liquid food at regular intervals. Tonics, as bitter vegetable infusions and the mineral acids, hasten convalescence.
E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Remon′strants [Lat. *remonstrare*, "to show back"], the name by which the adherents of Arminius were designated when in 1610 they addressed a remonstrance (*remonstrantia*) to the states of the province of Holland. Their adversaries, the adherents of Gomarus, answered with a counter-remonstrance, and were called Contra-Remonstrants, but both designations fell subsequently out of use.

Remote′ness [Lat. *removere*, to "remove"], in law. This expression is used to denote the fact that a provision in a will or deed, such as a marriage settlement, in favor of some person, is so long deferred as to its vesting, so as to be capable of alienation, that it is obnoxious to a rule of public policy requiring that estates should so vest within a fixed period. This doctrine is otherwise called the rule

concerning "perpetuities." The positive rule of the English law upon this point is that estates should thus vest in ownership within the compass of a life or lives in being and twenty-one years and a fraction afterward, the fraction being allowed in the case of the gestation of a child. The rule was derived from the provisions common in a marriage settlement. It is usual in this case to create life estates in favor of the parties to the settlement, and to give the fee to the unborn child or children of the marriage, who on their birth will have a remainder in fee (see REMAINDER), and on reaching their majority will be able to sell or convey it, and in conjunction with their parents may dispose of the entire fee. It is plain that the power to sell the property could only be withheld under such a provision during the lives of the parents and the attainment of majority on the part of the child. The rule thus derived came to be extended to every case of postponement of the power of sale, whether of real or personal property. The number of lives is not confined to two, but any number may be designated by the creator of the estate, since, after all, the postponement cannot be made to exceed the life of the longest liver. The term of twenty-one years may also be used as an absolute one without any reference to minority. Thus, a testator may give his estate to a non-existent corporation, provided that he directs that it shall only take on condition that it be chartered within twenty-one years after his death. It will be fatal, however, if the provision exceeds the period of remoteness, though in fact the person designated comes into existence within the prescribed time. The time in case of a deed is calculated from its delivery, and in case of a will from the testator's death. A provision offending against the rules of remoteness is void, though it does not necessarily destroy the effect of the entire instrument. Its influence in that respect will depend upon the closeness of its connection with other parts of the deed or will, and whether it can be rejected without defeating the main intent of the instrument. The rules governing this subject are frequently difficult of application, and only general principles can be stated. The rule itself is founded on a wise and solid principle—to prevent estates from being withheld from sale. The policy of the law properly requires that estates should be so far in the market that there is some person who can convey them in case a sale becomes desirable for the purposes of commerce. A testator should not be allowed to control by a fixed purpose the use of property long after his death when circumstances have so changed as to make his directions positively injurious. The great Lord Nottingham, in discussing as lord chancellor one of the cases involving this question, said: "They who would introduce perpetuities fight against God, as they would introduce fixedness and stability into human affairs where he has ordered instability." Some of the States have thought the common-law rule too liberal. In New York and some other States the power of alienation of real estate cannot be suspended beyond two lives in being at the creation of the estate. The term of twenty-one years is dropped off. A similar rule is applied to the suspension of the absolute ownership of personal property. The rule does not prevent a permanent investment of property devoted to charitable purposes. (See TRUSTS.) (Consult Lewis on *Perpetuities* and the textbooks on *Real Property*.) T. W. DWIGHT.

Rem'scheid, town of Rhenish Prussia, has very extensive manufactures of cutlery and all kinds of iron-ware. P. 22,017.

Rem'sen, p.-v. and tp., Oneida co., N. Y., on Black River and Utica and Black River R. R. The township has 12 churches, in 10 of which the services are in the Welsh language, there being a larger proportional number of Welsh residents than in any other town in the State. Dairying is the principal industry. P. of v. 289; of tp. 1184.

Remus. See ROMULUS.

Rémusat' (JEAN PIERRE ABEL), b. at Paris Sept. 5, 1788; studied medicine, took his degree, and served as a physician in the military hospitals of Paris during a typhus epidemic in 1813, but devoted himself principally to the study of the Tartar languages, especially Chinese, and was appointed professor of Chinese at the Collége de France in 1814, a chair which was established specially for him. D. at Paris June 4, 1832. His principal works are *Recherches sur les Langues tatares* (1820), *Éléments de la Grammaire chinoise* (1822), *Mélanges asiatiques* (2 vols., 1825), *Nouvelles Mélanges asiatiques* (2 vols., 1829), numerous translations from the Chinese and Thibetan languages, besides minor essays in various scientific periodicals.

Rémusat, de (CHARLES FRANÇOIS MARIE), COUNT, b. in Paris Mar. 14, 1797; educated at the Lycée Napoléon; entered public life as a journalist, belonging to the *doctrinaires;* was a frequent contributor to the *Globe* after 1824; member of the Chamber of Deputies from 1830 to 1848; minister of the interior for a short time in 1840 in the cabinet of Thiers, and minister of foreign affairs from 1871 to 1873. During the Second Empire he lived in retirement, devoting himself chiefly to literary pursuits. D. at Paris June 6, 1875. The most remarkable of his works are *Essais de Philosophie* (2 vols., 1842), *Abélard* (2 vols., 1845), *Passé et Présent* (2 vols., 1847), *L'Angleterre au XVIII. Siècle* (2 vols., 1856), *Bacon* (1857), *Histoire de la Philosophie en Angleterre depuis Bacon jusqu'à Locke* (2 vols., 1875), *Lord Herbert de Cherbury* (1875).

Renaissance' [Fr.], the name of a style of architecture which originated in Italy in the first half of the fifteenth century under the influence of the awakened enthusiasm for classical literature and art, and which in the following centuries wholly superseded the Gothic style all over Europe. It may be characterized generally as a return to the classical principle of building and decoration, and the course of its history may be described as beginning with the simple adoption of classical motives in ornamentation, and ending in the mere copying of antique buildings. In Italy—where the Gothic style never became fully at home, because to some degree it contradicted the genius of the people, while on the other hand the classical style never could die out entirely, because its monuments covered the whole soil—the return from Gothic to classical ideas in architecture was very easy, and followed of necessity the revival of the classical spirit in philosophy, in poetry, and in art generally. Three different schools of Renaissance are distinguishable here—the Florentine, the Roman, and the Venetian—and from these three schools resulted the so-called Italian style, which seldom sinks into mere copying, but generally is an application of ancient forms to modern requirements, often rather curious, but sometimes very successful. The cradle of the Renaissance was Florence, and the dome of her cathedral is generally mentioned as the first example of the style. In the original design of this building by Arnolpho di Lapo, in the latter part of the thirteenth century, a dome 130 feet in diameter was proposed over the crossing of the nave and the transepts, but this giant task was not accomplished until nearly 150 years later (in 1420) by Filippo Brunelleschi (1377–1446), who had made this achievement the aim of his life, and who thereby ushered in a new style. The Gothic avenue, sublime in its perspective and fascinating with its subdued light from the painted windows, disappeared and gave place to the broad, powerful dome which, bright and majestic, spread over the congregation. Still more characteristic of the new style and of the genius of Brunelleschi are the palaces of Florence, for which he gave the model by the erection of the Palazzo Pitti. Florence was at that time a very turbulent place. He who had anything to lose had to make his house a castle, and the famous Florentine palaces Riccardi, Strozzi, Gondi, Rucellai, etc. were actually built for defence. They consist of huge blocks of freestone, and present to the street an austere, almost gloomy, appearance. But the heaviness of the masses is lightened by the exquisite elegance of the proportions, and the noble simplicity of the forms makes an impression of strength and dignity which reminds one of the best classic architecture. Nevertheless, in all these buildings a connection is still traceable with the former mediæval architecture—the Gothic style, the castle of the baron—while in the Roman school this connection is wholly broken. The chief monument of Roman Renaissance is the church of St. Peter, commenced in 1506 by Bramante, continued by Raphael 1514–20, by Peruzzi 1520–46, by Michelangelo Buonarotti 1546–64, by Carlo Maderno 1605–29, and finally completed by Bernini in 1667. In this building, as in the cathedral of Florence, the dome, erected by Buonarotti, is the most prominent feature, and the weakest point is the front façade. The architects of the Renaissance never found the true connection between the dome and the portal. The front façade is generally nothing but an architectonic decoration, a screen of columns, behind which a low and entirely insignificant entrance is hidden. Of greater consistency in their construction, and of a more perfect harmony in their details, are the private buildings, such as Palazzi Farnese and Giraud, and the Cancellaria. The peculiar invention of the school, the connection of two stories in one order of columns or pilasters, with an attic or low story above, is in palace architecture of great effect, and has been used very extensively. In the Venetian school, however, which is very rich in palace architecture, this invention was never employed. Here each story is provided with its own tier of columns or pilasters, and separated from the other stories by conspicuous friezes or belts, often in the form of balustrades broken by pedestals and ornamented by figures. The windows are arched and ornamented with columns. The spandrels are filled with figures, and the whole has a rich, varied, and gay ap-

pearance. The most interesting examples of this architecture are the Palazzo Vendramin Calergi, built in 1481 by Pietro Lombardo, the Scuole di San Marco and di San Rocco, and the palace of the doges. France also is very rich in Renaissance architecture; she even gave the style an individual development, and it is chiefly in this its French shape that it was adopted by England, Spain, Germany, and Russia. To France the style was introduced during the reign of Louis XII. (1461–83), who invited the Italian architect Fra Giocondo to his court, and during the reign of Francis I. (1515–47) some of the most interesting buildings arose which the style ever produced. But while in Italy the classical element was predominant from the very beginning, a real contest took place in France between the Gothic and classical ideas. The ornamentation soon became purely antique, but the plan remained Gothic for a long while. That wilderness of turrets, gables, corners, chimney-tops, etc. which had such a fascinating power over the imagination of the Middle Ages, people would not as yet renounce; they retained the whole variety and multitude of forms, but dressed them all with the simple Greek ornaments, which on such a background produced a strange effect. To this class of buildings belong the castle of Chambord and the palace of Chenonceau, both built in the time of Francis I.—the former by Trinqueau, the latter by an Italian architect. The castle of Chambord is somewhat grotesque, but the palace of Chenonceau is a graceful structure. The church of St. Eustache in Paris, built in 1532, is also a handsome and interesting edifice, though its architecture is very much mixed. Soon, however, a closer study of the classical monuments led to the adoption of simpler plans and a better disposition of space. The Tuileries, begun in 1564 by Philibert de l'Orme, and large parts of the palace of Fontainebleau, built during the reign of Henry IV. (1589–1610), show this transition, but they also show signs of that exaggeration of ornamentation and that empty ostentation which afterward became the characteristic of the French Renaissance, and from which it received the name of Rococo. The most striking example of this style is the château of Versailles, built under Louis XIV. by Hardouin and Mansard. It is colossal, but not grand—pompous, but not imposing. Its most interesting feature is the ingenious combination of many buildings into one arrangement. But it is a city rather than a building. From the Rococo, which literally covered the walls with columns, pilasters, entablatures, friezes, cornices, and ornaments of every kind, the taste suddenly turned during the Revolution to a mere copying of antique buildings, of which the Madeleine in Paris is a striking example. This last phase of the Renaissance, which indeed is the dissolution of the style, was very predominant in Germany. Many of the most conspicuous buildings in Berlin and Munich belonging to this century are entirely devoid of originality, and are mere imitations of Greek conceptions. But neither in Germany nor in England did the Renaissance produce any great and interesting results. The royal palace of Dresden, the château of Heidelberg, and the church of St. Paul in London are fine structures, but, generally, the Renaissance architecture in these two countries has the meagreness of the plan without that abundance of graceful ornaments which, at all events, brings variety into the masses, even if it does not bring true life. A great number of princely residences in Germany are built in the Renaissance style, but they are cold and flat, and sparingly ornamented with flimsy Rococo. CLEMENS PETERSEN.

Renaix′, town of Belgium, province of East Flanders, has breweries, distilleries, tanneries, salt and dye works, bleach-fields and manufactures of cotton, linen, tobacco, and chicory. P. 11,905.

Re′nal [Lat. *renes*, "kidneys"] **Diseases,** or **Diseases of the Kidneys,** are mostly of an inflammatory nature. According to the location and character, there are many different affections. Inflammation of the pelvis (see KIDNEYS) is called *pyelitis*, and is generally a continuation of catarrh of the bladder. The tissue of the kidney proper might be the seat of all kinds of inflammatory processes, from simple hyperæmia (and in consequence thereof bursting of blood-vessels and bleeding) to the most severe forms of hyperplastic action, with deposition of diphtheritic and croupous masses. The obsolete name BRIGHT'S DISEASE (which see) used to comprise the majority of these forms, which a more distinct knowledge now keeps asunder. The most important symptoms of the kidney troubles arise from the fact that the epithelium of the canaliculi is detached, thereby allowing the albumen to escape. (See BRIGHT'S DISEASE.) In more advanced cases the secretion of urine is hindered, and even suppressed, and the urea in the blood (uræmia) leads the affection to a fatal end. Of other renal disorders may be mentioned the formation of gravel and stone, giving origin to so-called renal colic and some new formations, especially cancer of the kidneys. Perinephritis is called the inflammation of the cellular tissue around the kidneys; large abscesses might take their origin therefrom, which can be cured by making an incision and thereby giving the pus a free outlet. FREDERICK ZINSSER.

Renan′ (JOSEPH ERNEST), b. Feb. 27, 1823, at Tréguier, Côtes-du-Nord; trained in the parish school of his native town, at the age of sixteen he went to Paris to prepare himself for the Church. During his course in St. Sulpice he displayed remarkable ability in the Oriental languages, and his studies leading him to results unfitting him for the priesthood, he abandoned the seminary and devoted himself to linguistic studies. In 1847 he gained the Volney prize by his *Mémoire sur les Langues sémitiques;* in 1848 was crowned by the Institute for his *Étude de la Langue grecque au Moyen Age;* in 1849 was sent by the Académie des Inscriptions on a literary journey through Italy; in 1851 was appointed to a position in the MS. department of the Bibliothèque Nationale; in 1856 was elected member of the Académie des Inscriptions; in 1860 was sent on a scientific mission to Syria, and on his return in 1862 was appointed professor of Hebrew in the Collége de France, from which he was shortly afterward removed, owing to the publication of the *Vie de Jésus.*

Renan is best known by his *Origines du Christianisme,* a series of books in which he depicts with marvellous beauty the material surroundings of Christ and the early Church; but his work is superficial and lacks all critical value. The most deserving of his writings is his *Histoire générale des Langues sémitiques,* which is on the whole the best sketch of the Semitic languages. The following is a list of his works: *Histoire générale et Systèmes comparés des Langues sémitiques* (prem. part), *Histoire générale des Langues sémitiques* (1856), *Le Livre de Job* (1859), *Le Cantique des Cantiques* (1860), *Averroës et l'Averroïsme* (1852), *Origines du Christianisme:* A. *Life of Jesus* (New York, 1863), B. *The Apostles* (1866), C. *St. Paul* (1869), D. *L'Antichrist* (1873). He has been a frequent contributor to *Liberté de Penser*, the *Débats, Revue des Deux Mondes;* and the best of his essays are collected in *Études d'Histoire religieuse* (1867) and *Essais de Morale et de Critique* (1869). THOMAS C. MURRAY.

Renault′, p.-v. and tp., Monroe co., Ill. P. 1617.

Ren′de, town of Southern Italy, province of Cosenza, at the foot of the Apennines, in the midst of fine pasture-grounds. The clay of the vicinity is admirably suited for pottery, in the manufacture of which the inhabitants are chiefly engaged. P. 5300.

Ren′del (JAMES MEADOWS), b. near Dartmoor, Devonshire, England, in 1799; became celebrated for his skill in the construction of colossal bridges; introduced a system of crossing rivers upon floating bridges, employed by several railways, and was the architect of the harbors of refuge at Holyhead and Portland. D. in London Nov. 21, 1856.

Rends′burg, town of Prussia, province of Sleswick-Holstein, on the Eider, is strongly fortified, and carries on some trade in timber. P. 11,514.

René (or **Renatus**) **I.,** count of Provence, duke of Anjou, titular king of Naples, b. at Angers Jan. 16, 1409, the second son of Louis of Anjou and Yolande of Aragon. Having married Isabelle of Lorraine, he laid claim to this country after the death of her father, Duke Charles, in 1431, but was opposed by a nephew of Charles, the count of Vaudemont; was captured and imprisoned for several years. In 1434 his elder brother, Louis III., who had been in actual possession of the throne of Naples, died and left to him Provence, Anjou, Naples, Sicily, and Jerusalem. In 1437, René succeeded in buying his liberty and the acknowledgment of his right to Lorraine for 400,000 pieces of gold, and he now led an army to Naples, where his claims were disputed by the king of Aragon. He was unsuccessful, and in 1442 returned to Provence, gave up all his ambitious schemes, and confined himself to the improvement of his beautiful family estates. He encouraged agriculture, manufactures, literature, and art. His subjects gave him the surname *the Good*, poets and artists gathered at his court, and he was himself a successful cultivator of literature. There is an edition of his writings (*Œuvres des Roi René*) by Quatrebarbes (4 vols., Paris, 1845). The crown of Aragon was offered him, but he refused it for himself and accepted it only for his son, who, however, died shortly after entering the country. At his death (July 10, 1480) most of his possessions fell to the French crown—Anjou, Bar, Maine, and Provence—his sons having all died before him.

Renews, a port of entry of Ferryland district, Newfoundland, 54 miles S. of St. John's. Its harbor is shallow.

The town is an ancient settlement, and has large cod-fishing interest. P. 859.

Ren'frew, county of Scotland, bordering N. and W. on the Clyde. Area, 225 sq. m., with 216,919 inhabitants. The western part is hilly and moorland; the eastern level and very fertile. Coal and other useful minerals abound; manufactures are important. Cap. Renfrew.

Renfrew, a large county in the N. of Ontario, Canada, bounded N. E. by Ottawa River. The leading interest is the cutting, manufacture, and export of lumber, which is carried on on a very large scale. Brockville and Ottawa Railway extends into this county. Cap. Pembroke. P. 27,974.

Renfrew, p.-v., Horton tp., Renfrew co., Ontario, at the falls of Bonnechère River, 100 feet high, which present a scene of great beauty and afford a fine water-power. Renfrew has a large trade, and is 9 miles from Bonnechère Point on Ottawa River. P. about 1000.

Re'ni, town of Moldavia, at the influx of the Pruth into the Danube, is fortified and trades in grain. P. 7300.

Reni (Guido). See Guido Reni.

Ren'nell (James), b. near Chudleigh, Devonshire, England, Nov. 3, 1742; early entered the British navy, from which he passed to the service of the East India Company; was distinguished in the campaigns of Lord Clive; was many years surveyor-general of Bengal; returned to England 1786; aided Mungo Park in his preparations for African travel; published an atlas of Bengal (1781), a map of Hindostan, with an elaborate *Memoir* (1783), *Elucidations of African Geography* (1793–98), *The Geographical System of Herodotus examined and explained* (1800), *Observations on the Topography of the Plain of Troy* (1814), and *Illustrations of the Expedition of the Younger Cyrus* (1816), *Comparative Geography of Western Asia* (1831), and *Investigation of the Currents of the Atlantic Ocean* (1832). D. in London Mar. 29, 1830.

Rennes [Roman, *Redones*], in France, the ancient capital of Brittany, now capital of the department of Ille-et-Vilaine, at the confluence of the Ille and Vilaine, 232 miles S. W. of Paris, consists of two parts—an upper or new town of an elegant and modern appearance, and a lower or old part, mostly built of wood, with narrow and winding streets. It has many good educational institutions, manufactures of sailcloth, linen, lace, and embroideries, and an active trade in honey, wax, butter, and poultry. P. 52,044.

Rennet. See Cheese.

Rennie (Sir John), b. in London Aug. 30, 1794. His father, a distinguished civil engineer (1761–1821), early introduced him to that profession as assistant in the construction of Southwark and Waterloo bridges. In 1821 he succeeded his father as engineer to the admiralty. The New London Bridge was completed by him, from designs of his father, in 1831, when he was knighted. The important works of Sheerness dockyard, Ramsgate harbor, and Plymouth breakwater, commenced by his father, were completed by Sir John, as well as the great system of drainage and land reclamation in Lincolnshire. Of the more important works designed and executed by himself are the Whitehaven and the Cardiff docks. With his brother George (1791–1866) the machinery for the mints of Bombay, Calcutta, and Mexico were designed and erected; also the Royal Clarence victualling yard at Plymouth. Sir John was considered the highest authority on all subjects connected with hydraulic engineering, harbors, canals, irrigation, storage of water, and the management of rivers. President of the Institution of Civil Engineers 1845–49; fellow of the Royal Society; author of *The Theory, Formation, and Construction of British and Foreign Harbors*, and many valuable professional papers. D. Sept. 3, 1874.

Re'no, county of S. Kansas, on Arkansas River, formed since census of 1870. Cap. Hutchinson. Area, 1512 sq. m.

Reno, p.-v. and tp., Leavenworth co., Kan., on Leavenworth and Kansas Pacific R. R. P. 946.

Reno, p.-v. and tp., Pope co., Minn. P. 254.

Reno, p.-v., cap. of Washoe co., Nev., on Truckee River and Central Pacific R. R., 11 miles E. of the base of the Sierra Nevada, is an important centre of mining and manufacturing interests, and has 2 newspapers. P. 1035.

Reno (P. O. name of v. of Laytonia), Sugar Creek tp., Venango co., Pa., on Allegheny River, on Franklin branch of Atlantic and Great Western and Allegheny Valley R. Rs., 3 miles S. W. of Oil City. P. 150.

Reno, tp., Preston co., West Va. P. 2536.

Reno (Jesse L.), b. in Virginia in 1823; graduated from the U. S. Military Academy, and entered the army as brevet second lieutenant of ordnance July, 1846; in the war with Mexico was engaged in the siege of Vera Cruz and in the battles of Cerro Gordo, Contreras, Churubusco, and Chapultepec, and brevetted first lieutenant for gallantry; subsequently served on duty with his corps, being in command of Mount Vernon Arsenal, Ala., at the time of its capture Jan., 1861; appointed brigadier-general of volunteers in Nov., 1861, he accompanied Burnside's expedition to North Carolina; was promoted to be major-general of volunteers July, 1862, and in August assigned to the command of the 9th army corps, which he led in the second battle of Bull Run and at Chantilly, Aug. 29–Sept. 1. At the battle of South Mountain, while at the head of his command, he was killed Sept. 14, 1862.

Reno (Marcus A.), b. in Illinois, 1835; graduated from the U. S. Military Academy, and entered the army as brevet second lieutenant of dragoons in 1857; captain 1st Cavalry Nov., 1861; prior to 1861 was on duty in Washington and Oregon Territories; in the civil war served with his company throughout the Virginia peninsular campaign of 1862, and in the battle of Antietam commanded his regiment; was engaged at Kelly's Ford, Va., Mar. 17, 1863, in the Richmond campaign of 1864, in the Shenandoah campaign of 1864, as chief of staff of the cavalry, and engaged in the battle of Cedar Creek and numerous minor actions; appointed colonel 12th Pennsylvania Cavalry Jan. 1, 1865, which commission he held until July; in Dec., 1868, became major of 7th U. S. Cavalry.

Renovo, p.-b., Clinton co., Pa., on Philadelphia and Erie R. R., 28 miles W. of Lock Haven, along the W. branch of Susquehanna River. It was incorporated as a borough in 1866, but its origin dates back to the establishment by Philadelphia and Erie R. R. of their boiler, repair, and foundry shops here in 1862. It has 3 churches, a public library, 2 large school buildings, a banking-house, 1 newspaper, several hotels, and 1 theatrical hall. Renovo has an efficient fire department and waterworks. It is a resort for summer tourists. P. 1940.

John U. Shaffer, Ed. "Renovo Record."

Rens'selaer, county of E. New York, extending from the frontiers of Vermont and Massachusetts on the E. to Hudson River on the W., traversed by Hoosick and Little Hoosick rivers and Kinderhook Creek, and by the Taghkanic and Petersburg ranges of mountains, is intersected by several railroads, has a hilly surface and a stony soil, best adapted to pasturage, but the valleys are well cultivated and produce large crops of corn, oats, potatoes, and hay. Hops, flax, maple-sugar, wool, butter, and cheese are staples. Manufactures form the leading industry, there being not less than 792 establishments, representing a capital of $12,000,000, and giving employment to 15,588 hands. The chief manufactures are iron and iron-ware, agricultural implements, bells, stoves, clothing, especially linen collars and cuffs, and hosiery, printing paper, and woollen goods. Annual products of manufactures above $28,000,000. Cap. Troy. Area, 690 sq. m. P. 99,549.

Rensselaer, p.-v., cap. of Jasper co., Ind., in the centre of a fine agricultural, dairying, and stock-raising region, has 5 churches, good schools, 2 newspapers, 1 grist-mill, a Catholic orphan asylum, and 2 hotels. P. 617.

James & Healey, Eds. "Rensselaer Union."

Rensselaer Falls, p.-v., Canton tp., St. Lawrence co., N. Y., on Oswegatchie River and Rome Watertown and Ogdensburg R. R. P. 395.

Rensselaerville, p.-v. and tp., Albany co., N. Y., 24 miles W. of Albany, contains 4 churches, a flourishing academy, a manufactory of felt for paper-mills and lung-protectors, an iron-foundry, 1 newspaper, and 1 hotel. Fine water-power exists; principal employment, farming and dairying. P. of v. 526; of tp. 2492.

Peter Winne, Ed. "Rensselaerville Press."

Rent [It. *rendita;* Sp. *renta;* Fr. *rente*—from Lat. *reddere*, to "give back" or "return"], money, service, or products paid for the use of land and its appendages, commonly called "real estate." Rent implies ownership of land. This is not the place to discuss the abstract right of property in land. (See Property.) It is enough here to say that the wealth which God has hidden in the vegetable and mineral resources of the earth cannot be developed without some exclusive possession and control of the land itself. When appropriated it must be reckoned as capital, partaking of the nature both of material to which labor may be applied and of an instrument of labor. As capital, its use, as well as its ownership, may be transferred, and rent is simply the compensation paid for the use of capital in this form. Several sorts of rent are indicated by different names, the distinctions having originated mainly in the peculiar features of the feudal system and the laws of entail and primogeniture to which that system gave rise. Thus, a *rent-charge* means a fixed sum paid annually as a commutation for military services or

other obligations due from the occupant of land to its feudal proprietor. *Quit-rent* is a definite reserve in grants of land, by the annual payment of which the tenant is quieted or quit from all other service to a feudal lord. *Metayer-rent* is an equal division of the actual products between the cultivator and the owner of land. *Rack-rent* is rent raised to the utmost by forced competition. *Cottier-rents* is a term applied chiefly to the usage in Ireland, where sub-tenants rent each a cottage and an acre or two of land from the small farmers, the amount of the rent being ordinarily paid in labor at a money valuation.

In Great Britain the influence of the old feudal system is still felt in the monopoly of the lands of the kingdom by a few families of the nobility and rich gentry, and in many restrictions on the transfer of titles. There, consequently, the problems of rent are many and complicated. In 1817, David Ricardo published a work on political economy which is taken up chiefly with a theory of rent designed to meet the condition of things in that country. Its leading idea is that rent advances with the progress of society from the first settling of a country, when, on account of the abundance of fertile land, there will be no rent, up to the time when the necessities of the growing population compel the bringing into cultivation, at the expense of greatly-increased labor, the poorest of the land. Then all the grades of land except the very poorest will yield rent proportioned to their fertility and situation. With the increase of rent the cost of food must steadily increase. And so, by inference, this theory was made to sustain the Malthusian theory of population, presenting general starvation and wretchedness as the certain result in a not distant future, unless some restrictions are laid on the natural increase of population. The elementary principle of this theory is true, and defines a law of rent which is good for all time and all countries. But the deduction from it can stand only on the assumption that the food of a people must be provided entirely from the culture of its own soil, limited in extent. The repeal of the corn laws and the adoption of the principle of free trade have shown that even England has little occasion to apprehend the sad consequences of the so-called Ricardo-Malthusian system, though she may have occasion to revise her laws concerning real estate, and give a chance for the cultivator to become the owner of the land he works.

In a country like ours, where real estate is held by an allodial title, unencumbered by entails and mortmain holdings, where the ownership and transfer of such property is free from burdensome restrictions, and powerful influences favor the acquisition of such property by all industrious and thrifty persons, the principles of rent are very simple and may be stated in few words. For agricultural purposes the rent of land is determined mainly by four considerations: (1) Its *fertility*, on which the amount of products depends. The crops must provide for rent by a surplus above what is necessary for the support of the laborer. (2) Its *location* with respect to a market, and somewhat also to beauty of situation. A home-market is always the best, as the expense of transportation is thereby diminished. Distance from a market may more than counterbalance the advantage of fertility. Increased facilities of transportation virtually bring remote lands nearer market, and so enhance the value of both the land and its products. (3) *The growth of population*, and especially its concentration in new centres. Agricultural and manufacturing industry have a most intimate relation to each other, and the free development of both in proximity to each other promotes the most general and genuine thrift. The value of land is also increased by the attractions of good society. (4) *Improvements* put upon the land, including drainage, fertilizers applied to the soil, fences, and buildings. These are indispensable to successful agriculture, and every addition adds value to the land. Very rarely, however, is the value of the land, as indicated either in rent or purchase-price on sale, increased in proportion to the expenditure laid out on these improvements, because no other can come fully into the interest which the original proprietor has in these things. We may fitly add that in this country almost invariably rented farms rapidly degenerate in respect to both fertility and improvements.

In cities, where population is condensed within narrow limits, rents for lots and buildings are determined almost entirely by *location* with respect to facilities for business, the social character of the neighborhood, and the freaks of fashion. With the growth of cities the eligible locations are subject to frequent change, occasioned often by the mere whims of fancy or bold speculation. The compensation paid for the use of capital in the form of real estate is, except in the favorite locations of great cities, generally less than the average rate of interest allowed for other forms of capital and the rate of profits from business. This is due mainly to the security of property in real estate entrusted to others' use. It cannot be run away with, nor destroyed, nor fraudulently disposed of. Meantime, while society is advancing, its bottom-value steadily increases. For this reason an owner of city lots is willing for a very moderate ground-rent to grant others the privilege of building on his land, since he runs no risk, and has the benefit of increased value from the use of the land at the end of the lease. (For the legal aspects of this subject, see LANDLORD AND TENANT; also RENT.) A. L. CHAPIN.

Rent, in law, as defined by the early common-law writers, is a certain annual profit issuing out of lands and corporeal tenements, which profit may be money, personal services, or products of the soil, as wheat or other grains, or animals, such as horses, cattle, sheep, and the like. The word is directly borrowed from the French noun *rente* and verb *rendre*, to "return," since the money or other articles due are something returned from the land and for its holding and use. In this original legal acceptation, however, the rent is not strictly the money, services, or articles paid, but the right of the holder to demand such payment, and the corresponding obligation of the one who owns or possesses the land to make it. In this sense rent is regarded at the common law as a species of real estate, an incorporeal hereditament, a right in the thing of another (*jus in re aliena*). It may be created and granted in fee simple, in fee tail, for life, or for years. When in fee, it is inheritable in the same manner as a similar estate in the land itself; it may be devised or conveyed. In England it has been very common, especially in family settlements and as a means of providing for daughters and younger sons, for landed proprietors to create by deed or will rents in fee or for life issuing out of their own lands, and to bestow such rents upon present holders for life, with future dispositions by way of remainder. It was also not uncommon for such proprietors, when conveying lands in fee, to reserve to themselves a rent in fee. In these and similar instances the rent was an estate, with all the incidents of real property, and it is of such kinds of rent that the older common-law writers chiefly speak in their discussions of the general subject. In the U. S. these ancient species of rent exist to a very slight extent, and are practically confined to one or two of the older commonwealths. In the great majority of the States the only rent actually known—whatever other forms may theoretically exist—is that arising between the landlord and tenant from the ordinary letting of land, and it may be properly defined as a certain pecuniary sum agreed upon between the parties, paid at fixed intervals by the lessee to the lessor, as a compensation or hire for the use and possession of the leased land. Even in England this species of rent, as the incident of leasehold estates, has in modern times become far more common and far more important than any other. The ancient common law, in respect of the varieties then in use and described above, divided rent into three classes —rent service, rent seck, and rent charge. The first was of purely feudal origin, and existed when the tenant, for the land held of his lord, owed the latter some corporeal service, at least that of fealty; as, for example, a holding by fealty and ten shillings annually, or a holding by ploughing the lord's land and five shillings annually, the personal services in each of these cases affecting the entire rent. The lord could always distrain for arrears as long as he held the reversion—that is, owned the final fee in the land. The second class was granted or reserved by deed without any clause in the conveyance authorizing the holder thereof to distrain, and was called seck or dry rent, because by the law, prior to alterations made by statute, such holder had no means of enforcing his claim. A rent charge was one where the owner thereof had no reversion or future interest in the land, but was still entitled, by virtue of a clause in the deed creating it, to distrain for any arrears. As illustrations, if the owner of certain land should convey the whole estate therein to A, and also a rent issuing therefrom in fee or for life to B, with a clause enabling B to distrain, or if an owner should grant a rent out of his own land to A in fee or for life, with the same power of distraining, or if the owner should convey his land in fee and reserve a rent to himself and his heirs with like power, each would be a rent charge. English statutes have removed some of the distinctions between these three classes by making distress a remedy in all sorts of rent; on the other hand, distress has been very generally abolished by the legislation of the American States. In Pennsylvania a variety of rent charge is still preserved in constant use under the name of ground-rent; that is, when the grantor of land in fee reserves a perpetual pecuniary rent to himself and his heirs. From such a conveyance the law of Pennsylvania recognizes two estates as coexisting—that of the land-owner in fee, and that of the rent-owner in fee. The latter, being real property, is bound by judgments, may be mort-

gaged, conveyed, or devised. As ground-rent deeds are usually drawn, the owner of the rent has three remedies in case of non-payment—an action to recover the arrears, distress, and, for want of sufficient distress, the right to re-enter upon the land and resume in it the original estate of the grantor. In other States a ground-rent is simply that reserved by the lessor in a building lease, or one by which the lessee covenants to erect a building upon the land, and which is therefore given in most instances for a considerable term of years. In several eastern counties of New York a large quantity of land originally owned by patentees of the British crown was conveyed by them or by their successors and held by the grantees in fee, with a perpetual rent reserved to the grantors, either pecuniary or payable in products of the soil. After a bitter and protracted controversy these peculiar holdings, so inconsistent with the spirit of American law and institutions, have nearly if not quite all been converted into absolute estates, and the rents extinguished by arrangement between the owners of the land and the parties in whom the rights to the rents had become vested. (For the rules governing the relations of the parties in ordinary lettings of land see the articles LEASE and LANDLORD AND TENANT.)

JOHN NORTON POMEROY.

Ren'ville, county of N. W. Dakota, extending from the boundary of British America on the N. to the Plateau du Coteau du Missouri on the S. W., watered by Mouse River, a tributary of the Red River of the North, has a rolling surface and is well adapted to pasturage. It has been formed since the census of 1870, and has few inhabitants. Area, about 1800 sq. m.

Renville, county of S. W. Minnesota, on Minnesota River, on the line of Hastings and Dakota R. R., consists of fertile rolling prairies. The staple products are wheat, oats, hay, wool, and butter. Cap. Beaver Falls. Area, 836 sq. m. P. 3219.

Ren'wick (JAMES), LL.D., b. in New York City in 1792; graduated at Columbia College 1807; was professor of chemistry in that institution from 1820 to 1853; wrote biographies of Fulton, Rittenhouse, and Count Rumford for Sparks's series; wrote *Outlines of Natural Philosophy* (2 vols., 1822–23), the first work on the subject published in the U. S.; *Elements of Mechanics* (1832), and other scientific textbooks; prepared lives of De Witt Clinton (1834), Jay, and Hamilton; contributed to the reviews, and was U. S. commissioner on the N. E. boundary 1838. D. at New York Jan. 12, 1863.

Renwick (JAMES), son of Prof. James, b. in New York in 1819; graduated at Columbia College 1836; was for some years engineer on the Erie Railway; superintended the construction of the distributing reservoir of the Croton aqueduct; was the architect of Grace church and of St. Patrick's cathedral, New York, of the Smithsonian Institution, of Vassar College, and many other important edifices.

Reph'idim [Heb., "stays," "props"], a station in the Sinaitic peninsula, where the Israelites under Moses and Joshua gained a great victory over the Amalekites. Its identification depends upon that of Sinai, in whose immediate neighborhood it was. If, as Lepsius supposes, Serbal was the Mountain of the Law, Rephidim must have been in the wady Feiran. If Sufsafeh was the mountain—which can hardly be questioned—Rephidim must have been in the wady es-Sheikh, at the pass called el-Watiyeh.

R. D. HITCHCOCK.

Replev'in [L. Lat. *replevina*], one of the common-law forms of action, originally used for certain special purposes, but adopted and greatly enlarged in its scope and operation by those States of the U. S. in which the common-law methods have heretofore prevailed or are now existing. Its object is to recover the possession and very corpus of goods belonging to the plaintiff; but in England and in a portion of our States it could only be resorted to when the goods had been wrongfully *taken* by the defendant; in the other States it was, or is, employed whenever the goods had been improperly *detained*, as well as when they were originally taken in violation of right. The peculiar characteristic of the action is the right of the plaintiff at its very commencement, by furnishing the sheriff with security that he will prosecute the suit and will restore them in case he fails to recover judgment, to procure the goods to be at once seized by the sheriff and delivered into his own possession. The judgment in replevin is peculiar. If the chattels have remained in the defendant's custody, the plaintiff when successful recovers their possession, or in default thereof their value, which has been assessed by the jury, together with damages for their unlawful detention or taking; if the custody had been transferred to the plaintiff, his title is confirmed and he recovers the damages alone while a judgment in such case for the defendant restores to him the possession or the value instead thereof. In the reformed American procedure this action has been abolished, but a suit for the possession of personal property is permitted similar in its features, its object, and its relief. Replevin was originally confined in England to cases where cattle or other goods of the plaintiff had been taken in distress and he desired to try the legality of the distraint. Sir Henry Maine has shown in his *Early History of Institutions* that the proceeding is of great antiquity—that it can be traced among the Saxons prior to the Conquest, and in some of the primitive Germanic codes.

JOHN NORTON POMEROY.

Reports', in law. These are collections of opinions given by courts in deciding cases brought before them for adjudication, and useful as forming a basis for other decisions involving similar questions. The distinction between the *record* and *report* of a case should be pointed out. A record is a collection or formal statement of all the papers essential to the progress of the cause, such as the writ or summons calling the defendant into court, the pleadings, order for trial, verdict, judgment. These are enrolled on paper or parchment, and, taken together, constitute the "record" of the case. The "report," on the other hand, is in the main a statement of the reasons which influenced the court in the decision of the cause, together with the argument of counsel and a brief account of the pleadings and facts, sufficient to make the decision intelligible. Recourse accordingly is had to the latter for principles of law, though it is frequently quite necessary to consult the record in order to ascertain precisely what questions were necessarily involved in the cause.

The value of reports consists in the fact that it is a well-settled rule in England and America that if a case has been deliberately adjudicated by a court of high authority and having appellate jurisdiction, the principle determined is binding upon inferior courts when another case arises involving the same facts; and it will in general be followed in the court itself which rendered the decision unless strong reasons can be given to the contrary. The law in this way consists in the main of a collection of principles evolved from the decisions of actual controversies disposed of by the courts, rather than theoretical propositions laid down by jurists and philosophers. It is, however, true, notwithstanding these doctrines, that many cases have been overruled and discarded as not containing a correct view of the law. Much skill is frequently necessary to determine the value of the cases in the reports. A few of the leading rules may be stated.

Rule I.—Decisions of the court of last resort in any State are to be treated as technically *authoritative* and binding on the inferior courts. It would be an act of insubordination for an inferior court not to follow them. They can only be properly set aside and rejected by the tribunal which rendered them.

Rule II.—Decisions of inferior courts may be referred to as evidence of the law, and will be binding, if they are appellate courts, upon those of a lower grade, and from which an appeal may be taken to them. They may be cited, though not as "authority," even in courts of last resort, as arguments to prove the validity of the position taken by the person who cites them.

Rule III.—Decisions of courts of one State of the Union are not binding as "authority" upon the courts of another State. They can be cited, however, and will receive respectful consideration, and, if their arguments are deemed to be sound, will in general be followed in a court not bound by the doctrine of "authority" already referred to. In case of a conflict between decisions in the higher courts of a State where an action is pending and those of a sister State, the former must in general be followed. The same principle prevails as to the decisions of the U. S. courts. Thus, a State court is not bound to follow the decisions of the Supreme Court of the U. S., except as to matters involving the construction of the U. S. Constitution and the laws and treaties made under it. As to these, that tribunal is made the final interpreter, and the State courts must surrender their opinion. A similar rule prevails as to decisions in the English courts, except so far as they were made before the time fixed upon in any State for the adoption of the English common law as the basis of its jurisprudence. The decisions rendered in England before that date have the aspect of authority, while those since given are to be regarded as arguments.

Rule IV.—A special rule prevails in the U. S. courts as to the weight to be attached to decisions in State courts upon matters having in them a local element, such as the construction of a State constitution or statute, or the exposition of the local law of real estate. In the first of these cases the U. S. courts follow the interpretation of the State constitution adopted by its own courts if that has taken place. Having once followed the view of the highest

State court, Federal tribunals will not be bound to change front though the State courts may adopt a new interpretation. This is particularly true as to transactions which have been entered into on the faith of the prior interpretation. On like principles the construction of State statutes by State courts is adopted, as well as the rules governing real estate. In commercial matters this special rule does not prevail, and the Federal court may consider a question on its merits, independently of the action of any State tribunal. The whole rule gives way when it leads to any conflict with the U. S. Constitution.

Rule V.—Distinctions must be taken as to the value of cases in the reports, depending upon the grade and standing of the court, the thoroughness of the discussion, and the ability of the reporter. (1) The grade of the court is of much consequence. Thus, the decisions of the House of Lords in England are of more weight, not only there, but even in this country, than those of inferior tribunals. As the inferior courts have in many instances reporters, this distinction must be carefully attended to. There is a class of cases known as *nisi prius* decisions. These are rendered in England by a single judge at a trial with a jury, and would not in general have the same value as those announced by an appellate court after careful consideration. However, in special instances they have an exceptional worth, owing to the pre-eminent ability of the presiding judge. (2) In all courts respect is paid to the decisions of particular judges whose capacity is superior to that of their associates. It is proper to urge in argument that a commercial question was decided by Mansfield, or a point in the law of evidence by Ellenborough, or a constitutional question by Marshall, or a rule of equity law was established by Hardwicke or Eldon in England or by Kent and Story in this country. (3) Much uncertainty is introduced into the law by hurried and incomplete arguments by counsel. The judges may confine their studies to the authorities presented to them. Inferior arguments beget worthless decisions, which will naturally be overruled after a more elaborate and complete discussion in a later case. (4) The ability of the reporter has much to do with the value of the decision. It is his office to prefix to the opinions of the judges a sufficiently full statement of the facts in the case, as well as a "head-note" containing an abstract of the points decided. He may readily err in both respects. If a person of moderate ability, he may fail to grasp the reasoning of the judges and to make an accurate abstract. In the early reports these defects were more manifest than at present. The judges delivered their opinions orally, and the reporters took such notes of what was said as they were able. These notes are frequently obscure and unintelligible. In modern times, as the judges write their opinions, this source of error is much diminished. It is, however, never wise to rely upon the reporter's head-note, but to consult the opinion itself. Care is usually taken in this note to indicate what points are really decided. For this purpose the word "*Held*" is resorted to. When the object is to show that a point has been discussed and not decided, the expression "*It seems*," or "*Semble*," an equivalent, is adopted. Such remarks thrown out in the course of a discussion are called *dicta* or *obiter dicta*. They have no weight as authority, and are only useful in subsequent cases as a matter of argument.

Reports have been preserved in England from an early day. They were at first called "Year Books," and were strictly official, the reporters being appointed by the government. These books are composed in Norman-French, with many abbreviations difficult to be deciphered. Only a few of them, recently published in England, have been translated. This method after a time fell into disuse, and the matter of reporting was left open to any one who might choose to follow it. Under this system some good reports were obtained, while others were simply execrable. Since 1866 reporting has been regulated by the action of the bar, and the reports are well systematized, and are of a high degree of excellence. In the U. S. the reporters are in general appointed by some public authority. Reports are of quite unequal value, and good judgment is required in order to know how and when to use them.

This whole subject is beginning to present quite a perplexing problem. Reports are multiplying with a truly alarming rapidity. They increase at the rate of more than 100 volumes per year. Various projects for codes and authoritative digests have been presented, but these meet as yet with but little favor from the profession. The spirit of development of English jurisprudence is to adopt case-law instead of the works of jurists. This course of development cannot well be arrested. Digests are, however, of the highest value when well prepared, as a means of consulting the reports, and are constantly in the hands of the profession. In the present state of jurisprudence the greatest security which the public has against uncertainty in decision is to establish the most perfect means for securing ability and independence in the judiciary, and learning, thoroughness, and candor on the part of the bar. We shall thus secure the greatest possible completeness of discussion and facility for accurate decision. The multiplication of reports may be endured when there is some sufficient guaranty that they will contain the matured conclusions of a wise and impartial judiciary. (Consult Wallace on *Reporters*; Marvin's *Legal Bibliography*; Bouvier's *Law Dictionary* (ed. 1862 and later, title "Reports").) Lists of reporters and the courts to which they belong can usually be found in the catalogues of leading law-booksellers.

T. W. DWIGHT.

Representation and **Representative System.** See DEMOCRACY, by CHARLES O'CONOR, LL.D.; GOVERNMENT, by HON. A. H. STEPHENS, LL.D.; and PROPORTIONAL REPRESENTATION, by HON. C. R. BUCKALEW.

Reprisals. See INTERNATIONAL LAW, SUMMARY, by PRES. T. D. WOOLSEY, S. T. D., LL.D.

Reproduction. See APPENDIX.

Rep'tiles [Lat. *reptare*, to "creep"], a class of vertebrates, the third in the descending series of the system of the animal kingdom, succeeding mammals and birds and preceding amphibians and fishes. They may be briefly defined as vertebrates with a trilocular (or imperfectly quadrilocular) heart, incomplete circulation, and cold blood, the lower jaw connected with the skull through the intervention of a quadrate bone, the skull with a single occipital condyle, and the tegumentary appendages developed as scales or plates. In form, as well as the development of limbs and modifications of the skeleton and other parts, they differ so much that it is impossible to contrast them as a homogeneous group with the other classes of the animal kingdom. The chief characteristics and modifications of parts, so far as they are of primary systematic importance, may be examined under the head of the tegumentary, osseous, muscular, nervous, dental, alimentary, circulatory, respiratory, and reproductive systems.

Tegumentary System.—The tegumentary appendages forming the exoskeleton are developed in the form of thin horny scales or bony plates, which, however, are generally readily distinguishable from those of fishes. In the rhynchocephalians, saurians (lacertilians), and ophidians the scales are generally imbricated on the back and sides, and often developed as transverse scutellæ on the abdomen; in the crocodilians, bony plates are developed; in the tortoises, the vertebral column and ribs are peculiarly modified, forming a shield which becomes superficial and covered, generally, by a number of angular contiguous plates; certain extinct types appear to have had naked skins, and others a plated or scaly armature.

Osseous System.—The skeleton is always completely developed and ossified. The vertebral column in the quadrupedal forms is divided into four or five regions, less distinctly differentiated, however, than in the mammals: (1) the cervical in recent types has not more than nine vertebræ, but in certain extinct forms had very many; (2) the dorsal is also variable in development, and has but few (about 10) vertebræ in the tortoises, but numerous ones in some lizards; (3) the last dorsal vertebræ, like the others, generally bear ribs, but when they are deficient in such, as is the case in some lizards and all the crocodilians, they are distinguishable as lumbar; (4) the sacral region is composed at the most of two vertebræ, and is generally but little differentiated; (5) the caudal region is very diversiform, often being extremely elongated and composed of numerous vertebræ, and sometimes (*e. g.* Amphisbænidæ) having very few. In the apodal forms there is no definite differentiation of the vertebral column into regions. No epiphyses are developed. The vertebræ are generally concave in front and convex behind (procœlous), but not infrequently (*e. g.* the gecko lizards, rhynchocephalians, certain crocodiles) biconcave (amphicœlous), like those of fishes, and sometimes (certain crocodilians) they are concave behind (opisthocœlous). The ribs differ considerably in the mode of attachment to the vertebræ, and their several variations in this respect have been utilized for the combination of the orders into more comprehensive groups. (1) In the saurians, ophidians, and rhynchocephalians, as well as extinct pythonomorphs and sauropterygians (Plesiosauria), "the dorsal vertebræ have transverse processes, which are either entire or only very imperfectly divided into terminal facets" (*Huxley*); *i. e.* they have the "tubercular and capitular surfaces united" (*Cope*), and hence have been grouped by Huxley as *Erpetospondylia*, and by Cope as *Streptostylica* and (including tortoises) *Synaptosauria*. (2) In the crocodilians, as well as extinct Anomodontia, Dinosauria, and Ornithosauria, "the anterior dorsal vertebræ have elongated and divided transverse processes, the

tubercular being longer than the capitular division" (*Huxley*); *i. e.* they have the "tubercular and capitular surfaces separated" (*Cope*), and have been combined under the name *Suchospondylia* by Huxley and *Archosauria* by Cope. (3) In the extinct fish-like ichthyosaurians "the dorsal vertebræ have double tubercles in the place of transverse processes," and have been distinguished by Huxley as *Perospondylia.* (4) Finally, in the "tortoises the dorsal vertebræ (which, like all the other vertebræ, are devoid of transverse processes) are not movable upon one another, nor are the ribs movable upon the vertebræ," and consequently they have been isolated by Huxley as *Pleurospondylia.*

The skull is quite diversiform in the several orders. Its sutures are generally well defined, and the bones usually readily homologized with those of the mammals. The occipital bones are well developed and completely ossified. The basioccipital has a single convex condyle, into the composition of which, however, the exoccipitals also assist to a greater or less extent. The proötic bone is completely ossified, and becomes united with the epiotic and opisthotic only after they have united with the adjoining elements, or remains separate throughout life. No median inferior element or parasphenoid is persistent or retained in the adult. The lower jaw has compound rami, each ramus having several distinct bones—*e. g.* the dentary, containing the teeth; the articular, articulating with the upper jaw (quadrate bone); the angular, an elongated bone between the dentary and angular; the supra-angular, parallel with and above the angular; and the coronoid, above the supra-angular. The articulating surface is concave, and some distance in advance of the posterior end of the ramus. Between the lower jaw and the skull intervenes an element, the quadrate bone, which is regarded by Huxley and some others as the homologue of one of the auditory ossicles (the malleus) of mammals. The hyoid apparatus is little developed in the mature animal.

The sternal apparatus is wanting or atrophied in the apodal and composite in the quadrupedal ones. Its modifications are to a considerable extent characteristic of the several orders.

The members are very diversiform in development. They are primarily fitted for running or walking in the limbed saurians, rhynchocephalians, crocodilians, and tortoises, as well as the extinct dinosaurians and dicynodonts; modified for swimming in the normally-limbed sauropterygians and fish-limbed ichthyopterygians; the anterior members are modified for flight in the ornithosaurians or pterodactyles; and limbs are completely wanting or atrophied in the ophidians and many saurians; sometimes the anterior and sometimes the posterior limbs are developed, and not the others. In the boas and pythons rudiments of the posterior limbs exist. A common character of the limbed species (shared, however, with the birds) is the division of the tarsal bones into two series, the proximal of which are connected more with the tibia, and the distal with the metatarsal bones.

Muscular System.—This offers nothing specially noteworthy, save that it is developed more like that of the mammals, and especially the birds, than that of the amphibians or fishes. Its modifications correspond with the diversity exemplified in the saurians, ophidians, and tortoises.

Nervous System.—The brain is small compared with the size of the skull, but mostly fills the cranial cavity. The cerebrum is moderately developed, and is much the largest of the elements of the brain. The hemispheres are not connected by a corpus callosum, but a small anterior commissure is developed. The optic lobes are generally contiguous, and imposed over the mesencephalon; they have ventricles. The olfactory lobes are generally elongated, and are excavated by ventricles which are continuous with those of the hemispheres of the cerebrum. The cerebellum is moderately developed, and in the crocodilians is provided with a vermis with transverse fissures.

Dental System.—The teeth are extremely diversiform, and their modifications are characteristic of various groups, major and minor. They often (in most lizards) become ankylosed with the jaws in the old; and in many forms, besides being present on the jaws, they exist also on the palatine and pterygoid bones.

Alimentary System.—The intestinal tract is generally differentiated into an œsophagus, a stomach, a small intestine, and a large intestine. The terminal portion is a cloacal cavity.

Circulatory System.—The heart in the saurians, ophidians, rhynchocephalians, and tortoises is trilocular; in the crocodilians quadrilocular, a septum dividing right and left ventricles. Venous blood is in all, however, more or less commingled with arterial, and the temperature is low. The blood-corpuscles are rather large, distinctly nucleated, oval, and red. There are generally two or more aortic arches, but sometimes only one; in which case it is always on the right side.

Respiratory System.—Respiration is always performed by lungs, which are highly organized, but in which the bronchi do not branch dichotomously. A distinct trachea is developed. No diaphragm divides the lungs from the rest of the abdominal cavity.

Reproductive System.—The organs of generation differ according to the orders. There is always, however, a cloaca. In the saurians and ophidians the copulatory organs are paired; in the crocodilians and tortoises there is a simple organ, and in the rhynchocephalians there are no copulatory organs. The ova are large, and are in some hatched in the interior of the body, but in most expelled and left to the heat of the sun. The vitellus is very large. The oviduct is a Fallopian tube, which is dilated and forms a kind of uterus near its termination. The embryo has an amnion and an allantois.

(See further HERPETOLOGY and the different orders, etc.)

THEODORE GILL.

Rep'ton (HUMPHRY), b. at Bury St. Edmunds, England, May 2, 1752; was at first a merchant, but having failed in that business, devoted his attention to landscape gardening, in which branch he soon attained the foremost position in England, and was employed by a large number of the nobility in laying out their country-seats. He also published works on landscape gardening, which were reprinted in 1830 with a *Memoir.* D. in Essex Mar. 24, 1818.

Repub'lic [Lat. *res publica*, "public concern," "commonwealth"], a political community in which the sovereign power is lodged in the whole body of the people or in a portion of them, and exercised through representatives or agents directly or indirectly elected by them for that purpose. Sometimes the word is used in its widest meaning, generally to designate a state which is not ruled by an hereditary monarch. It is called an *aristocratic* republic when the exercise of the sovereign power is confined to a nobility, a number of patrician families, or a privileged class of whatever description, to the exclusion of all others; a *democratic* republic when all classes of the people participate in the exercise of that power alike. The purest form of the democratic republic exists where all the people periodically assemble in general meeting to make their own laws and to appoint their agents for the execution and enforcement of those laws—a system which has been found practicable only in small or at least very compact communities, while in larger states the sovereignty of the people can act only through the instrumentality of representation, at present generally adopted.

Of the republics of ancient Greece, Sparta had a strictly aristocratic government, while Athens might have been called a democratic republic but for the circumstance that a majority of its population were slaves, and as such excluded from all political rights, at the time of its greatest prosperity the number of its free citizens being only 135,000, while that of the slaves rose to 365,000. The republic of Rome was, during the first centuries of its existence, aristocratic in its political organization, but in the course of time the patrician aristocracy found itself compelled to yield to the lower orders of the people, the *plebs*, access to the high offices of the government, which thereby acquired a more democratic character; all the while, however, as in all republics of antiquity, a large part of the population remaining slaves and without political rights. The Italian republics which became the most flourishing and powerful commercial communities of the Middle Ages—notably, Venice and Genoa—were strictly aristocratic; a number of patrician families, who chose from among themselves the head of the government, called the doge, enjoyed a monopoly of political power. The first important republic of the modern era, the United Netherlands—formed, after their separation from Spain, out of seven confederate provinces (1580), and recognized by Spain as an independent republic (1609)—was of a more democratic tendency, as was also the republic or "Commonwealth" sprung from the English revolution, which, however, after an existence of only eleven years (1649–60), was overthrown by the restoration of the Stuart dynasty. Of a similar character were most of the free cities and Hanse towns of Germany, only three of which—Hamburg, Bremen, and Lubeck—have to this time preserved their republican institutions as members of the German empire. Two miniature republics in the S. of Europe have survived to our day—San Marino in Italy and Andorra in the Pyrenees—remarkable mainly for their insignificance as independent states. Spain had, immediately after the abdication of King Amadeus (1873), a short period of democratic republican government, which, however, appeared only as a mere episode in a series of revolutions and reactions. At present there are only two re-

publics of importance in Europe—Switzerland and France. In Switzerland small communities of peasants had from time immemorial, and while the country was under the overlordship of the German empire, maintained among themselves republican institutions of a strongly democratic character, while in the larger towns aristocratic rule prevailed. In the Treaty of Westphalia (1648) the national independence of Switzerland was formally recognized, and in 1815 the great powers guarantied her existence as a federal republic consisting of twenty-two cantons and the neutrality of her territory. While Switzerland was under the influence of the French Revolution, and subsequently of the Napoleonic empire, the aristocracies ruling the Swiss towns were deprived of their power, but regained it in a great measure after 1815. Since 1830 the federal as well as the cantonal constitutions of Switzerland have undergone very important reforms, entirely eliminating their aristocratic features and making them more and more democratic. Several cantons have introduced in their constitutions the provision that certain classes of bills passed by their legislatures shall be submitted to a vote of the people to acquire the force of law (the *referendum*), in the same manner in which in the States of the American Union constitutional amendments are ratified by the people; and another provision, making it the duty of the legislatures to take into consideration and pass upon propositions submitted to them by a number of citizens fixed by the constitution (the *initiative*). Thus, the people are made to participate in legislative proceedings, and the element of direct popular action is infused into the representative system. The Swiss cantons here referred to may therefore be called the most democratic republican states now in existence. An attempt was made to engraft the same provisions (*referendum* and *initiative*) also upon the federal constitution, but failed (May, 1872). In France a republican form of government was adopted in 1792, which passed through violent convulsions and various transformations until in 1804 it was supplanted by the Empire under Napoleon I. The second attempt at republican government was made in Feb., 1848, after the overthrow of the Orleans dynasty, but already in Nov., 1852, it made room for the Second Empire under Napoleon III. On Sept. 4, 1870, when Napoleon III. had fallen into the hands of the German forces after the battle of Sedan, the Republic was proclaimed in Paris for the third time. The National Assembly has since passed a number of constitutional laws for the permanent organization of republican government resting upon universal suffrage, and the present condition of things seems to give promise of greater stability.

In America all states except Brazil and the colonial possessions of European powers have republican governments with democratic institutions. The largest and most powerful of them, the republic of the U. S., presents the realization of the democratic republican idea on the greatest scale.

In our days, the distinction between aristocratic and democratic republics has scarcely more than historical importance, inasmuch as there is at present not a single state with a republican form of government in existence in which a nobility or a privileged class of any description enjoys a monopoly of power; and since the abolition of slavery and the enfranchisement of the colored race in the U. S. there is none in which any considerable class of people is excluded from the exercise of political rights. But while all republics, with a uniform tendency, have drifted toward democracy as far as the equality of political rights among citizens is concerned, we find an essential difference between them as to the character of their political institutions in another respect. (1) The constitution of a republic may be such as to make the general government in its legislative and executive capacity the depository of the whole sovereignty of the people, so as to give it control not only of national affairs, but also of local administration; or (2) the general government of a republic may be one of strictly limited powers, being confined in its constitutional sphere of action to a certain class of things which concern the nation as a whole, while the administration of affairs of a local nature is left to the "self-government" of the people in their local organizations respectively, with entire independence of the central authority; or (3) these two systems may be so mixed as to leave to the local self-government of the people only a limited range, subject to supervision and interference by the central government. A government of the first description would be called a *centralized*, of the second a *decentralized* government, and of the third either one or the other as it more nearly approaches the first or the second standard. The French republic presents an illustration of the centralized system in a but slightly modified sense, while the so-called *federal* republics—and among them most conspicuously and on the greatest scale the republic of the U. S.—exemplify that which combines the independent administration of local interests by the people in their local organizations with a central government controlling affairs of national concern. For the system of centralization the advantage is claimed that it imparts to the government great power, energy, and rapidity of action by enabling it to employ the whole machinery of general and local administration for its purposes. It is therefore by many thought preferable in a country whose surroundings and international relations are such as to render the possibility of an instantaneous employment of all its resources desirable, or whose internal peace is threatened by a lawless and turbulent spirit, so as to require prompt and vigorous measures for the maintenance of order and security. But while the centralized system thus creates, in the common acceptation of the term, a "strong government" which may be used for good ends, it produces at the same time an accumulation of power which may become, and sometimes has shown itself, very dangerous to popular liberty and to the permanency of republican institutions. Elective governments are always apt to be governments by political parties, and political parties are, in the nature of things, not only greedy of power, but almost always unscrupulous in the use of it for their own advantage and to the prejudice of their opponents. To avert or lessen the danger of such partisan abuse of power encroaching upon the rights of the minority, and becoming generally oppressive, that power itself must be hedged in as narrowly as possible. But in a republic in which the system of centralization prevails the party in possession of the central government, being permitted to thrust its hands into local administration, controls almost every official influence of any importance and wields almost every instrument of power in the land, unchecked by any independent local authority. The very magnitude of the power is in itself a temptation to use it in an arbitrary manner, and history does not tell us of many political parties that were conscientious enough entirely to resist temptations of that kind. Another serious objection to the centralized system consists in the inducements and facilities it offers for sudden changes of government by means of force and surprise. The power of the government being omnipresent in the country in an immense number of agencies and influences so organized as to respond at all times to the impulse and direction given by one controlling will, he who has or obtains control of this central focus will be apt to have or obtain control at the same time of the whole country through that vast and potent machinery. Great revolutions may therefore be effected, and their results imposed upon the country, by bold and sudden strokes of force at the seat of government, whether the majority of the people be in sympathy with such movements or not. Such things may be done with an intention to serve the interests of popular liberty and progress, but history shows that they are done as frequently by daring factions or by unscrupulous rulers or military chieftains to advance selfish schemes of individual ambition, and in the latter case generally with disastrous effect. Thus, the centralized system holds out a tempting prize to popular insurrection at the seat of government, as well as to the *coup d'état* on the part of those in power; and what appears as an element of strength and energy in the government becomes thereby in reality an element of instability. This tendency is the more dangerous as the centralized system fosters among the people the habit of looking for all that is to be done for their interests not to themselves, but to the superior wisdom of those directing the machinery of power. Not being permitted to manage their own local affairs independently and on their own responsibility, the people are by the centralized system deprived of that most important school of political education which local self-government affords. It is essential to the success of democratic republican government that the political intelligence of the masses of the people be well developed, and this the centralized system fails to do. People who are not permitted to learn how to manage their local concerns by independent action cannot be depended upon to act with steady judgment and wisdom in exercising a directing and decisive influence upon the government of a great republic. The exercise of their suffrage in electing presidents or members of the national legislature will, therefore, where the centralized system prevails, be apt frequently to degenerate into a mere choice of tyrants. For this reason it is to be hoped that the French, in order to give true vitality and permanence to their republican institutions, will be able to throw off their traditional fondness for a strong centralization, and give as great as possible a measure of independence to popular self-government in their *communes*, and extend it to the *departements*.

In the so-called *federal* republics the *decentralized system* of government has been a thing of natural growth. They were formed by uniting in common political organ-

izations a number of already existing communities (cantons, colonies, states), and these pre-existing communities, after their union still preserving their identity, and also a degree of independence necessary to that end, remained, as to their local concerns, self-governing bodies, while within them the smaller units of local organization (municipalities, townships, counties) continued to stand in a similar relation, subject to certain necessary restrictions, to the respective cantons, states, etc. Of the nature, as well as of the practical working, of this complex system the republic of the U. S., where it has developed itself on a great scale and unhampered by external influences, furnishes the most instructive illustration and the fairest criterion. There local self-government exists, not as a concession granted from above, but as the original condition of society, and is firmly rooted in all the ways of thinking and the habits of the people; while the national idea, politically embodied in the general government, although a thing of later growth, has also developed itself to great moral potency. The national government is restricted by the Constitution to a limited sphere of action, covering matters of national concern, such as to provide for the national defence, to make treaties with foreign nations, to declare war and conclude peace, to levy taxes for its support, to organize a general postal service, to regulate commerce, to coin money and fix the standard of weights and measures, to establish rules of naturalization, to dispose of the national domain, to admit new States into the Union. The several States are left free to manage their own local affairs, being restrained, however, from doing anything that would encroach upon the constitutional sphere of the national government, and, by recent amendments to the Constitution of the U. S., from depriving any class of citizens of the equal protection of the laws or of the right of suffrage on account of race or color; while the national authority, on its part, is bound to guaranty to every State a republican form of government and to protect it against invasion, and, upon its own application, against domestic violence. Republican government on this plan has been carried on in the U. S. for nearly a century, and during that time shown its strong as well as its weak points. It might be supposed that a national government hedged in by such constitutional limitations would indeed not be able to endanger the liberties of the people, but would rather be hampered by the opposition of local interests and jealousies acting through the several State organizations, so that it might lack the strength and energy necessary at all times to enforce its will even within its constitutional sphere, and especially to meet great and sudden dangers from without or within. The history of a century, however, has demonstrated that the national government possesses vigor enough to accomplish all the objects for which it was instituted, and that it has been able successfully to carry on foreign wars of considerable magnitude, and also to overcome an insurrection supported by nearly one-third of the people, organized upon a tremendous scale, and commanding great resources. It has even now and then, when under the control of an ambitious party spirit or under the pressure of great emergencies, shown a tendency, for special ends, to break through its constitutional restrictions or permanently to enlarge the scope of its powers. It might also be apprehended that under such a system in some of the several States powerful interests may obtain control, wield an oppressive rule over a part of the people, and intrench themselves behind the right of the States to govern their local concerns. This was the case in the States in which slavery existed, and remained so until slavery was abolished in consequence of the rebellion. Since then that particular form of local oppression within State limits has been guarded against by constitutional provision. Attempts by political factions or party organizations to exercise an oppressive rule may be expected to find their remedy in the resources of popular government. There have been now and then conflicts of authority between the national government and individual States, but with the exception of that which gave rise to the rebellion of the slave States they have all been peaceably composed either by compromise or by decision in favor of one or the other side.

A republican government so organized is unquestionably less subject to certain dangers, to which centralized republics are apt to succumb. A *coup d'état* or an insurrection at the seat of the national government, set on foot for the purpose of effecting a general revolution by one stroke of force, would in a country like the U. S. be a mere blow in the air. Neither will a political party in possession of the national government be able to maintain itself or to oppress opposition by an arbitrary stretch of power, for the rights of the citizen are sheltered by the protection of local self-government. The people would find, with a proper exercise of vigilance, in their local organizations sufficient means to frustrate such attempts. If there is any real danger threatening the political institutions of the U. S., it is certainly not that of their overthrow by force, but it is their deterioration by the influence of corrrupt practices and habits. In this respect nothing can be more deplorable than the usage which has developed itself in the U. S. in the last forty years—to treat the offices of the government as the mere "spoils" of party victory, so that whenever the control of government passes from the hands of one party into those of another, all or nearly all the officers belonging to the outgoing party are removed, and their places are distributed among those members of the victorious party who have gained a title to reward by partisan zeal or service, or who are the favorites of influential politicians, especially the members of the national legislature. Persons being appointed to office not on account of their ability and character fitting them for the discharge of official duty, but on account of their usefulness in party warfare, the civil service of the government gradually sinks down to the level of a partisan agency. The pursuit of office becomes an organized trade, attracting to itself a class of political prolétaires who follow active politics mainly as a means to gain a living, and who, knowing that their tenure of office is likely to be short, are under a strong temptation to use their opportunities as much as possible for their own benefit, at the expense of the public interest. Fortunately, there are many men found among them conscientious enough to resist that temptation, but many others have yielded to it, relying upon their party service and the favor of influential men for their protection. The civil service, organized upon the "spoils" principle, has therefore proved the source of widespread demoralization and corruption. Moreover, this class of spoilsmen, stimulated by their selfish interest to great activity in political movements within the reach of their influence, are apt to become a very powerful, sometimes even a controlling, element in their respective party organizations, and are frequently found banded together to promote the elevation of men to places of power upon whose favor and protection they have reason to rely, and against those who may be expected to use their power with a single eye to the public good. The consequence is, that men of the highest character and ability are not unfrequently discarded as "too good" to be candidates for public employment, because they could not obtain the support of the lower class of politicians; that the moral tone of politics is becoming so low as to repel many of the best citizens from active participation in public life; and that political parties, especially when they grow old, show a tendency to resolve themselves into close corporations, to whom the possession of power and "public plunder" is the first, and the promotion of the public interest only a secondary object. The people of the U. S. are gradually becoming sensible of the dangers growing out of this condition of things, and several efforts have been made to effect a reform of the civil service, upon the principle that fitness in point of character and ability should be considered the only title to appointment and promotion, thus stripping the civil service of its partisan character, and by the abolition of the "spoils" system removing the most dangerous source of political demoralization and corruption. These efforts have to contend against the stubborn resistance of established usage and a selfish interest powerfully organized, but the reform appears so necessary to prevent the decline of public morals that it can scarcely fail ultimately to receive the support of an intelligent and patriotic people proud of their republican institutions.

But, on the whole, it will be admitted, even by those not partial to the republican theory, that in spite of temporary abuses and occasional jarrings the decentralized system of republican government with its "checks and balances" of power has not only proved itself entirely practicable, and very successful even in holding together in one national organization a very numerous population spread over a vast extent of territory, but that the people living under it, in Switzerland as well as in the U. S., have attained a social condition remarkably prosperous, progressive, and happy. This has undoubtedly been owing in a very great measure to the stimulus which active self-government imparts to popular education, enabling men to manage their own affairs, private and common, upon their own well-understood responsibility, giving them an opportunity to reap the benefit of their own wisdom, and to learn from their own errors and blunders, and thus signally advancing the standard of general intelligence and practical sense among the masses.

Experience shows, however, that even the best form of government is not alone sufficient to produce the same effects everywhere and under all circumstances. Under republican institutions very similar to those which in the U. S. and Switzerland are attended with such happy results, the other republics of the western hemisphere have been

disturbed by frequent revolutionary outbreaks, lawlessness, anarchy, and a generally disordered state of society. This must be in a great measure attributed to climatic influences and to the character of the populations inhabiting those tropical or semi-tropical countries. It has been observed that in latitudes where nature is so bountiful as to render assiduous and well-directed labor unnecessary to the support of life, and where the climate subjects human nature to an alternation of indolent lassitude and fitful excitement, and does not permit an even exercise of its energies, the exercise of reason and the sense of order easily yield to an inordinate activity of the imagination and the government of the passions; and that, therefore, whatever constitutional machinery may be devised, political life there is apt to vibrate between two extremes—liberty liable to drift into anarchy, and order maintained by means of despotism. It is also to be noted that those countries have been colonized and are permanently inhabited by nationalities most accessible to the peculiar influences mentioned. It may be stated as an historical fact that free institutions have conspicuously prospered only in the temperate zone, and are prospering most with people of industrious habits and an enterprising spirit, who need such institutions for their pursuits of daily life, and cannot well do without them. Aside from these industrious habits, the following seem to be the essential conditions to secure the success and permanency of republican government: A manly pride of individual independence among all classes; popular education; general respect for the sanctity of the law; patient submission to the will of the majority until the majority can be changed by legal means; a scrupulous regard for the rights of the minority; a conscientious observance of constitutional principles and forms; a moral sense abhorring corrupt practices; a patriotic national spirit, strong enough to keep under control the selfish impulses of partisanship. CARL SCHURZ.

Republic, county of N. Kansas, traversed by Republican River, consists of rolling prairie. Chief industry, agriculture. Cap. Belleville. Area, 720 sq. m. P. 1281.

Republic, tp., Republic co., Kan. P. 770.

Republic, p.-v., Scipio tp., Seneca co., O., has 1 newspaper. P. 481.

Repub'lican, tp., Jefferson co., Ind. P. 1125.

Republican, tp., Clay co., Kan. P. 856.

Republican Fork, the northern branch of Kansas River, rises in E. Colorado, flows through S. W. Nebraska, bends S., and joins Smoky Hill Fork in Davis co., Kan.

Republican Party. The first sign of political parties after the Declaration of Independence arose out of the attempt to form a constitution or frame of government. The colonies had gone on nearly to the end of the Revolutionary war following the advice of the Continental Congress, and it was not until 1781 that Articles of Confederation were finally agreed upon by all the States and set in operation. Still, the Confederation was in no sense a government, and the whole people of the U. S., though forming in some sense one people, and appearing to foreign nations as such, and answerable to them as such, were not by their own constitution a *state* in the philosophic sense of the term. They were a confederation. The feebleness of this system became more and more apparent, and all felt the necessity of some change. The convention called in 1787 was professedly for the purpose of amending and strengthening the Articles of Confederation. During the four months of its session opinions became developed and men took their sides. Those who finally prevailed were for giving up all attempts at improving the Confederation, and for substituting a republic which should be in the full sense of the term a state, a political organization with all the attributes of a government within the sphere of its operation. Washington favored this course, Hamilton was the chief constructive genius, and its chief supporters were Madison, Pinckney, Rufus King, Sherman, and Ellsworth. It was a bold and novel conception. The result was to be the constitution of a republic as a central state, sovereign and supreme in all matters coming within its jurisdiction, its powers derived from the people themselves, the ultimate sovereign—every person within its limits to be its subject, owing to it a direct personal allegiance, and liable to be coerced or punished by it through its own tribunals for any disobedience to its authority. The republic was not to act through the States in any things essential, but directly upon individuals. It was to have a complete organization of its own, legislative, executive, and judicial, to make its laws through a Congress, to adjudicate all questions through its own courts, and to execute its laws through its own executors. At the same time, the States were to be preserved. Each State was to be sovereign on all its internal questions not remitted by the Constitution to the jurisdiction of the republic.

The opposition to this Constitution was of two sorts. Some members were opposed to any constitution of government, and wished only to strengthen and improve the Articles of Confederation. Others, willing to have a constitution and a central state of some sort, were opposed to the provisions. They feared the single executive head as monarchical, the small Senate with long terms of office as oligarchical, and a judiciary appointed by the President and holding for life as still more oligarchical. They thought too many matters were brought within the jurisdiction of the republic, and too great powers given to its departments, and predicted the absorption of the States and the growth of the central power, which would be anything but democratic.

When the Constitution was adopted by the convention and submitted to the people, meeting by conventions in the several States, the division of opinion between the members of the national convention extended through the whole people. The discussions through the press and in the State conventions were long-continued, vehement, and able. A series of articles addressed to the people, entitled *The Federalist,* written mainly by Hamilton, with most valuable aid from Madison and Jay, constituting the most remarkable body of political discussion in American, and, it may fairly be said, in English literature, has come down to posterity side by side with the Constitution itself. By what seems an accident those who supported the Constitution were called "Federalists," and those who opposed it "Anti-Federalists." When the Constitution was adopted —which it was by very small majorities and after the utmost exertion of the influence of leading men—those who supported it, the Federalists, naturally formed the majority of the first Congress and undertook the administration. The known opinions of Washington gave that party a great advantage, which it held through his life. Those who had opposed the Constitution naturally but gradually formed themselves into an opposition. The Constitution being a fact, the title of Anti-Federalist was no longer applicable, and they gradually took to themselves the title of "Democrats." So the first acknowledged political parties after the adoption of the Constitution became the Federalists and the Democrats. The same reasons which made some opposed to any constitution of central government, and led others to object to its powers and scope, caused both those classes to unite in sustaining such constructions of the Constitution, and such methods and policies of legislation and administration, as should reduce its scope and powers to the minimum. There were two influences in this direction: first, the ultra-democratic opinion, which in the latter part of the eighteenth century was jealous of all conservative political institutions, and had all but unlimited faith in the capacity and willingness of the people themselves, not only to organize, but to administer government, looked to have all offices elective, tenures short, and no obstructions in the way of the instant action of public opinion for the time being; and secondly, what subsequently became known as the State-Rights feeling—that is, a jealousy of a central government, however constituted, and a determination to make the utmost of the State governments, however they might be constituted. Doctrinaire Democrats were naturally State Rights men, for a central government framed upon principles they objected to was more dangerous, in their view, to popular liberty, than State governments could be; and State-Rights men, however, conservative in their philosophy, naturally acted with the Democrats.

Jefferson, the head of the Anti-Federal party, its philosopher and instructor, always objected to the use of "Democrat" as the party name. He insisted upon calling it the "Republican party;" and that term was struggled for for some time, but not with success, though it often appeared in official titles and documents. Jefferson's reason was perhaps, partly, a bias against the name, but more largely his view of the policy of securing the title of Republican to his party, as creating an implication that the Federalists were something other than republicans, and so aiding in the attacks made upon them as being disguised friends of monarchical and oligarchical institutions. It may, therefore, be said that notwithstanding the occasional efforts of a few, there has been in the U. S. no party which established for itself the title recognized by its opponents in history of the "Republican party" until the middle of the nineteenth century.

The Federalists held the government for twelve years, through the administrations of Washington and Adams; the Democrats came in under Jefferson in 1801, and continued to hold the government until what is known as the "era of good feeling," when the Federal party as a distinct organization had dissolved, the old opposition to the Constitution did not appear in the new generation, the government had been carried on upon substantially Federal prin-

ciples, the old lines of demarkation had nearly disappeared. There was no opposition to the re-election of Mr. Monroe in 1820. The election of 1824 was mainly a personal contest between Jackson, Adams, Clay, and Crawford, in which Federalists and Democrats of the old generation and their descendants of the new were not discernible. The election of 1828 was a contest between Adams and Jackson, and no name indicating principle was adopted by the supporters of the two candidates. In the course of the eight years of Jackson's administration his supporters gradually organized themselves into what they claimed to be the Democratic party. Many Federalists and descendants of Federalists joined this party, and the opposition party contained a large number of Jeffersonian Democrats and their descendants, among whom Mr. Clay was conspicuous. There was some resistance to allowing the administration party the monopoly of the popular term "Democrat," but it soon subsided, and the Jackson Democrats of 1829–37 remained in undisturbed possession of the title.

The opposition to Jackson's administration organized themselves under the title of National Republicans in 1831, and Mr. Clay was their candidate in the election of 1832, when Jackson was re-elected. It is difficult to distinguish any general political principle dividing these parties, but the local, temporary, and more accidental causes of division were deeply felt at the time. Jackson and his party were opposed to the U. S. Bank, and the favorers of the bank were in opposition. Jackson and his supporters were opposed to any general plan of internal improvements under the direction and at the expense of the republic, and, with some local exceptions, to what was known as the "American system" of protection of manufactures by duties on imports laid for the purpose of protection. Thus, the National Republican party had for its active principles the support of the U. S. Bank, protection by tariff, and internal improvements; yet perhaps, after all, it was the personal character of Jackson and the line of party policy he pursued which most affected the opposition. He was thought to be arbitrary and passionate, but little suited to civil and constitutional government, and naturally to encourage and develop that form of democratic opinion which holds to the absolutism of the popular majority of the time being, and consequently of its elected agents. They argued that the process was simple from the popular majority of a party electing a President to the absolutism of that President as representing that majority during his term of office. And certainly the course pursued by Jackson gave countenance to this objection. He seemed to regard the majority that elected him as in possession of the government by right of political conquest, and himself as their designated agent for his term of office. He considered them as entitled to all the offices to be appointed by the government, however purely ministerial, and he proceeded to remove officers of the customs and post-office on the sole ground that they did not support his administration, and to fill their places with his friends. One of his chief supporters, a Senator from New York, avowed the doctrine in the memorable words, "To the victors belong the spoils of victory." The doctrine was, however, new to the American people, certainly in its application, and among its strongest opponents were men of the old Democratic school, who proved by the later writings of their great teacher, Jefferson, that he feared a tendency to the absolutism of a majority, quoting his well-known words, "An elective despotism is not the government we fought for." Still, it is not to be denied that Jefferson himself, at the opening of his administration, adopted the same principle, though with limitations and carried out to a low degree, for he removed a small number of Federal post-office and custom-house officers of admitted fitness upon the avowed ground that nearly all office-holders were then Federalists, and that the majority were entitled to a fair share of the offices. His course was earnestly opposed by the Federalists as resting on a principle fraught with great danger to public morality and safety. From Jefferson's inauguration till Jackson's there had been no such party revolution as called for an application of the doctrine of "spoils," but John Quincy Adams during his Presidency refused to remove any office-holders (except the few acknowledged political agents of the administration) for their political opinions. And Mr. McLean, Jackson's postmaster-general, refused on principle to remove postmasters solely for their opinions, and was himself displaced by Jackson.

At the same time there was a change taking place in the methods of legislation by Congress. The Speaker of the House had become the recognized agent of the majority. Every committee had its chairman and major part of its members from the ruling party; the chairmen of these committees were regarded as party representatives in intimate official relations with the heads of the departments to which their duties related. These various developments, and the frequent use of the veto-power by Jackson, led the opposition to drop the title of National Republican, and adopt the name of Whig, in imitation of that party in England, whose war-cry was that the power of the throne "had increased, was increasing, and ought to be diminished." In the great Presidential election of 1840, in which the Whigs gained their first national victory, they owed it in a great measure to a popular dissatisfaction with the extreme party government followed up by Van Buren, the disordered state of the finances after the rejection of the U. S. Bank, and to a widespread belief that the Whig party was more conservative and constitutional than the Democratic. This belief had countenance in the course of the Democratic party in the internal politics of the States. It was owing to that party that the State judiciaries were made on principle agents and representatives of the majorities for the time being by changing their tenures from appointments by the executive for life to tenures for a few years by popular elections, and that nearly all appointments were taken from the executive and made subjects of popular elections for short terms; and so the elections became frequent, complex, and gave rise to a class of electioneering managers acting through caucuses, whose powers and profits became enormous. But when the Whig party obtained power under Harrison, it appeared that its leaders in the forum and press had not the courage or the desire to reverse the party policy of Jackson, and resist the clamor for office, and a general removal of office-holders took place. Thus, both parties became committed to the "spoils" system, and it has been ever since the most exciting and demoralizing acting power in our elections.

The question of a U. S. Bank as a bank of discount, as well as a fiscal agent of the government, became settled against the Whigs; a practical line of distinction sufficient for application removed from party politics the question of internal improvements; a surplus revenue made duties for protection only indefensible; and although the Democratic party furnished most of the free-traders, the adjustments of the tariff became mostly local struggles of different interests for the advantage of duties laid professedly to raise the necessary revenue.

A new question, which was to dwarf and gradually absorb all others, was fast coming above the horizon. By the close of the last century all the Northern and Middle States had abolished and prohibited slavery, and it had been prohibited in all the Territories belonging to the republic at the adoption of the Constitution; and the slave-trade was abolished. It had been hoped that these causes would lead to the gradual extinction of slavery throughout the Union, or at least to its becoming a feeble power confined to a small number of States. But the result had been far otherwise. The Louisiana purchase and the acquisition of Florida, to which no restrictions were applied, had more than doubled the number of slave States; the raising of cotton, rice, and sugar had become among the largest interests of the country; and the ownership of about 4,000,000 slaves was regarded as an enormous investment. The slave States had thus one paramount interest on which they would unite at any moment in disregard of every other political question. They had also the advantage of sectionalism, for the free and slave States were separated by a geographical line, and the slave States began to feel themselves a country divided from the rest of the republic by a geographical line and by a unity of domestic institutions—a country to which every inhabitant owed a kind of patriotic duty in the defence of an institution as to which they stood almost alone against the civilized world, and which, they acknowledged, required constant vigilance and was attended with great perils.

As a domestic institution within each State, it was acknowledged by all intelligent public men to be entirely a State matter. Not that the Constitution specially made it so in terms, but because it clearly came within that category of domestic institutions which were left to the control of each State, and not transferred by the Constitution to that of the republic. Abolitionism, therefore, in the free States, and as far as concerned the general government, was a moral and not a political question, and societies for promoting abolition or emancipation were at the North, as they would be in Europe, organizations for moral influence upon the slave States themselves. At first there were emancipation societies in some of the slave States, and many of their prominent statesmen in the early part of this century looked with some hope to gradual emancipation; but before the middle of the century the slave-holding community had become not only the apologists, but the advocates and propagandists, of slavery, seeking to extend slave territory everywhere, avowing that a substantial control over the administration and legislation of the republic was essential to their safety; and if there were any favor-

ers of emancipation in the slave States, they were silenced or had emigrated to free States.

There was one cause which removed the slave question from the category of domestic institutions, and made it necessarily a subject of national politics. Had the republic been confined to the original States, this cause would not have existed. But the republic possessed, and from time to time had acquired, a vast amount of unsettled territory lying beyond the limits of the States. Over this territory Congress had the exclusive legislative power. Part of it lay N. and part lay S. of the line dividing slave States from free States. It was rapidly filling up with population, and was to be made into new States which would have great wealth and numbers, and have a vast if not controlling influence on the politics of the country. Slavery had been prohibited under the Confederation in all the territory then possessed by the U. S.; and that prohibition was regarded as based on compact among the States. When new territory was added to the republic, as by the Louisiana purchase, the free States sought to prohibit slavery in those territories at the outset, and also to make it a condition to their admission as States that slavery should not exist within them. The slave States naturally resisted these efforts, and strove to secure for themselves as large a share of the expected States as possible. At first the right of Congress to legislate upon the subject of slavery within the Territories, as on all other questions of the Territories, was not seriously denied, and the struggle was limited to defeating any such proposed legislation, and leaving the subject to the control of each Territory through its legislature; and the South trusted to its own emigration with slaves into the southernmost Territories, and the practical establishment of slave interest, and to the political power of combined slave-holders, to securing these Territories as slave States. The struggle in Congress therefore was, that slavery should be prohibited in the Territories by Congressional legislation, and that each new State must be a free State.

But the emigration into the Territories was largely from the free States, and the foreign emigration was from countries in which slave-labor was unknown, and the balance evidently inclined to freedom if the subject was left to Territorial legislation. A doctrine then began to be promulgated from the South that there was no rightful authority anywhere to prohibit slavery in the common domain of the republic. This argument was drawn from a subtle construction of the general nature of the Constitution, and rested largely upon an extreme view of State sovereignty. It was contended that each State had an equal right in the public territory, and that where slavery was the system of any State, that State had the same right to have its system planted by its citizens in any Territory on transferring their slaves there as a free State had to a system which would enable its citizens to hold their property in such Territory. Answers to this argument seem plain enough now, but the doctrine gained great strength from its absolutely prohibiting all attempts to exclude slavery by law, and as a logical consequence requiring from the Territorial legislatures or from Congress such legislation as might be necessary to secure the rights of the slave-holders within the Territories. It derived an accidental advantage from the fact that, though unsound in its basis, it was more logical in its methods, and, if it could be carried out, more peaceful and dignified than the other policy, which proposed to leave the question of slavery or freedom to the Territorial legislatures themselves, without any interference by Congress, which came to be called "Squatter Sovereignty." Squatter sovereignty was indeed a mere expedient. All who did not adopt the doctrine just before stated of the absolute right of slavery in the Territories admitted that the control of the subject was within the legal authority of Congress, for the Territorial legislatures themselves were the mere creatures of Congress, and their legislation subject to its revision, and their existence dependent upon its will. But the argument for adopting it as a policy was that it would remove this exciting and dangerous subject from national politics and remit it to the inhabitants of the several Territories.

The first great struggle respecting slave and free territory arose out of the Louisiana purchase, which carried with it the delta of the Mississippi and its entire right bank until it reached the original territory. A portion of this new territory, of which St. Louis was the capital, had been largely settled by slave-holders, and applied for admission as a State under the name of Missouri, with a State constitution which not only established slavery, but prohibited emancipation. The people of the free States insisted upon the abolition of slavery as the condition of its admission. After a struggle of two years or more, the united delegations from the slave States, with the aid of a few sympathizers from the North, gained a clear victory. Missouri was admitted without condition, and an act was passed establishing what was known as the "Missouri Compromise," prohibiting slavery in so much of the new territory as lay N. of lat. 36° 30′, known as "Mason's and Dixon's line;" which was practically an extension of the line which separated the free and slave States, leaving territory S. of that line clear of prohibition.

The next struggle was on the annexation of Texas. It was an independent republic, with slavery, had very large territory, and lay S. of all our slave States. Its acquisition would add greatly to the political slave-power. By this time the slave States were principally in the Democratic party, while the Whig party had its main strength in the North, in the free States, although it still had an uncertain hold on Louisiana, Tennessee, Kentucky, North Carolina, and Maryland. The Whig party, as a general thing, was opposed to the acquisition of Texas, yet it did not dare to put it upon the ground of slavery, for that would alienate its Southern supporters. An attempt was made to insert the proviso that slavery should not exist within the State. But, although the slave-power failed to carry through the Senate the treaty of annexation between the U. S. and Texas, which required a vote of two-thirds, it accomplished its object by the extraordinary process of a joint resolution of the two houses of Congress—a mode of legislation intended only for the light and temporary subjects of jurisdiction—and the clause was introduced providing that Texas might be divided into four States as soon as it had sufficient population, and that the existence of slavery should be no objection to their admission.

The annexation of Texas with a disputed boundary brought on a war with Mexico, which resulted in the acquisition of the very large Territories of New Mexico and California, and a renewal over them of the struggle between slavery and freedom. In the course of the contest Mr. Wilmot of Pennsylvania moved the proviso to the acquisition of any territory from Mexico "that neither slavery nor involuntary servitude shall ever exist in any part of said territory." This struggle was so momentous that the term "Wilmot Proviso" stood to that generation to represent the prohibition of slavery in the public domain —the principle coeval with the republic. Although the proviso passed the House of Representatives more than once, it was always defeated in the Senate.

It will thus be seen that in respect to slavery in the Territories and new States there were three positions: first, the ancient one of its prohibition, secured by action of Congress in its legislation over the Territory and as a proviso to the question of admitting new States, popularly termed the "Wilmot Proviso;" second, the abstaining by Congress from all interference with the subject, leaving the decision to the Territorial legislatures, with the understanding that the existence of slavery should be no objection to the admission of a Territory as a State, the policy popularly known as "squatter sovereignty;" and lastly, the new doctrine that there was no power anywhere to prohibit slavery in any part of the public domain, but if slaves were taken into it all powers of master over slave must be enforced by the government of the Territory, aided, if necessary, by a legislation of Congress.

The device of squatter sovereignty was tried out in the Territory of Kansas, and its folly and dangers demonstrated. Kansas was a part of the Louisiana cession, lay N. of 36° 30′, and consequently by the act of 1820, called the Missouri Compromise, slavery was prohibited within its limits. But the slave-power had now become paramount in the politics of the country. It was determined in the councils of the Democratic party that the administration should take the Southern position that there was no power anywhere to prohibit slavery in a Territory. Accordingly, the act of 1854, establishing the Territory of Kansas, declared the Missouri Compromise inoperative and void, as inconsistent with the principle of non-intervention by Congress with slavery in States or Territories. The act provided that the existence of slavery should be no objection to the admission of the Territory as a State, and it confined the right of voting in the Territory to white inhabitants. On the same day a bill was passed organizing the Territory of Nebraska in the same terms. So the measure of Congress repudiating the Missouri Compromise, and leaving all the public domain open to slavery, became identified in popular speech with the Kansas-Nebraska bill.

As slavery could not be prohibited in Kansas while it was a Territory, the struggle turned upon the constitution it should adopt as a State, and was transferred to the soil of Kansas. In the free States emigrant aid societies were organized to assist Northern families in moving to Kansas and establishing themselves there. A small portion of Southerners moved in with their slaves, but a clear majority of the actual residents were free State men. But the

slave-power met this by invading the Territory from the adjacent slave State of Missouri with organized armed bands at the time of the elections, and by intimidating the free State inhabitants and fraudulent voting claimed to have carried the elections. These bands resolved to drive out of the Territory all inhabitants who came there under the emigrant aid societies. Every election was contested, each side claiming to have had a majority. Each side established a Territorial legislature, each had a constitutional convention, each submitted its constitution to vote, and each constitution was declared to have been adopted. The result was anarchy and civil war. There was a great deal of fighting, assassination, lynch law, burning of houses and towns, and violence of every description. Steadily through the whole contest the Democratic administration took the side of the slave State men. The Democratic Presidents appointed a succession of Territorial governors, and as any one showed signs of supporting the free State party as being the actual majority of *bonâ fide* residents, and rejected the alleged majorities of the slave State men as fraudulent, or otherwise recognized the proceedings of the free State men as legal, he was displaced and some one of whom more thorough obedience was expected substituted. But no governor could be there long without either siding with the free State men or resigning, unwilling to carry out the policy of the administration. The slave State legislature established slavery, made it a capital offence to assist a fugitive slave, a penal offence to deny the legal existence of slavery in Kansas, and required of every voter an oath to obey the Fugitive-Slave law of 1850. The U. S. marshals sided with the slave State men, took their organized bands into pay, and their grand juries indicted for treason men who supported the free State constitution. The seat of the free State conventions and legislature was at Topeka, from which their constitution took its name, while the constitution submitted by the slave State men was known as the Lecompton constitution. The Lecompton constitution was submitted in a way the free State men deemed grossly unjust and illegal, and they did not vote, but the constitution was declared adopted; and although the governor, Robert J. Walker of Mississippi, appointed by the President as a sure friend of the slave-holding cause, went in person to Washington to present to the President the fraud and outrage of the whole proceeding, the President approved it, and the Lecompton party was in the ascendant, and Gov. Walker resigned in disgust. This condition of anarchy and violence lasted from 1854 to 1858 with but little intermission. Congress at last ordered a vote upon the Lecompton constitution in Aug., 1858, and it was rejected by so overwhelming a majority of what were evidently legal voters that the slave-power was obliged to abandon it. But the slave State legislature submitted another slavery constitution, and declared it adopted, though the vote was very small. At the next election for a Territorial legislature, in 1858, the free State people abandoned their Topeka organization and constitution, despairing of sustaining it against the Democratic administration, and took part in the election. They carried the legislature, called a convention at Wyandotte, which adopted a free State constitution, known as the Wyandotte constitution, submitted it to the people, who adopted it, and petitioned Congress for admission into the Union as a State. That these proceedings were legal, and that the majorities were fairly given, admitted of no doubt, yet the State was not admitted until 1861, when the delegations from many of the slave States had left Congress and Pres. Lincoln had been elected.

This history of the struggle in Kansas has been given entire at this place, that it may be better understood, and as having had great influence in the formation and growth of the Republican party, hereafter to be described. In 1856–57 the slave-power obtained a great victory by the decision of the Supreme Court in the case of Dred Scott. That case might have been decided without passing upon any great question affecting slavery under the Constitution, and an opinion of that nature drawn by Judge Nelson was intended to be the opinion of the court. But after the Democratic party had carried the Presidential election of 1856 the members of that court from the slave States, who then as always were a majority, came to the conclusion that they could take advantage of that case to make a decision which would for ever remove from national politics the question of slavery in the Territories, make void all the prohibitions of slavery in the public domain, and give every citizen the right to carry slaves there, and make it the duty of the government of the republic, as well as of the Territory, to recognize the relation of master and slave therein, and enforce all the rights and powers connected with it. With this view, and in the belief that they could accomplish the purpose, they gave up the opinion prepared by Judge Nelson, and Chief-Justice Taney prepared a most elaborate opinion to the effect described, and took advantage of a plea in abatement which had been overruled and abandoned below to pronounce an opinion that a person of African negro descent could not be a citizen of the U. S. in the sense of entitling him to sue as such in the courts of the republic. The majority differed on some points of reasoning, and the two Northern judges, who were not Democrats, Justices McLean and Curtis, gave powerful dissenting opinions. But the doctrine of the chief-justice's opinion, to which the majority subscribed, was declared to be the law of the land, was adopted by the Democratic administration as the guide of its conduct, and the Democratic conventions throughout the country pledged themselves to sustain it.

There was another subject which brought slavery into national politics. This was the rendition of fugitive slaves. The Constitution provided that the fugitives from one State to another should not be discharged from the obligation of service by any law in the latter State, but should be delivered up on the claim of the person entitled to the service. It was always a serious question whether the intention of this clause was to make the apprehension and delivery the act of the general government, or was merely a prohibition upon liberation by State legislation which the courts would be obliged to respect, making the surrender to the claimant the act of the State officers. Still, a fugitive-slave law was passed by Congress in 1793, on the principle that the surrender was a national function, but the law was not effectual, and with the growth of the slave-power a demand was made for a new law, and in 1850 one was passed of the most extreme character, seeming to be devised for the purpose of irritating and outraging the Northern sentiment to the utmost. It broke down and set at naught the traditional guaranties of the common law for personal liberty, raised conclusive statutory presumptions against reason and fact, and gave decisive effect to the most untrustworthy of judicial proceedings. The pursuit of fugitives in the free States by hired slave-hunters, arrests, attempted rescues, and the enforcement of this new law with all its shocking provisions brought slavery home to the hearths and hearts of Northern people in its most repulsive features, and did more to educate and inflame the anti-slavery sentiment of the North than anything in our history.

There is one more topic to be considered before the structure of the Republican party can be properly understood. That is the subject of what is called State Rights, or, more properly, State supremacy. The feeling in the convention that formed the Constitution, and among the people, of jealousy of a central government and devotion to the power and dignity of the separate States, was always powerful. The Democratic party, after the Constitution was adopted against their votes, naturally took to close construction of its jurisdiction and authority and especially as between it and the States. These views culminated in Virginia and Kentucky in 1797, 1798, and 1799 under the great influence of Mr. Jefferson. Resolves were passed by the legislatures of these States in these years, drawn by Mr. Jefferson and by Mr. Madison, who had gradually passed under Mr. Jefferson's influence, substantially alike in sentiment, asserting doctrines which are generally described as the doctrines of the Virginia resolutions of 1798. They assert that the Constitution is a federal compact between sovereign States, and continues to be such; that as, in such compacts between sovereigns who are equal, there is no common arbiter, each State is the rightful judge, as a party to the compact, of the constitutionality of any measure; each may construe the compact for itself, and judge as well of infractions as of the mode and measures of redress; and the resolutions of 1799 say in terms, "A nullification by the sovereignties of all unauthorized acts done under color of that instrument [the Constitution] is the rightful remedy." Mr. Madison's report to the legislature of Virginia in 1800 asserts the right of each State to judge of the constitutionality of any measure of the general government. These resolutions became part of the platform of principles of the Democratic party, and were adopted with a kind of enthusiasm and unanimity by the slave-holding States. At the time they were passed the government had been solely in possession of the Federal party and there was a New England President, which gave them more currency at the South. But the slave States had already begun to look forward to this doctrine as the bulwark of their protection in case a majority of free States ever should do or omit to do what they should consider a violation of the rights of slavery. Still, as the Democratic party came into power in 1801, and held the administration—with the exception of Mr. J. Q. Adams's term of four years, from 1825 to 1829—under a succession of Southern Presidents from 1801 to 1836, there had been no occasion to appeal to the doctrine.

But in the struggle over the tariff in 1832, South Carolina, under the lead of Mr. Calhoun, planted herself on the doctrine of these resolutions, and declared void an act of Congress by a process which was called "nullification." This doctrine, now for the first time seen in operation, was met by Mr. Webster, in his famous debates with Hayne and Calhoun in 1830 and 1833, with a power of reason and logic which may now be pronounced conclusive. Fortunately for the country, there was a Democratic President in power, whose despotic nature and firm belief that he represented the sovereign people, aided by his intense personal hostility to Mr. Calhoun, threw him on the side of the general government with all the energy of his character. As he was the acknowledged representative of his party, his action placed that party in an awkward position, but it eventually rallied to the support of its chief, with the exception that Virginia, Georgia, and a few other Southern States took a neutral position, not questioning the abstract right of South Carolina to act as she had done, but treating her as exercising it unwisely in that instance.

This first attempt at nullification showed the practical absurdity of a State remaining in the Union, taking part in the government of other States, and receiving its benefits, yet taking an exception to one or more laws at its discretion, and resisting them as inoperative within its limits, though operative elsewhere. It put an end to the theory of nullification, and the extreme State Rights party at the South resorted to the doctrine of secession, contending that the lawful remedy of a State in case of what it considered a violation of the Constitution or an intolerable grievance was to secede from the Union. This was asserted to be the right of a State under the Constitution, the exercise of which by a State became binding on the republic and the other States, the seceding State being the final judge of the propriety of the exercise of the right. As the conflict between freedom and slavery became more imminent from year to year, the slave States committed themselves to the doctrine of the right of secession, and the general Democratic party of the country was committed to it, at least to this extent, that if a State chose to secede there was no authority in the general government to prevent it; or, as the theory was commonly expressed, the general government cannot coerce a State. So completely was this doctrine ingrained in the Democratic party that when the secessions took place in 1860–61, Pres. Buchanan, while he reproved the acts of secession as unpatriotic and without sufficient cause, announced himself as having no authority to resist it by force.

This history of the great questions which agitated the republic in the middle of this century prepares us to trace the rise of the Republican party.

As has been stated, the early anti-slavery societies looked solely to moral influence. As the subject of slavery began to press upon the national conscience, and the steady advance of the slave-power in national politics and the concentration of Southern feeling in favor of slavery and its propagation became apparent, these societies became political associations and nominated candidates for election. But there was a deep-seated cause of division in the anti-slavery societies which soon came to the surface with most serious results. A portion of its members came to the conclusion that it was wrong either to hold office or vote under the Constitution of the U. S. Their process of reasoning was simple: Slavery is not merely a wrong and an evil, but a sin. No man may voluntarily take part in a sin. The Constitution of the U. S. recognizes slavery, and to some extent protects it. It is a compromise with sin for advantages supposed to be received. No man, therefore, may voluntarily avail himself of the benefits of the Constitution or take part in executing it. It was soon seen that if this principle was adopted, it involved withdrawal from State political life, for every State officer is compelled to make oath to support the Constitution of the U. S. The consequences of this reasoning were honestly accepted and boldly avowed by its supporters. The struggle within the American Anti-Slavery Society was long and fierce, resulting at last in the victory of the extremists and the withdrawal of those who admitted political action. The former retained possession of the society, became known as abolitionists proper, or Garrisonian abolitionists from the name of the master-spirit and leading character among them, Mr. Garrison; while the latter ultimately organized themselves into a political party which eventually took the name of the "Liberty party," and entered into State and national elections with all the machinery of conventions and candidates. It was never a large party, never a majority in any State in the Union, or perhaps in any district of a State, but as a third party, well organized and earnest, it often exerted an indirect influence upon the two great parties of the country in the free States. Sometimes the term "Abolitionist" was applied to any person who made opposition to slavery in national politics a leading principle of action, but in strict logic it was applicable only to the Garrisonians. They insisted on the abolition of slavery within the slave States as the *conditio sine qua non* of any action under the Constitution, and, despairing of that, they urged secession of the free States; and while that was not attainable they held the position of personal seceders from the government, refusing all action under it. They also with but few exceptions were non-resistants, holding the doctrine that war or any taking of life or forcible resistance was against the law of God. The adoption of this principle gave more consistency to their position. When asked why they paid taxes to a government of sin, their reply was that as they would not resist the tax-gatherer by force, and he had a right to seize their property for taxes, they might as well pay him in the first instance. They were not quite so successful in answering the objection that they availed themselves of the post-office, custom-house, and peace and sanitary protections of the government, which were voluntary acts on their part. Taking no part in political action, and never very numerous, they still exerted a good deal of influence by constantly pressing the subject of slavery, its wrongs and perils, upon the people, and keeping a sharp watch over the action of such public men and newspapers as professed general anti-slavery sentiments. The two great political parties of the republic did not divide upon any question connected with slavery, and the Whig candidates, Harrison and Tyler, both natives and one a citizen of Virginia, were elected by a majority of nearly four to one, carrying a full proportion of the slave States. In the Presidential election of 1844, between Clay and Polk, slavery began to enter as an important element. The project before the country was the annexation of Texas, which if carried out would add greatly to the slave-power. The Democratic party throughout the country supported it, and it was declared by their national convention at Baltimore in 1844 "a great American measure which this convention recommends to the cordial support of the Democracy of the Union." The Whig party was nearly unanimous against it, though its national convention adopted no resolution on the subject. The objection of the Whigs in the free States was unwillingness to add to the slave-power, while the Whigs of the slave States put their opposition upon other grounds of expediency. Down to the day of the election there seemed scarce a doubt of the success of Mr. Clay, but he wrote a letter to a Whig in Alabama—a State in which a Whig majority was hopeless—which dissatisfied the Liberty party. New York, which cast 36 electoral votes, gave every sign of going for Clay, but on the publication of this letter the Liberty party suddenly and unexpectedly cast about 16,000 votes for Mr. Birney, a leader of their party, nearly all of which were withdrawn from the Whig party. This small local incident settled the Presidential election, and affected most seriously—it can never be guessed how seriously—the history of the country. The popular vote of New York out of nearly 500,000 votes gave a plurality of 5106 to Polk over Clay, while 15,812 were cast for Birney, none of which would in any event have been given for Polk, and most of which would have been cast for Clay but for his letter. The election in New York did not require a majority over all others, but only a relative plurality, and the vote was cast by general ticket, so that Polk received the 36 electoral votes of the State—more than one-eighth of the whole electoral college—by virtue of this small plurality of about 5000, while he was in an actual minority of over 10,000. The electoral vote throughout the republic was 170 for Polk to 105 for Clay, while the transfer of the 36 votes from New York to Clay would have given him 141 votes to 134 for Polk. This was the first indication of the importance of slavery in national politics. The popular vote throughout the country was 2,698,605; of these Polk received 1,337,243, Clay 1,299,062, and Birney 62,300; so that Polk just fell short of a majority, while he had 38,181 more votes than Clay. In Pres. Tyler's message to Congress (Dec. 4) he declared the election of Polk to be a decision of the American people in favor of annexing Texas, which the administration was bound to carry out, while not only did an inspection of votes show that Polk had not a majority if the contest could be construed to be solely on that issue, but in many parts of the North it had been declared by the Democrats that the election of Polk did not mean annexation.

The history of the annexation has been given in its general character. In the House of Representatives only four Whigs voted for the resolution, and they were from slave States; in the Senate but three Whigs, also from slave States. All other Whigs, from the North or South, voted against it. Every Southern Democrat in each house voted for annexation, and all but three or four of the North-

ern Democrats in the House. The passage of this act of annexation was a triumph of slavery over constitutional doubts, settled legislative practice, just apprehensions of war, and over anti-slavery sentiment in its most constitutional and reasonable aspect. The result was to bind the Democratic party more firmly to slavery, and to weaken the already feeble hold of the Whig party upon the slave States.

The war with Mexico which necessarily followed never roused the sympathy of the Whig party. Being a legal war, they made no factious opposition to it, and the Southern Whigs generally entered into it. Its success gave us the Territories of New Mexico and California and reopened the question of slavery in the Territories and of new slave States.

Between 1844 and 1848 the anti-slavery sentiment was developing itself rapidly in the Whig party at the North, especially in Massachusetts, the western part of New York, and the northern part of Ohio, and many Whigs took strong anti-slavery ground in Congress, especially Mr. J. Q. Adams of Massachusetts and Mr. Giddings of Ohio. The national convention of the Whig party at Philadelphia in June, 1848, took up Gen. Taylor of Louisiana for its candidate. It was adroit policy, for he was the popular hero of the war, as a large holder of slaves he would be trusted by the South, and his personal popularity and party allegiance were relied upon to carry the Northern Whig States. But this policy necessitated the suppression of all anti-slavery expressions. The Wilmot Proviso, to which nearly all the Northern Whig States had committed themselves, was rejected contemptuously, and no declarations of principles were adopted upon any subject whatever, and even the resolutions were rejected which required their candidate to accept the nomination as a Whig. A portion of the Massachusetts delegation refused to adopt the nomination and withdrew from the meeting—one of whom was Henry Wilson, afterward Senator and Vice-President. The Democratic convention of 1848 nominated Gen. Cass, and the whole spirit of its proceedings was so entirely pro-slavery that a good many Northern Democrats, who could not get over the effects of their early education in the principles of liberty and equality, withdrew from the support of Cass, professedly upon anti-slavery grounds. Their chief strength was in the State of New York, where they were known by the title of "Barnburners." The objections to both Presidential candidates resulted in the call of a political convention at Buffalo, N. Y., in June, 1848, in the hope of organizing a national political party based upon opposition, under the Constitution, to the further extension of the slave-power. As the Buffalo convention and Buffalo platform were the foundation of what was afterward the Republican party, and laid down the principles on which the struggle with slavery was at last successfully conducted, they require particular attention here.

In organizing the convention it was agreed that each State which took part should have six delegates at large and three from each Congressional district, with the understanding that they should be equally distributed between the three organizations which were to constitute the convention—viz. the old Liberty party, the anti-slavery Whigs, and the anti-slavery Democrats or Barnburners—and it is believed that this arrangement was on the whole fairly carried out. The country was surprised to find that Mr. Van Buren, who while President served the interests of slavery and had never exhibited any anti-slavery tendencies, with several of his political devotees, sustained the convention, and that he allowed himself to be put in nomination as its candidate. The candidate of the Liberty party was Mr. John P. Hale of New Hampshire, a tried member of their organization, while the Whigs agreed upon the support of Judge McLean of the Supreme Court. The platform asserted the following principles: (1) A common resolve to maintain the rights of free labor against the aggressions of the slave-power to a free people; (2) that Cass and Taylor had been nominated under slave-holding dictation, and could not be supported by the opponents of slavery extension without a sacrifice of consistency, duty, and self-respect; (3) that slavery in the several States is matter of State law alone, over which the general government has no authority, and for which it is not responsible, and therefore there can be no interference by Congress with slavery within a State; (4) that it was the settled policy of the nation at the beginning to exclude slavery from all the Territories, which never should have been abandoned; (5) the only safe means of preventing the extension of slavery into territory now free is to prohibit its extension by act of Congress; (6) no more slave States, no more slave territory; (7) no more compromises with slavery; (8) free institutions for California, New Mexico, and Oregon; (9) the motto "Free Soil, Free Speech, Free Labor, and Free Men." The platform was adopted unanimously, and the convention required that some friends of each candidate should give assurance that the candidate would accept the platform.

Just as the convention was about proceeding to vote for a candidate for President, Mr. Van Buren and Mr. Hale having been nominated by the Barnburners and the Liberty party respectively, the Whigs put in nomination Judge McLean. Mr. Salmon P. Chase of Ohio, afterward chief-justice of the U. S., who was elected to the convention as a Liberty party man, but had gone over to the support of Mr. Van Buren and the Barnburners, announced that he was authorized to withdraw the name of Judge McLean. As Mr. Chase was connected with Judge McLean, and intimate with him, and asserted the refusal of Judge McLean to stand, or rather his authority to withdraw his name, and as he possessed great weight in the convention as its presiding officer and otherwise, and there was no opportunity to communicate directly with Judge McLean at this late moment, the Whig members were obliged to submit to the result and to choose between Mr. Van Buren and Mr. Hale. It was scarce concealed that they had but little confidence in Mr. Van Buren's anti-slavery declarations or in the motives which led him and his personal friends to take part in the convention. But, on the other hand, it was plain that but little popular support from the body of moderate anti-slavery men of the old parties, from whom the votes must be drawn, could be expected for Mr. Hale, while the supporters of Mr. Van Buren proclaimed that his great influence with the Democratic party and his position as an ex-President gave a fair promise of carrying the State of New York and of revolutionizing the Democracy of the North, or at least of making a great inroad upon it. The result was that most of the Whigs voted for Mr. Van Buren, and he was elected, and, as the choice was fair and regular, it was made unanimous. But the choice was a misfortune to the party. It made very little impression on the Democratic party outside of New York, where it about equally divided the Democratic party and gave the State to Taylor; and Mr. Van Buren's name was not received by the country with respect, in its new and temporary connection.* In Massachusetts, where the strength of the new party was drawn almost entirely from the Whigs, it drew a large vote, notwithstanding the distrust of the candidate, and numbered a large proportion of men of education and character who have since become eminent.

The next struggle was in 1849–50, on the admission of California, which had adopted a free constitution. There were 15 slave States and 15 free States, and California would throw the balance for freedom. This was the real objection. The slave-power resisted it as matter of life or death, and made their yielding the occasion of securing great concessions for slavery. Many of the slave States threatened secession, and made preparations for it, if California should be admitted without some concessions of a security and equality of the slave States in the future. They demanded a recognition of the principle that slavery could not be prohibited in the Territories, or its permission be made an objection to the admission of a new State, a guaranty against the abolition of slavery in the District of Columbia, and a stringent fugitive-slave law. This contest lasted in Congress from Dec., 1847, to Sept., 1850. The chief feature in its party significance was the abandonment by Mr. Webster, the acknowledged head of the Whig party at the North, of his previous anti-slavery position, and his substantial concession of the demands of the slave-power in his celebrated speech of Mar. 7, 1850. This speech divided the Whig party of the North in sentiment, though not at once in organization, and made Mr. Seward the leader of the anti-slavery portion of the party. Pres. Taylor, who, though a large slaveholder, seemed determined to hold the balance fairly, and was a good deal roused by the attempts at intimidation upon him made by the extreme Southern men and their threats of secession, died at the height of the struggle, and the administration passed into the hands of Fillmore, the Vice-President. He put Mr. Webster at the head of the cabinet, and from this time the whole weight of the administration was given to carrying the Compromise measures, as they affected to call them, demanded by the South; and they were passed at the close of the session, Sept., 1850. Notwithstanding that the administration was Whig, it placed the party in an awkward position. By far the greater portion of the opposition to these measures came from the Whig party, and at the South what remained of the Whig party did not join in the secession demonstrations.

* An attempt was made to give this party the name of "Free Democracy," but the name did not hold, and it was popularly known as the "Free-Soil" party, especially after the hope of changing the front of the Democratic party at the North was abandoned.

In the Presidential canvass of 1852 the Whig party appeared for the last time upon the stage of national politics. It was divided in sentiment. The national conventions of the Democratic party in 1848 and 1852 had gone very far in surrendering it to the rule of the slave-power. They adhered to the rule requiring the two-thirds vote to nominate a President, never adopted by any other party, the purpose and effect of which was to give the slave States a veto, and so, practically, the designation of the candidate. They had adopted resolutions against the prohibition of slavery in the Territories, and in 1852 denounced all resistance to the Fugitive-Slave law, and all attempts to modify or repeal it as unpatriotic and dangerous to public peace. This attitude of the Democratic party gave it great strength at the South, and an attempt was made by a portion of the Whig party, led by Pres. Fillmore, Mr. Webster, and the remaining Southern Whigs, to put that party in a position which would give it a fair chance of Southern votes without the risk of losing much of its Northern anti-slavery element. The convention which was held at Baltimore in June, 1852, adopted with little opposition—212 against 70—a platform entirely acceptable to the Southern wing, and in fact previously arranged to its satisfaction. They declared the series of acts of 1850, known as the Compromise measures, to be a settlement; insisted upon the strict enforcement of the Fugitive-Slave law, and deprecated all further agitation of the slave question. Mr. Seward's policy controlled the greater part of the Northern vote. It was to let the pro-slavery section have the platform, but secure a President who would be not unacceptable to the anti-slavery section. His candidate was judiciously selected. It was Gen. Winfield Scott, who had gained a great reputation in the war with England (1812–15) and in the late Mexican war, and, though a native of Virginia, had made his home in the free States, and was generally thought to be a firm man of moderate opinions, who would adapt himself to the composition of his party and would not yield to the dictations of the slave-power. The anti-slavery portion of the convention united on Gen. Scott. The Compromise section was, unluckily for them, divided. Their principal candidate was Pres. Fillmore, who received during twenty-five ballots about an equal number of votes with Scott; but Mr. Webster was a candidate, and would not withdraw, although he represented the same principles with Fillmore, and although his vote never rose above one-tenth of the convention, and only prevented a choice. On the fifty-third ballot Scott was nominated.

The Democratic convention of 1852, besides affirming the Compromise measures, promising a faithful execution of the Fugitive-Slave law, and denouncing all attempt to revive the agitation of the slave question, promised faithfully to abide by the principles of the Kentucky and Virginia resolutions of 1797 and 1798 and Mr. Madison's report of 1800, the character of which has been previously described. Mr. Pierce of New Hampshire, who had no votes in the early part of the balloting, which lay between the acknowledged leaders, Cass, Marcy, Buchanan, and Douglas, was suddenly and unexpectedly, except to the managers, elected by all but a unanimous vote on the last ballot.

The Free-Soil party, which had organized at Buffalo in 1848, held its second national convention at Pittsburg in Aug., 1852. There were delegations from all the free States and from four of the border slave States, though the latter probably represented a very slight constituency. Their platform was substantially the Buffalo platform. It denounced the Fugitive-Slave act of 1850 as unconstitutional in many of its provisions, and cruel and perilous to freedom in its operation; it insisted on the right and duty of Congress to prohibit slavery in the Territories and to refuse the admission of any new slave States; adopted for its rule of practice that slavery should be sectional and freedom national; disclaimed any right to interfere with slavery as a State institution; and repeated the motto of Buffalo, "Free Soil, Free Speech, Free Labor, and Free Men." Its candidate was Mr. Hale of New Hampshire.

At the election of 1852 the popular vote stood thus: Pierce, 1,601,274; Scott, 1,386,680; Hale, 155,825. Although in a popular vote of over 3,000,000 Pierce had less than 30,000 majority, and but little more than 200,000 plurality over Scott, the result, taken by the electoral votes, gave Pierce every State in the Union except four, which gave their votes for Scott. Mr. Webster, notwithstanding that he was a candidate before the Whig convention and accepted its platform, withdrew from the support of Scott and gave his influence to Pierce. The result of the election so discouraged the Whig party that it never reorganized as a national party. This was not because of any paucity of its popular vote, but because it was demonstrated that it had lost the confidence of the slave States, and had not a sufficiently strong hold on the anti-slavery element of the North to enable it to carry the Northern States against the Democrats wherever the Free-Soil party was large. It is to be remarked, too, that the series of measures relating to Kansas (which have been already detailed) between 1852 and 1856 had greatly educated and aroused the anti-slavery sentiment of the North, and prepared to form a political party based substantially on the Free-Soil platform.

The leaders of the Free-Soil party and of the anti-slavery wing of the Whig party saw the propriety of not requiring either party to join the other, and agreed upon organizing a new party. They adopted the name of "Republican." As has been stated, this had never been the generally recognized title of a permanent political party. Jefferson and others attempted to secure it for their party at the end of the last century, but without success, and there was a short-lived National Republican party about the year 1832, which became the Whig party. By the time the Presidential canvass of 1856 began, the new party was well organized, and the country was divided into two camps—the Democratic and the Republican parties. The Democratic convention was held at Cincinnati in June, 1856. It reaffirmed the doctrines of 1852, the denunciation of all attempts to prevent slavery in the Territories or the District of Columbia by legislation, or to object to the admission of a new State on the ground that it established slavery; the affirmation of the Kentucky and Virginia resolves of 1797 and 1798; the recognition of a right to maintain slavery in any part of the public domain; a promise of a faithful execution of the Fugitive-Slave law, and a denunciation of all attempts to alter the compromises of 1850. Their candidate was Mr. Buchanan, whose selection was determined, as usual, by the slave-power, under the influence of the two-thirds rule. It was a politic nomination, as they were sure of the votes of the slave States, while his being a Northern man would help them in the free States, and especially for the reason that he was a citizen of Pennsylvania, a State whose vote it was thought would be decisive in the contest.

The Republican convention met at Philadelphia, June 17, 1856, and nominated John C. Fremont as President on the first ballot; Mr. Dayton of New Jersey was the candidate for Vice-President. The platform was substantially that of Buffalo of 1848 and Pittsburg of 1852, adapted to the special questions of the day; but as it was the first platform of the Republican party, it deserves special attention.

The platform welcomed to the party, without regard to past differences, all who were opposed to the repeal of the Missouri Compromise and the extension of slavery into free territory, and who favored the admission of Kansas as a free State. The resolves may be condensed in the following form: (1) the prohibition of slavery in all Territories of the U. S., and the denial of the authority of Congress or of a Territorial legislature to give legal existence to slavery in any Territory, freedom being the public law of the national domain under the Constitution; (2) the right and duty of Congress to prohibit in all Territories "those twin relics of barbarism, polygamy and slavery;" (3) a detailed recital of the wrongs and frauds practised upon the people of Kansas with the knowledge, sanction, and procurement of the Democratic President, his cabinet, and supporters; (4) the immediate admission of Kansas as a free State into the Union.

In 1854–55 there suddenly rose into existence a party—or, more strictly, a vast secret political society—known as the "Know-Nothings," whose assumed name was the "American" party. Its principle was the exclusion of all foreign-born residents from citizenship until they should have lived twenty-one years in the country, and the selection of natives for all offices in preference to naturalized citizens. It swept the country in an astonishing manner in the State elections of 1854, carrying nearly every State in the Union. The next year the excitement somewhat abated, and by the year 1856 the slavery question had practically divided and destroyed the party, as it had the Whig party before it. Still, it held its convention in 1856, and nominated Mr. Fillmore for President, and a small remnant of the Whig party met and adopted the same nomination. The contest, which was practically between Fremont and Buchanan, was a geographical conflict between the slave States and free States. Mr. Fillmore received the vote of Maryland only; all the other slave States voted for Buchanan. Of the 16 free States, 11 voted for Fremont and 5 for Buchanan. In Pennsylvania and Illinois the popular vote was very close. In Pennsylvania, out of 459,756 votes, Buchanan had a majority of less than 10,000; while in Illinois he had a small plurality over Fremont, which gave him the electoral vote of the State, but he was 14,000 short of a majority; and, taking all the States together, in a popular vote of a little over 4,000,000, Buchanan was in a minority of 377,629; but his plurality

over Fremont and his sweeping of the slave States gave him a considerable majority in the electoral college.

The administration of Mr. Buchanan saw the slave question become the paramount subject of national politics, chiefly, as has been said, by reason of the contest over the Territories and new States, and from the exasperating attempts to enforce the Fugitive-Slave law in the free States. Immediately after the election became known, the Supreme Court gave its opinion in the Dred Scott case, and the judiciary, the administration, and the Democratic party became committed to the doctrine that there is no power anywhere to prohibit slavery in the Territories, that it exists there as of right, and that the national government, as well as the Territorial authorities, is bound to recognize and protect it. Kansas, as has been said, against every effort by force and fraud on the part of the slave-power, countenanced by the administration at Washington, adopted at last, in 1859, a free State constitution by processes which could not be objected to; but the Democratic party refused to receive it into the Union, and it had become generally understood that several of the slave States would secede if that was done. During the course of this administration the secession party at the South presented a bold front. They avowed that they remained in the Union only at their pleasure, and that they should retire whenever they chose to consider what they called their wrongs greater than their self-respect required them to endure. They claimed a legal right in each State to withdraw from the Union at its discretion, and that its decision was legally binding upon the Union. In support of this position they cited the Virginia and Kentucky resolves of 1797–98, which the Democratic party had pledged itself to sustain at successive national conventions. This doctrine was popularized in the phrase, "A State cannot be coerced." Mr. Buchanan considered himself bound by it, leading Democrats publicly assented to it, it was the logical result of the Virginia and Kentucky resolves of 1797 and '98, and there can be no reasonable doubt that it was generally believed at the South that they had a legal right to secede, and that if they did so, no attempt would be made to coerce them by a Democratic administration, and that if the Republican party should come into power, and should attempt to oppose secession by force, it would not be sustained by the Northern people.

In 1858 was the memorable contest between Abraham Lincoln and Stephen A. Douglas for the Senatorship of Illinois. It was becoming understood that the Presidential election of 1860 would depend upon the votes of Pennsylvania and Illinois. As the Democratic candidate would be sure of all the slave States, and would doubtless have the vote of some free States, the Republican party certainly would not succeed if it lost both, and probably could not succeed if it lost either of those two States. These two distinguished public men personally canvassed the State of Illinois in the summer and early autumn of 1858, and their speeches were read with great interest throughout the country. Mr. Lincoln advocated the right and duty of Congress to prohibit slavery in the Territories, while Mr. Douglas advocated the policy which has heretofore been explained, and which acquired the name of "squatter sovereignty"—the policy of abstaining from all legislation by Congress on the subject, leaving the people of each Territory to establish or prohibit it at their discretion. This was not the thoroughgoing slave-power doctrine, which was that slavery could not be prohibited in the Territories by any power whatever; but the pro-slavery people of course sustained Douglas against Lincoln, who advocated the duty of Congress to prohibit it in all the Territories, which would result in all the new States being free States. As Senators are elected by the legislature, the contest was for the election of members. In the aggregate popular vote of about 250,000, Lincoln had a plurality of nearly 4000, but the arrangement of districts by which members were elected was based upon an old census, which gave to the southern part of the State, where the slavery interest was the strongest, a representation disproportioned to the population in 1858; and in this way Mr. Douglas had a small majority of the members of the legislature. The formal victory was with the Democrats, but the result showed that the Republicans would probably carry the general ticket in the Presidential election.

The cowardly and brutal assault made upon Mr. Sumner, Senator from Massachusetts, in the Senate chamber, by two Southern members of Congress in May, 1856, and more especially the honors paid to the assaulters by the people, and even the legislators, of some of the slave States, and the unwillingness of the administration party to take any proper notice of it, had a great effect through the Northern States. It was one of those cases where the impersonating a great wrong, presenting it in the concrete to the minds and hearts of multitudes, ripens rapidly their opinions into action.

The critical election of 1860 was now approaching. The Republican party was well organized, unanimous, and hopeful. They felt reasonably sure of carrying the New England States, New York, Ohio, and a range of the North-western States. The large free States which were doubtful were Indiana, Illinois, and Pennsylvania. The whole number of electoral votes at this election would be 303, requiring 152 for a majority. The free States were entitled to 183 votes, so that the loss of 32 Northern votes would be a defeat of the Republican candidate. They could afford to lose Pennsylvania alone or Illinois alone, but not both those States, nor either of them and Indiana. The loss of New York alone would defeat the Republican party. Had the Democratic party been united, they would have gone into the contest with 120 votes from the slave States secure, and would have needed only 32 out of the 183 Northern electoral votes to carry the election. But the Democratic party was not united. Its public men and political managers had gone too far in the support of slavery, and the slave-power had presented itself too defiantly in the attitude of propagandists of slavery, and had made too great demands on the Democratic party, to secure entire co-operation. And the South itself was not united. There was a secession party and a Union party. The former was represented by South Carolina chief of all, and by Jefferson Davis in the Senate. There was a Union party, composed mostly of those moderate Southern Whigs who had not joined the Democratic party nor abandoned themselves to extreme pro-slavery opinions. A considerable portion of the Democratic party at the South were not prepared to go to the extreme length of secession. They felt that extreme doctrines put forth or an extreme candidate selected by the Democratic party might unite the Northern electoral vote on the Republican party and destroy the influence of the Democratic party in the free States, and that there was danger of breaking up the Democratic party in the national convention by proposing such measures or such a candidate. The Republican convention met at Chicago in May, 1860. The platform adopted denounced the new dogma that the Constitution of its own force carried slavery into the Territories; declared freedom to be the normal condition of the Territories; denied that there was any power either in Congress or a Territorial legislature to give legal existence to slavery; censured the course of the Democratic administration in the treatment of Kansas and Nebraska, and demanded the immediate admission of Kansas into the Union. The platform was adopted with unanimity and enthusiasm. The most prominent and probable candidate was Mr. Seward. Since the defection of Mr. Webster in 1850 he had been recognized as the great teacher of the Northern people on the political bearings of slavery, and as the Senatorial leader of the Republican party. At first he led largely in the convention, but the argument was used with great force that the nomination should be adapted to securing the vote of the three States which were lost in 1856—Pennsylvania, Illinois, and Indiana—and the delegates from those States made up their minds that Mr. Lincoln was more likely to carry them than Mr. Seward. The result of the convention was the nomination of Mr. Lincoln. He was born in the South, though not belonging to the slave-holding class, but to the class of poor whites; removed early to Illinois; had been a Whig until the organization of the Republican party, and was a man of moderate opinions. He was willing to be satisfied with securing the Territories to freedom, and thus all the new States, and did not propose any national action, even if it could constitutionally be had, against slavery in the slave States.

The most moderate class of the Southerners, with some of the Whigs of the North, who had supported Mr. Webster, but had not gone over to the Democratic party, met in convention at Baltimore in May, 1860, and organized what they called the "Constitutional Union" party. They adopted no platform except the single phrase, "The Constitution of the country, the Union of the States, and the enforcement of the laws." The last clause of the sentence was intended to refer to the Fugitive-Slave law. They nominated Mr. Bell of Tennessee for President and Mr. Everett of Massachusetts for Vice-President.

The Democratic convention met at Charleston, S. C., also in May. The popular candidate was Mr. Douglas. He was the only Democrat with decided pro-slavery inclinations who had any chance of carrying any Northern States. But, though he had done the work of slavery with great power and zeal, and had acknowledged abilities and extraordinary power of will and courage, and there seemed little doubt of his devotion to Southern interests, the extreme party of the South was not satisfied with him. He had not been willing to force the Lecompton constitution upon the people of Kansas, and his policy of squatter sov-

ereignty was not as acceptable to the extreme slavery propagandists as the new dogma that slavery existed by force of the Constitution in the whole public domain, and could not be prohibited while the Territory remained a Territory. The struggle was on the platform. The majority report asserted the dogma that slavery existed under the Constitution in all the Territories, and could not be prohibited, and recommended a resolution which was understood to intend the repeal of the laws prohibiting the maritime slave-trade and the protection of that trade. The principal minority report reaffirmed the Cincinnati platform of 1856, and further as to the Territories, declaring slaves to be property, and that all rights of property are judicial in their character, and pledged the Democracy to defer to the decisions of the Supreme Court on that subject. The difference between the two reports may seem slight when looked at from this distance of time, but it was sufficient to rend the Democratic party in twain, give the election to Mr. Lincoln, and to precipitate the war of secession. The slave-power was determined to force the Democratic party to abandon squatter sovereignty in the Territories, and to adopt the dogma that slavery existed in them by force of the Constitution, and could not be prohibited by any power whatever. The party had never adopted that dogma in terms in its national platform, but the Kansas-Nebraska bills of 1854, repealing the Missouri Compromise, declared prohibition by Congress to be void; to that the party was committed. The Supreme Court in the Dred Scott case in 1856 was claimed to have decided, and seems to have decided, in favor of the new dogma. When asked why the minority report was not sufficient, the answer of the extremists was that the Dred Scott case was but the decision of a majority, and might be reversed, and in that case the minority report would commit the party to the reverse doctrine, and, besides, many lawyers held that the majority of the court was not necessarily committed to the dogma, and if the Democratic party meant to sustain the dogma, they should do it explicitly as a part of its political creed, and not remit so vital a question to the chances of a majority of the Supreme Court. In the course of the debate the chairman of the committee admitted that the slave-power would be beaten if the policy of squatter sovereignty was allowed, saying, "The Southern men encumbered with slaves cannot compete with the emigrant aid societies at the North in a contest for the occupation of the Territories." After a very excited debate, in which the delegations from many of the slave States threatened to secede if the majority report was not adopted, the report of the minority was substituted for it by a vote of 165 to 138. Thereupon about half the delegations from the slave States withdrew and organized a separate convention. The original convention passed a resolve that two-thirds of a *full convention* should be required for the nomination of a President. This was a defeat of Douglas, for although in the balloting, which continued several days, he received a majority of a full convention, he could not attain to two-thirds, and the convention adjourned to meet at Baltimore on the 18th of June. The seceding convention adjourned to meet at Richmond in June. When the original convention met at Baltimore by adjournment, it admitted after a violent discussion new delegates favorable to Douglas who had been elected in the interval to supply the place of the seceders. Upon this vote the entire delegations of five slave States and portions of the delegations from three other States seceded and formed a convention, which was joined by Caleb Cushing of Massachusetts, who had been president of the regular convention, and was chosen president of the seceding convention, and by most of the delegates who had seceded at Charleston. This seceding convention acted with unanimity. It adopted the majority report made at Charleston, and nominated Breckenridge of Kentucky, an extreme pro-slavery man and secessionist, for President. The original convention, after the two secessions, nominated Douglas with but little opposition, but it nominated for Vice-President Mr. Johnson of Georgia, whose pro-slavery and secessionist principles were as extreme as those of any man in the South—who had declared himself in favor of the new dogma, the sacredness of slave property, and of the principle that capital everywhere should own labor. In fact, the Douglas section of the Democracy were unwilling to commit themselves to a dogma which would ruin the party at the North, but would go as far as possible short of that, and hoped to satisfy the South by nominating a Vice-President of the most extreme school.

In the canvass of 1860 the Republican party went before the country united on its platform and its candidate. The Democratic party was divided as to both. In every Northern State it had two organizations; and although Douglas in those States had a much larger vote than Breckenridge, yet the latter had votes enough to give the electoral vote of several States to Lincoln in which he had not an absolute majority, and Mr. Lincoln received the electoral votes of all the free States except three in New Jersey. Douglas received but twelve votes in all—three from New Jersey, a free State, and nine from Missouri, a slave State. The Bell and Everett ticket received the votes of Virginia, Kentucky, and Tennessee. Breckenridge received by great majorities the votes of all the other slave States. This result gave the Presidency to Mr. Lincoln. Still, in the popular vote, counting Douglas, Breckenridge, and Bell as against him, he was in a minority of nearly 1,000,000 votes, and the Republicans had failed to obtain a majority of the House of Representatives; the Democrats held the Senate by a very large majority; and there was but one Republican upon the Supreme bench, and the majority of the court were slave-holders.

As soon as the election of Lincoln was announced, South Carolina took steps for secession. On Dec. 17 her legislature adopted an ordinance of secession unanimously, and her course was followed rapidly by Georgia, Mississippi, Florida, Louisiana, Alabama, Arkansas, and Texas, who organized a confederation of sovereign States, and by the time of Mr. Lincoln's inauguration, on Mar. 4, 1861, all the Gulf States had seceded, and the remaining slave States were in a critical condition, acting upon the principle of State sovereignty and the right of secession, but doubting the policy or justification of exercising the right at this time.

There is, unfortunately, an interval of nearly four months between the popular election and the inauguration of the President elect, and during those four months, while the secessionists were organizing their military and political system with the utmost energy and seizing the forts, arsenals, navy-yards, and dépôts of the government within the slave States, the protection of the Union was left to Pres. Buchanan and his cabinet and a Democratic Senate and House, all whose sympathies were strongly with the South. Nothing can show more clearly the demoralized condition to which the slave-power had reduced the Democratic party than the action of the President and his cabinet. In his message to Congress of Dec. 4, 1860, he took the position that the government had no power to coerce a State by measures of war; that the republic executes its laws as a part of civil government, and has the aid of its militia and army and navy for that purpose in the way of suppressing insurrections and tumults and protecting public property; but that if the people of a State declared their independence and organized themselves with such force and numbers that war-measures became necessary, it was not competent for the republic by any form or method, legislative or executive, to make war upon one of its own States. His attorney-general, Mr. Black, gave him an official opinion to that effect previously to the message. This left the government in a ludicrous and contemptible position of helplessness; nor was this all. The secretary of war had been for many months transferring munitions of war of all descriptions from the arsenals at the North to those at the South, so that on the breaking out of the rebellion, the South by simply seizing these arsenals was fully supplied with the materials of war, while the arsenals at the North were nearly stripped; and the secretary of the navy had been playing into the hands of the secessionists by leaving a large number of the best ships in the Southern navy-yards, and sending nearly all the other available ships to remote stations at various parts of the world after the danger of civil war became imminent, and by accepting the resignations of Southern officers, who were openly engaged or about to engage in the rebellion, without any inquiry or any attempts to hold them, and allowing them to draw their full pay, some of these officers in their letters of resignation announcing their new positions. The secretary of war resigned and joined the rebellion; the secretary of the navy, being a Northern man, held office under censure until the end of the administration, and retired to private life. The secretary of the treasury was a secessionist, and resigned to join the rebellion, and his successor, a Mr. Thomas, disapproved of all coercive measures, and soon resigned. The secretary of the interior also resigned from disapproval of coercive measures. No attempts whatever were made to arrest persons who were openly at Washington engaged in the rebellion, and members of the Senate and House resigned their seats to go and take part in the rebellion, announcing themselves as no longer citizens of the republic, but of the new Confederacy in arms, and remained in Washington during their convenience without any objections on the part of the government.

In the period of time between the secession of South Carolina and the end of Buchanan's administration unceasing efforts were made to effect what was called compromise. These took various forms, and received a good

deal of support from the fears of people and the extreme reluctance to see either a severance of the Union or a civil war for its preservation. But all these proposed compromises which there was any chance of the South's accepting were surrenders on the part of the North and of the government. They received their chief support from the border State men, not quite ready for secession, from those who supported the Bell and Everett ticket, and from Northern Democrats. The few utterances from the President elect showed that he was immovable in the position that the republic must not purchase the right to go on, however slight might be the terms required, and the Republican party stood firm in the same position. The retirement of the members from the seceded States reduced the strength of the Democratic party so far that no measures could be carried through Congress favoring any concession to the slave-power. An article upon the Republican party only, does not justify the following out of the history of these various attempts at compromise made in Congress and by the peace conventions, none of which were carried out to success. It is sufficient to say that the position of the two parties in the country was this: The secessionists for the last six years had acted with the Democratic party, and received its highest honors. The whole political force which carried the first eight States into rebellion may be said to have been derived from the Democratic party, almost if not quite without an exception. In the States that finally seceded and formed the Confederacy which carried on the civil war, it is not known there was one man engaged who had ever professed to be a Republican. Those Southern men who opposed secession, and joined in it with the most reluctance, were for the most part members of the old Whig party, and voted for the Bell-Everett ticket in 1860. The Democrats in Congress during the four months' interval—which might almost be called an interregnum—between the election and inauguration of Lincoln almost without exception passed concessions to the slave-power as a means of drawing them back into the Union, and the Democrats in the cabinet, in Congress, and in leading posts of influence in the press and before the people, with very few exceptions, sustained the view of the President that war-measures could not be used to coerce a State, and acquiesced in, if they did not approve, the policy of the administration in taking no proceedings against individuals avowedly engaged in both military and civil measures for separating the republic. The Republican party, on the other hand, were substantially unanimous in refusing any concessions to the slave-power, and in asserting the right and duty of the government to put down the rebellion by force of arms, and, if the power of the rebels required it, by war-measures on sea and on land, and in insisting upon the unconditional inauguration of Mr. Lincoln and the institution of his government.

Mr. Lincoln was inaugurated on Mar. 4, 1861, under the protection of careful military preparations superintended by Gen. Scott. His inauguratory address was of the most conciliatory character. He called attention to the fact that before his nomination he had declared his conviction that the republic had no right under the Constitution to interfere with slavery within States in which it existed; that he had no desire to have such a right acquired; and that he believed in the right of reclaiming fugitive slaves, and was willing to support proper legislation for the purpose; and to the fact that the platform of the Republican party declared the inviolability of the right of each State to order and control its own domestic institutions. He made no threats of the use of war-powers, expressed his determination to execute the laws and protect the public property in every State, if resident citizens could be found to hold office and execute its duties, by aid of the militia and ordinary military force. He made an earnest and effective appeal to the States engaged in secession not to allow things to go beyond such a stage, without threatening what might be done if such a stage were passed.

When the State of South Carolina on Apr. 12, 1861, opened fire upon Fort Sumter and reduced it by siege of thirty-four hours, and the act was approved by the entire Confederacy, and the Confederacy adopted the policy of reducing to its possession every thing belonging to the U. S. government within its limits by military force, and had organized a complete civil and military government, declared its independence of the U. S., and its determination to treat any attempt by force to execute the laws of the U. S. or to reclaim the property of the U. S. within its limits as a hostile invasion and an act of war, the Republican administration came to the conclusion that war *de facto* existed in those parts of the U. S. possessed by the rebels, and that this state of war must be met by the necessary corresponding exercise of war-powers on our part.

The history of the war is recent and familiar. We deal here only with the political questions involved as they bear upon the history of the Republican party.

There was a small portion of the Republican party, represented by Mr. Greeley of the New York *Tribune*, which was willing to see the seceding States left to their independence. This feeling arose from no doubt as to the powers of the government, but from their humanitarian and peace principles, their reluctance to see the country subjected to civil war, and their inclination, as doctrinaire radicals, to yield to the expressed opinion of clear majorities in any section of the country. But after war began, and the country was completely embarked in it, they sustained the administration. The Garrisonian abolitionists, as peace-men, could not approve the war, and as it was not waged for the purpose of abolishing slavery within the States, they could not approve its object, and while between the contending parties their sympathies would be against the slave-holders, they for the most part denounced the administration. But their influence upon the politics of the country was small.

The position in which this state of things left the Northern Democrats was extremely embarrassing. The rebel leaders had been the leaders of their party, their political and personal friends, the controllers of their administrations, and their favorite candidates. They had asserted repeatedly, and were educated to believe as true, the doctrine of the Virginia and Kentucky resolves of 1797–98, and their inclination was to believe that the logical result of those resolves was a legal right in the State to secede, or at all events to throw great doubt upon the question whether the government could coerce by war-powers States which had acted with such vast majorities. For the last twelve or fifteen years the Democratic party had denounced the Free-Soil and Republican platforms as unconstitutional and unjust to the South and perilous to the Union, and had gradually slid into a practice of denouncing all anti-slavery action in politics and defending or apologizing for slavery and its political attitude. It was inevitable that great numbers of them sympathized a good deal with the rebellion, some openly and throughout, and others, disapproving the actual secession, considered it entirely natural and excusable in view of the accession of Republicans to power. It was still more difficult for them to reconcile themselves to an actual war levied by the government under Republican auspices against the seceding slave States. Not only they, but some leading men among the Republicans, found great difficulty in understanding how men whom we claimed as citizens of the republic, owing it allegiance and guilty of treason in their rebellion, should at the same time be public enemies, receiving the same treatment which belligerents and prisoners of war are entitled to in wars between different nations; and how it could be that territory which we claimed to be of right a part of the republic should at the same time be enemy's territory; and how a government could be engaged in an actual war, to be recognized as such by foreign powers, with its own citizens, and be blockading its own ports. So extensive was this mystification that although we had established the blockade in pursuance of the law of nations, and claimed the right to stop and search neutrals on the high seas—powers which can be only exercised in time of war—and the Confederacy had declared war to exist, there was widespread indignation when it became known that Great Britain and France recognized a *de facto* condition of belligerency between the two parties. These difficulties were a good deal cleared up by the decision of the Supreme Court of the U. S. in the prize cases (2 Black's Rep. 635). The court held unanimously that there might be a condition of war *de facto* between a government and an opposite belligerent power composed of its own citizens and contending for the possession of its own territory; that in the present case the state of things was not an insurrection or rebellion to effect any purpose within the government, but was the case of the organization of a complete government, capable of performing all the functions of a government, intended to be permanent and entirely independent of the U. S., and claiming rightful jurisdiction over the entire territory it had marked out for itself, and the rightful allegiance of all the inhabitants of that territory, and having numbers and territory and ports sufficient to enable it to carry on war in the fullest sense of the term by sea and on land; that war was a question of fact and not of law, and the state of things was one of war *de facto;* that war being an appeal to force, the status of persons and of territory was also a question of fact, and territory in the actual occupation of the enemy was for the time being, and in the sense of the laws of war, enemy's territory, and the property of persons residing in that territory was, for the time being, enemy's property; and that while the war existed the line of enemy's territory was not to be determined by the civil law of the

U. S., nor by the pretended ordinances of secession or the civil boundaries of the seceded States, but was simply the line of bayonets. Upon these principles they upheld the right of the republic to maintain a blockade valid under the law of nations of ports in the possession of the enemy, and to make capture on the high seas of vessels and cargoes belonging to persons residing within enemy's territory, as above defined, as prize of war, without inquiry into the opinions or conduct of the owners, and without civil or criminal processes of law. As six of the nine judges were Democrats, this opinion had great weight with the party; and the question upon which the court divided, five against four—the right of the President to use war-powers in a civil contest without an antecedent act of Congress—was no longer a practical question, the act having been passed.

The firing upon Fort Sumter, the call of the President for volunteers, and the instant march of the Massachusetts regiments through the great cities of New York and Philadelphia to the relief of the capital, and the attack upon those regiments as they went through Baltimore, in which many were killed, had an electric effect upon the country, and especially it may be said upon the very lowest classes in the great cities, and unexpectedly upon that vast Irish vote of New York which had given the great strength to the Democratic party. They rose with enthusiasm for the Union, compelled those Democratic newspapers which had been reluctant, to unfurl Union flags, and overawed those of their political leaders who had opposed the war.

During the early part of the war little was heard of party strife at the North, but the war dragged on, the Union forces gained few successes and met with many defeats, the expenses of the war over so vast a territory, and of the maintenance of the largest commercial blockade ever known in history, were enormous; the debt was rapidly increasing, taxation became onerous, and paper money, which had been made legal tender, was depreciating in an alarming manner; volunteering subsided, the use of the militia of the States was impracticable, the largest bounties failed to call forth sufficient recruits, and the government was obliged to have recourse to conscription; and the *habeas corpus* was suspended and disloyal citizens were held in imprisonment. The natural result of this state of things was censure of the government and dissatisfaction with the war. The Democratic party began to reorganize itself, and to fall into the posture of political opposition—not avowedly to the war itself, but to the method and motives of the government and of the Republican party. This spirit increased in the party until at last the contests at the ballot-box were a good deal to the same purpose with those upon the field—viz. to determine whether the war should be fought through and the national authority established by force of arms over the whole Union, or whether it should be abandoned, and either the independence of the seceding States be recognized, or such concessions be made to them by amendments to the Constitution and otherwise as would induce them to remain in the Union.

The act for conscription was passed in Mar., 1863. A suit was brought in Pennsylvania to test the constitutionality of the act. Three of the five judges of the State supreme court were Democrats, and united in an opinion that not only this conscription act, but conscription in any form for adding troops to the army, was unconstitutional. The ablest of these judges, Woodward, was nominated by the Democrats for governor, and it was perfectly understood that if he was elected the conscription would be resisted in Pennsylvania. The great importance of this central State, and the fear that New York and New Jersey, under Democratic governors, would take the same course, made the Pennsylvania election of 1863 the most important State election during the war. But after a very severe struggle, in which public speakers from all parts of the Union took part, Woodward was defeated by a decisive majority, and Gov. Curtin, an energetic and loyal man, was elected. At the same time a Republican was elected to the supreme court in the place of a Democrat whose term had expired, and the decision of the court was reversed. This result put an end to the attempts to nullify the conscription by judicial proceedings. But when the conscription was first put in force there were mobs in many of the cities, and in New York the mob held possession of large parts of the city for several days, threatening the offices of Republican newspapers and the houses and lives of leading Republican citizens, and was suppressed only after considerable slaughter, by U. S. troops and parts of the volunteer militia of the city. Democratic politicians and newspapers of the lower order were charged with inciting these mobs.

In the spring and summer of 1864 a portion of the Democratic party, known as the War Democrats, agreed to support the re-election of Lincoln and the prosecution of the war. They were not, however, very numerous, and when the Democratic national convention was held at Chicago in Aug., 1864, the policy of the party was clearly proclaimed. The platform declared the war to be a failure—that there must be an immediate cessation of hostilities with a view to calling a convention of all the States to amend the Constitution upon a new basis of a federal union of the States. Although the language was cautious there was no misunderstanding its meaning. The war must be abandoned as a failure and as having been unjust, and the rebel States, acknowledged to be victorious and in the right, were to take part in the convention which should alter the Constitution in such manner as should be acceptable to them. Such a platform proposed in 1861 or 1862 would have ruined at once all public men who supported it, but the state of affairs was very low, the conscription, the increasing debt, the heavy taxation, the depreciation of the paper-money, the dreadful waste of life in battle and by disease, the long period without any decisive military results for the Union, and the internal troubles arising from civil arrests for disloyal conduct and the suspension of the privilege of *habeas corpus*, all combined to give this platform a probable chance of uniting the entire Democratic party in its support. The candidate was Gen. McClellan.

The Republican executive committee, desirous to make the support of the war as little a matter of party as possible, and to include the War Democrats, called a convention at Baltimore under the name of the Union national convention, and invited to it all persons irrespective of party "who desired the unconditional maintenance of the Union, the supremacy of the Constitution, and the complete suppression of the existing rebellion, with the cause thereof, by vigorous war." The platform insisted that there should be no compromise with the rebels, and that the war should be prosecuted with the utmost vigor to the complete suppression of the rebellion; denounced slavery as its cause, and recommended an amendment to the Constitution abolishing and prohibiting slavery in all the States. Mr. Lincoln was renominated by a unanimous vote.

The course pursued by the Republican party on the subject of slavery was cautious and abstinent in the extreme. At the beginning of the war a resolution passed Congress by very large majorities to the effect that the war was not prosecuted for the purpose of abolishing slavery within the States, and the rebels were assured that if they returned to their allegiance, while we should insist upon the freedom of the Territories, the right of the States to settle the question for themselves should be respected; and when a voluntary return of the States in rebellion was no longer to be looked for, it was not until Apr., 1862, that slavery was abolished in the District of Columbia, nor until June, 1864, that the Fugitive-Slave laws were repealed. In our military operations great care was observed not to incite insurrections among the slaves, and it was some time before the policy was adopted of treating slaves who came into our possession as contraband of war, and so not to be restored to their masters. On Sept. 22, 1862, Pres. Lincoln issued his famous "proclamation of emancipation," as it was called. The emancipation was to take effect upon Jan. 1, following, and in the mean time he promised to recommend to Congress to grant compensation to any slave States not then in rebellion which should abolish slavery within their limits. It declared that on Jan. 1, following, all persons held as slaves in any State which should be then in rebellion should be then and for ever after free. On Jan. 1, 1863, no State having withdrawn from the rebellion, he issued his second proclamation, designating the States and parts of States in rebellion, and ordering and declaring that all persons held as slaves in such regions are and shall be free, and pledging the government to maintain their freedom; and on this measure, he said, "I invoke the considerate judgment of mankind and the gracious favor of Almighty God."

This celebrated proclamation professed to be "a necessary war-measure," and to be done "by virtue of the power in me vested as commander-in-chief of the army and navy of the U. S. in time of actual armed rebellion;" and the phrase was used, "I do order and declare." Still, both proclamations were signed by him as President and countersigned by the secretary of state. As an act by a President in his civil capacity it was of no effect. If it was an act of legislation, it was void, for the President has no power to make general laws, either in time of war or peace. The truth is, it was only a military order by the commander-in-chief of the armies of the U. S. As such it did not effect the emancipation of a single slave. Yet its language assumed to do that, as it declared all slaves in the rebel States to be free on the day named. As a military order it simply established a policy of emancipation, and

it effected emancipation only so far as our military power extended. From that time all slaves who were, or who should at any time come, within our lines, or should be within territory which was under our actual military occupancy and control, became free. But slaves within the enemy's territory and in the enemy's possession could not be emancipated by pen and paper. No doubt the positive character and language of the proclamation gave it a greater effect on the popular mind and in history, but its legal character was no more than has just been defined. As, in point of fact, at the close of the war the whole rebel territory came under the firm military occupation of the government, and the status of war was held to continue although the fighting had ceased, every slave did become emancipated at last, but only as our military power extended itself. The abolition of slavery as a State system and its prohibition in the future, as distinguished from the emancipation of individual slaves, was a matter of civil legislation ultimately effected by an amendment of the Constitution of the U. S.

The Presidential canvass of 1864 was the most important ever held in the country. On the one side was the continuance of the war to the full restoration of the Union, no compromise with the rebels, and ultimately the extirpation of slavery throughout the Union. On the other, was the abandonment of the war as a failure, and compromise with the rebels on terms which would give greater strength and security to the slave-power. All means of influencing public opinion were exerted to the utmost, but the election was determined as much in the field as in the forum. A series of successes of the Union troops, especially in the South-west, and the steady advance of Grant toward Richmond, raised the hopes of the people, and their hopes of success were Republican gains. Those that sustained the war took to themselves in common speech the title of "Union men," and they fastened upon their opponents the slang phrase of "Copperhead," of accidental origin, but indicating disloyalty to the Union. The result was the re-election of Mr. Lincoln by an unprecedented majority. He had the electoral vote of every State not in the rebellion except Kentucky and Delaware, which had been slave States, and New Jersey—212 electoral votes against 21, and a popular vote of 2,213,665 against 1,802,237. In the New England States, Lincoln had 337,073 votes against 193,846. The Western free States gave 978,446 for Lincoln against 754,793 for McClellan, being a majority of only 223,653 out of an aggregate of 1,733,239. The Middle States—New York, Pennsylvania, and New Jersey—whose loyalty to the war after the government had adopted a decided abolition policy always hung in a nearly even balance, gave Lincoln a majority of 19,530 out of an aggregate vote of 1,432,146. The strength of the Union war party lay in New England, which gave it much the largest majority, and in the most northerly of the Western States. At the same time, it is to be remembered that in the Middle States the native American rural population was largely in favor of Lincoln, while the Democratic vote was drawn very considerably from the Irish population of the great cities.

The successful termination of the war in the spring of 1865, and the kind and liberal policy proposed by Mr. Lincoln toward the rebels, seemed to instate the Republican party in the good-will and respect of the American people, promising it a long tenure of power. The Thirteenth amendment to the Constitution, prohibiting slavery in the U. S., passed the Senate in Apr., 1864, by a vote of 38 to 6, 2 Democrats voting in its favor and 6 against it, and the Republicans unanimously in its favor. When it came up in the House in June following it received 95 votes against 66—less than the necessary two-thirds—only 2 Democrats voting in its favor. It passed the House in Jan., 1865, by a vote of 119 against 56, all the Republicans voting for it, and the Democrats voting 16 in favor and 56 against. Its ratification by 27 States out of 36 was proclaimed on Dec. 18, 1865.

The assassination of Mr. Lincoln in forty days after his second inauguration threw the government into the hands of Andrew Johnson. Johnson was a native of the South, sprung from the lowest classes, without early education, but with great vigor of mind and strength of will. He had been greatly admired at the North for the courage of his loyalty during the rebellion and for his speech in the Senate in 1861, which was a powerful onslaught upon the secessionists. But his accession to power resulted, as it did with John Tyler, in a separation from the party which elected him. The cause was difference of opinion as to the mode of dealing with the rebel States, or, as it was then called, "reconstruction." There was quite an unsettled state of opinion as to reconstruction running through the country. The state of things to be dealt with was unprecedented in history, principally from the kind of sovereignty which attached to the States. One policy received its first scientific announcement from a meeting at Faneuil Hall, Boston, immediately upon the surrender of Lee. This has been called the "grasp-of-war" policy. It took the ground that the status of war which had existed for four years was not to be terminated by the will of the rebels, nor as matter of law by the cessation of actual fighting; and as there was no power with which the government could treat, the cessation of the status of war depended upon the will of the government; that the territory of the old rebel States was in our military occupation, and its inhabitants subject to military government until the authorities of the U. S. considered it safe to allow them to reorganize their State governments and resume their place and functions as parts of the republic; that the government had a right to make such terms and conditions upon their readmission into political government, not inconsistent with the Constitution, as the public safety and welfare required. In the interval these States were to be under military government, or such provisional civil government as Congress might permit. This was the view of the matter which a large majority of the Republican party adopted, and which became the basis of reconstruction. Another theory entirely rejected the policy drawn from the continued status of war. It rested upon the notion that the state of things which had existed was in the view of constitutional law only an insurrection, and that it was a war only in so far as its dimensions required resort to the methods of war; that all rights drawn from war ceased with the cessation of hostilities; that between the republic and the States lately in rebellion no powers accrued to the government which did not belong to it under civil administration; that each State when it ceased hostilities had a right to reorganize itself under a State constitution and resume its place in the public system as matter of right, and that its Senators and Representatives were entitled to take their seats in Congress, subject only to the power given to each branch of Congress separately to pass upon the qualifications of each new member as an individual. This theory, or some other substantially like it, was generally adopted by the Democratic party. The object of the politicians of that party was to reinstate the white man's government in the late rebel States, leaving them to deal with the negro population, the late slaves, as they saw fit in respect to political and civil rights, not violating the Thirteenth amendment prohibiting slavery.

In June, 1866, the resolution was adopted to submit Amendment XIV. to the people. This amendment was vital in its character. Passing by its forms of expression, the substance and immediate effect would be to make the freedmen citizens of the U. S. and of the several States in which they lived, and to prohibit any State from abridging or limiting the privileges and immunities of citizens. It left each State to regulate the right of voting, but if a State excluded a class of citizens, it lost its representative and electoral numbers proportionately. It provided that no person should hold office under the U. S. or any State who, having taken an official oath to support the Constitution of the U. S., joined in the rebellion; but Congress might remove this civil disability by a vote of two-thirds of each branch. And it provided that neither the U. S. nor any State should assume or pay any debt incurred in aid of the rebellion, or any claim for the loss or emancipation of slaves. The adoption of this amendment by the States went very slowly, and was generally opposed by the Democratic party, and it was not until July, 1868, that its adoption by the requisite number of States was proclaimed.

The Civil Rights act of 1866 defined who should be citizens, so as to include the freedmen, and provided severe penalties against any persons who under color of any law or ordinance should attempt to deprive them of equal rights or subject them to any different penalty or prohibition from those to which whites were subjected; gave the Federal courts full jurisdiction under this act, and authorized the employment of the land and naval forces and militia for its enforcement.

The struggle between Pres. Johnson and the Republican Congress was mainly over the Reconstruction acts of 1867. He vetoed the act of Mar. 2, 1867, but it was passed over his veto by the requisite two-thirds vote, the Republicans having more than two-thirds of each branch, the greater part of the former slave States not having been restored to their political rights. This act was opposed by the Democrats almost unanimously. The chief provisions were as follows: It declared that there was no legal government in ten of the States, and it divided their territory into military districts and put them under military government. It provided as a condition of restoration that a convention should be called in each State to adopt a constitution; that in electing delegates to the convention all male citizens of full age and a certain term of residence, and irrespective

of color, should be entitled to vote if they were not disfranchised for rebellion or felony. If the convention should adopt a constitution which should provide the same rights of suffrage and holding office irrespective of color, and it should be adopted by the people, and it should be approved by Congress, and the State organized under it should adopt the pending Fourteenth amendment, its Senators and Representatives should be admitted to Congress. It also provided that none should be delegates to this convention or vote for delegates who were excluded from the right of holding office by the proposed Fourteenth amendment. All State governments otherwise organized were permissive only by Congress, subject at all times to the paramount authority of the U. S. The amended act of Mar. 28, 1867, established a registration of voters in those States, and required every person before entering upon an office to make oath that he had not, after having taken an official oath to support the Constitution of the U. S., engaged in rebellion against it. Under this reconstruction system of 1867, and the Fourteenth amendment adopted the next year, the process of reconstructing the rebel States went slowly on. There was intense dislike and strong suspicion of Pres. Johnson with the greater part of the Republican party. A majority of the House of Representatives passed articles of impeachment against him, which were opposed by all the Democrats and a small but respectable minority of the Republicans. Johnson had not united with the Democrats in form, and his cabinet, in which Mr. Seward remained, was still composed of Republicans. The trial of impeachment before the Senate was long continued, severely contested, and produced great excitement throughout the country. The Republicans had more than two-thirds of the Senate, but a sufficient number of them, among whom Mr. Fessenden of Maine was the leader, refused to join in the vote for conviction, and the requisite two-thirds were not obtained. The popularity of the impeachment decreased, and at the end of Johnson's term the better opinion of the Republican party was that the impeachment was unwise and a conviction would not have been justifiable.

In Feb., 1869, the resolution was passed for the Fifteenth amendment. It provided that neither the U. S. nor any State should abridge the right of any citizen to vote, on account of race, color, or previous condition of servitude. This completed the process of putting the colored people throughout the country on the same basis with the whites as to political rights. The votes upon its adoption in the legislatures of the several States were almost strictly on the old party lines. Several of the rebel States had by this time become restored to the exercise of their functions as States, and in them the freedmen, almost without exception, were at first Republicans, and the late rebels were mostly disfranchised; so that with the aid of these States and of the Republican States of the North the amendment was ratified by the requisite majority, and its adoption proclaimed Mar. 30, 1870.

When the Presidential election of 1868 drew near, the Thirteenth and Fourteenth amendments had been adopted, the Reconstruction acts had been in force more than a year, and all the rebel States except three had regained their right to take part in the election. In those States the freedmen almost without exception voted the Republican ticket, and the Northern whites who had taken up their residence there were mostly of the same party, so that there was a fair chance for the Republicans carrying some of those States. The Republicans were in the main agreed upon their platform, whose chief feature was to secure the political and civil equality of the blacks with the whites by constitutional provisions; to carry out their reconstruction policy according to the acts of 1867, and to give the freedmen, by the Civil Rights acts, actual protection in defending their rights through the courts of the republic, with the aid of its marshals, and when necessary of its military force. The Democratic party was a good deal divided. Slavery having been abolished and a political slave-power become impossible, many of the Democrats were in favor of an entire change of policy—of accepting the situation, and confining themselves mostly to the defence of what they considered the State Rights, against the growing centralization caused by the war, and to the assertion of the policy of full amnesty at once for the rebellion, and easier terms of reconstruction founded upon a higher view of State Rights and the theory of insurrection rather than war. Another portion of the Democrats, unwilling to acquiesce in the state of things, wished to keep the party in an attitude of hostility to all the leading measures of the Republicans and of alliance with the whites of the South. The moderate party prevailed in the contest upon the platform. The Democratic candidate was Mr. Seymour of New York, and the Republican was Gen. Grant. In the canvass the Republicans appealed to the gratitude of the people for the great work they had achieved in carrying the country through the war successfully, restoring peace, preserving the national credit, abolishing slavery, and securing practical freedom and equality throughout the land; and they were greatly aided by the fact that their candidate was the successful general-in-chief of the war. Gen. Grant was elected by a popular vote of 3,012,833 against 2,703,249, being a majority of a little over 300,000 in an aggregate vote of more than 5,500,000. Of the former slave States, Alabama, Arkansas, North Carolina, South Carolina, and Tennessee voted for Grant; Delaware, Georgia, Kentucky, Louisiana, and Maryland for Seymour; Virginia, Mississippi, and Texas had no vote; and Florida chose electors by its legislature.

During the four years of Gen. Grant's first administration the Republicans had a decided majority in each branch of Congress. The foreign policy of the government, under the immediate control of Mr. Fish, had been peculiarly successful, especially in the great Geneva arbitration, whose decision, favorable to the U. S., was received some two months before the election. The domestic policy of the party was unchanged, but a great deal of uneasiness had been created by the state of things at the South. The late slaves, put suddenly in possession of political power by the disabilities resting upon nearly all the men of education, property, and political experience in those States, showed themselves ignorant, fickle, and to a great extent corruptible; and while there were some honest emigrants from the North, large numbers of Northern men of low morality had gone there for the purpose of obtaining high or lucrative office through the votes of the freedmen, whom they flattered and misled. These "carpet-baggers," as they were called, were causes of a great deal of trouble, and were charged by the Democrats and suspected by others of making the utmost of the hostility between blacks and whites, and of inventing or greatly exaggerating accounts of outrages, and so keeping employed the military forces of the government for the purpose of intimidation of the whites. On the other hand, some of the worst of the whites had entered into a horrible conspiracy known as the "Ku-Klux," having for its purpose the driving out, and if necessary the assassination, of the Republicans from the North, and the complete intimidation and silencing of the blacks by violence and bloodshed. The Democrats contended that the best remedy was universal amnesty and restitution, which would allow the whites to regain the political power their education and experience entitled them to, and charged the Republicans with attempting by their legislation to go beyond political and civil equality, and to force social equality of the blacks upon the whites. In some of the States the new régime of blacks and carpet-baggers, with their ignorance, extravagance, and corruption, had brought about intolerable taxes, debts it was impossible to pay, and political bankruptcy. The amended Civil Rights acts of 1870–71 were certainly extreme measures. Their purpose was to secure the civil rights given by the Fourteenth and Fifteenth amendments, but the methods adopted and the powers brought into use were of an unprecedented character. They were aimed especially at any attempts or conspiracies or combinations to deprive the freedmen of the full and free exercise of their rights of voting and holding office, or qualifying themselves for civil privileges and equal rights, to make contracts, and be parties or witnesses in suits. The penalties for such conduct were severe; the powers given to marshals and other executive officers were extreme, especially the authority given to subordinates to call in the aid of the troops of the U. S. or the militia. They also provided a system of supervision over all elections for Federal officers, more or less under the control of the Federal courts, and punished with severe penalties all violations of the act. The definitions of what might constitute intimidation or obstruction of any citizen in the exercise of his rights were certainly very comprehensive. The Republicans contended that these extreme measures were rendered necessary by the extraordinary state of things at the South, and the great peril in which the freedmen stood in their anomalous and unprecedented condition. The Democrats answered that these perils were exaggerated for party purposes, and were increased by the Republican policy of withholding amnesty and oppressing the white race for the benefit of the blacks, who were their political supporters.

A domestic question of great importance arose out of our financial condition after the war. The act authorizing the creation of the debt did not say in terms that the bonds should be payable in coin, and several politicians of the less scrupulous and more adventurous sort started the notion that it was sufficient to pay the debt in the depreciated paper-money which was legal tender within the U. S. It was supposed that this would be a popular policy, as the debt was mostly owned abroad or by capitalists

in our great cities. Some of the politicians were Republicans, and on the other hand many leading Democrats advocated the payment of debt and interest in the gold and silver money of the world: yet, comparing the two parties, it was evident that the Democratic party furnished much the greater portion of those who favored this scheme of partial repudiation. The Democratic platform of 1868 declared that the national debt, when not in terms made payable in coin, should be payable in the paper-money of the government, and resorted to the plausible phrase of "one currency for laborer and bondholder, soldier and capitalist." The Republican platform declared that honor and good faith required that the debt should be paid in accordance not only with the letter, but with the spirit, of the laws under which it was contracted, and denounced everything in the nature of repudiation. Yet it is observable that it did not say in terms that the dollars named in the bonds meant the gold or silver dollars of the world's currency. Still, the capitalists had more confidence in the Republican party than in the Democratic on this point, judging from indications.

Another domestic question, a good deal outside of party lines, was that of civil-service reform. The "spoils" system, treating the entire civil service of the country as the prize to the victors of the Presidential election, and as a means of maintaining at the public expense a body of working electioneerers for the party and the leading politicians, had thoroughly demoralized that service, was demoralizing Congress and high office, and sapping the foundation of our popular system. The war, the debt, the increased taxation, and the direct taxes and imposts had vastly increased this army of office-holders, and added to their political power and their opportunities for peculation and extortion. A strong public sentiment had arisen which demanded such a reform as should make the tenure of these offices independent of political opinions, and especially independent of the members of Congress within whose States or districts the offices lay, and secure the office to the holder during good behavior, though limited by time. In 1871, Congress passed a resolve authorizing the President to prescribe rules for admission to the civil service which should best secure fit officers and promote efficiency, and made an appropriation to enable the President to appoint a commission. But it was too much to expect that members of Congress would renounce this great patronage which was practically in their hands, and the control of which gave them so much political power in their States and districts; and accordingly Congress has done nothing upon the subject except to throw the responsibility of doing something upon the President, without the aid of any legislation. In this shirking of duty one party has been about as much in fault as the other. The "spoils" system had been the system of the country for forty years, and there was no interest in its overthrow except on the part of the citizens at large, who were what is called outside of politics. Pres. Grant in 1871–72 caused an investigation by a commission, and laid down certain rules, but the deep springs could not be reached without legislation, and the departments did not adhere to the rules in stress of politics or of strong personal favor.

Out of this state of things a convention of what was called Liberal Republicans was called to meet at Cincinnati in May, 1872. It was necessarily a mass convention, as it had no organized party behind it to elect delegates. Its platform was a pledge not to reopen the questions settled by the Thirteenth, Fourteenth, and Fifteenth amendments and the system of reconstruction, a demand for the immediate removal of all civil and political disabilities at the South, a thorough civil-service reform, and the speedy return to specie payment. The candidate the convention intended to put up was Mr. Charles Francis Adams, but at the last moment the convention, being a mass convention, was *captured* by adroit politicians who cared nothing about the platform, and they carried the nomination of Mr. Horace Greeley. This was practically a deathblow to the new party. But the Democratic national convention, conscious that they had little or no chance of carrying a candidate against both Grant and Greeley, took the extraordinary course of nominating Mr. Greeley, in the hope of securing the votes of the dissatisfied Republicans, although Mr. Greeley was not and had never been a Democrat, but the earnest advocate of opinions and measures as opposite to theirs as possible. Some leading Democrats, regarding this measure as unprincipled and dangerous, called a convention and nominated Mr. Charles O'Conor for President and Mr. John Quincy Adams for Vice-President. Although these candidates declined to stand, they received some votes, and the protest a good deal weakened the Democratic party at the polls. The Republican convention met at Philadelphia in June, 1872. It repeated its former resolutions on the subject of reconstruction and civil rights, advocated a reform in the civil service, so that not zeal for party or candidates but honesty and capacity should be the test of office, and declared that the people expected a speedy resumption of specie payments. The Democratic party pledged itself not to reopen the questions settled by the three amendments to the Constitution, but demanded immediate removal of disabilities, and denounced the Civil Rights bills and the whole course of the administration at the South as tending to the overthrow of State Rights, the centralization of power at Washington, and the substitution of military for civil government. The three parties agreed in demanding some sort of civil-service reform, but the Democratic resolve on that point was weak and equivocal. They all agreed in favoring a speedy return to specie payments. At the election Gen. Grant received 3,597,070 votes, and Greeley 2,834,079 votes, being a majority over Greeley of 762,991. Of the former slave States, Grant received the votes of 8, and Greeley of 6.

During the second administration of Gen. Grant the policy of what is called "inflation"—meaning the issuing of more paper-money and the indefinite postponement of a return to specie payment—was urged by certain politicians and editors and by popular conventions. The President committed himself thoroughly and earnestly against all such schemes and in favor of a specie basis for payment and business. And in this he has been sustained by his cabinet, a considerable majority of Republicans in Congress, and by, to all appearances, a decided majority of the Republican party. Still, a few leading Republicans have committed themselves to the paper-money theory. The position of the Democratic party on the subject of inflation is more equivocal. Of its State conventions in 1875, some committed themselves to the inflation policy, some equally to specie payment, and several were equivocal. No Republican State convention adopted resolves in favor of inflation, a few were equivocal, but far the greater part supported a return to specie payments in the strongest terms. These facts, the unequivocal position of Gen. Grant, and the appearance of an increased confidence on the part of the inflationists since the elections of 1875, which secured to the Democrats the House of Representatives, give rise to a general impression that a return to specie payments will be less certain under a Democratic than under a Republican administration hereafter. Yet it is by no means certain that the Democratic party may not return to the position respecting bullion which it held in the preceding generation.

No progress has been made in civil-service reform, for the working politicians of neither political party seem disposed to take it up. They prefer the simplicity and power of the "spoils" system, in which they were educated. A great deal of pecuniary corruption has been developed in public life, whether political or civil. This is attributed by many to the effects of the war upon the habits of society, and the fluctuations in the values of everything caused by the depreciated paper-money. On the other hand, it is fairly to be said that the Republican party has not attempted to conceal the misconduct of its officers, but has itself instituted more thorough and public researches and investigations into all branches of administration than have ever been known in our political history.

The Republican convention of 1876, for the nomination of President, met at Cincinnati on June 14. It was an assembly of great respectability in the character and distinction of its members. In respect to its modes of proceeding it made one change of value. This was, that after a State had announced its vote by its chairman, it should not be altered except to correct mistakes. This rule prevents the sudden rush that sometimes occurs, under excitement, in favor of an apparently gaining candidate. A vote of the convention, passed by a large majority, in the case of the Pennsylvania delegation, made a rule for that convention that a delegate had a right to have his vote announced by the chairman of his delegation and counted in the ballot when he differed from the majority of his delegation, although all the delegates from his State were chosen by a general convention of his State, and not by districts, and that general convention had ordered that the vote of a majority of the delegation should be the vote of the entire delegation, as a unit. This rule, if adhered to in future conventions, will tend to diminish the vast power held by the leading political managers in the great States.

The important resolutions were adopted unanimously and without debate. The resolution on the subject of specie payment was as follows: "*Fourth.* In the first act of Congress signed by Pres. Grant the national government assumed to remove any doubts of its purpose to discharge all just obligations to public creditors, and solemnly pledged its faith to make provision at the earliest practicable period for the redemption of the U. S. notes in coin.

Commercial prosperity, public morals, and the national credit demand that this promise be fulfilled by a continuous and steady progress to specie payment." That on civil-service reform was as follows: "*Fifth.* Under the Constitution the President and heads of departments are to make nominations for office. The Senate is to advise and consent to appointments, and the House of Representatives is to accuse and prosecute faithless officers. The best interests of public service demand that these distinctions be respected—that Senators and Representatives, who may be judges and accusers, should not dictate appointments to office. The invariable rule for appointments should have reference to the honesty, fidelity, and capacity of the appointees, giving to the party in power those places where harmony and vigor of administration require its policy to be represented, but permitting all others to be filled by persons selected with sole reference to the efficiency of the public service and the right of citizens to share in the honor of rendering faithful service to their country." There were resolutions in general terms pledging the party to the permanent pacification of the South and the protection of all its citizens in the full enjoyment of all their rights. The only other resolution of much significance was on the public-school system: "*Seventh.* The public-school system of the several States is the bulwark of the American republic; and, with a view to its security and permanence, we recommend an amendment to the Constitution of the U. S. forbidding the application of any public funds or property for the support of any school or institution under sectarian control."

On the seventh ballot Rutherford B. Hayes, governor of Ohio, was nominated for President, and Hon. William A. Wheeler of New York was afterward nominated for Vice-President, both known to be thoroughly in favor of hard money and civil-service reform, to which, now, the Republican party is strictly committed.

The Republican party claims to have been the party which alone effectually resisted the progress of the slave-power and staked its existence upon that conflict. It claims to have saved the Territories and the new States for freedom; to have carried on successfully the largest civil war of modern (perhaps of any) times; to have abolished the most powerful and deeply-rooted system of slavery known since the Middle Ages; to have reconstructed the broken-up governments of ten States, preserved the public faith unbroken, organized the public debt and commenced its steady reduction, disbanded peacefully vast armies and navies and led back the country to the paths of industry and peace; and to have done all this often against the opposition of, and oftener without effectual aid from, their political opponents.

Richard H. Dana, Jr.

Repudia′tion [Lat. *repudiare*, to "cast off"], an act by which an administration declines to be bound by the debts contracted by the governments which have preceded it. In European history there are numerous instances of a government annihilating a portion of its debt by converting it into a lower denomination, and similar instances have occurred in Mississippi and Pennsylvania.

Repul′sion [Lat. *repellere*, to "drive back"], that force or agency inherent in matter which prevents its particles from coming into absolute contact. The fact that all substances contract by cooling, or that certain fluids when mixed have less volume than in an unmixed state, can be explained only by supposing there is no absolute contact between the particles of which the substances are composed: this separating power is generally called repulsion.

Reque′ña, town of Spain, province of Valencia, is a handsome and prosperous place. P. 7709.

Re′quiem [Lat. accusative of *requies*, "rest"], the first word of the Introit of the mass "for the faithful dead" in the Roman Catholic Church. Hence, the term designates the whole mass or any solemn funeral music.

Requier′ (Augustus Julian), b. at Charleston, S. C., May 27, 1825, of French parentage; was admitted to the bar 1844; was district attorney for the southern district of Alabama 1853–61, and held the same office under the Confederate government. Author of the dramas *The Spanish Exile* (1842) and *Marco Bozzaris* (1846), of a romance, *The Old Sanctuary* (Boston, 1846), and of a volume of poems (1860).

Requisi′tions [Lat. *requirere*, to "seek again"] and **Contribu′tions,** in the international laws of war, have not always been distinguished. Calvo, after De Garden, draws this line between them: that a *contribution* is what the inhabitants of a country occupied by an invading army are forced to pay or give in order to secure themselves from pillage, while a *requisition* is the demand made by the military authorities that the inhabitants shall place things, and even persons, at their disposal. There is no absolute difference in the use of the words. A contribution is especially a payment in money, whether for the purpose of carrying on civil government in the occupied district or for general military uses; a requisition is something, as breadstuffs, wagons and horses, wood, etc., needed for the subsistence or for *special* uses of the invading army. We call them all requisitions, and lay no stress on any discrimination. To account for them, especially for contributions, as payments for exemptions from pillage, is absurd; for pillage is barbarous, and in modern warfare the principle is that war is not waged against a quiet private person, and that his property is in general safe. But the necessities of an army of occupation for food and clothing, as well as the immediate needs of war, and outrages done by *tirailleurs* and by people without any license, who yet are sympathized with by the district, have made summary and harsh impositions seem just and necessary. No absolute rule can without difficulty be laid down, and the temper of a commander, the false information he receives concerning the plots of the conquered province, will sometimes give rise to severities of a deplorable character.

The following rules will express what the regulations of war ought to be, except in circumstances of extreme necessity, or where severe punishment on towns or communes is called for by their conduct: (1) The private citizen, nowise concerned in the war, is not to be treated as an enemy, and his property is to be respected. (2) The civil government in occupied territory must go on, under control of the invading commander, at the expense of the inhabitants. For this end taxes must be raised as before. (3) Special services for the army, supplies of food, and other necessaries ought to be paid for sooner or later, and for this end receipts should be given. (4) It is an unjust rule to make war pay for war. Wrongs ought to be repaired at the making of a peace. (5) For penalties on a town or district in the way of fines, or of bodily inflictions on a principal inhabitant, or of burning, which has been threatened even in quite recent times, there is very seldom a sufficient justification. Nor do severe requisitions or wholesale punishments do any good. Napoleon in his *Memoirs* acknowledges that the excesses in the way of requisitions during the war with Spain contributed not a little to the French reverses in the Peninsula.

We close this article by citing some modern opinions on this important but, unhappily, somewhat indefinite subject: (1) In *The Instructions for the Armies of the U. S. in the Field* the rightfulness of seizing private property is limited to cases of necessity, and the spoliated owner is declared to be entitled to a receipt, that he may obtain indemnity. (Comp. vol. ii. of this *Cyclop.*, p. 1252, col. 2.) (2) Massé concedes to an enemy the right of forcing merchants or others to supply his army with the necessary provisions, but on condition of purchasing them at a certain price determined in advance. (3) Heffter is more harsh. According to him (§ 731 of his *Völkerr.*) the enemy can impose and exact contributions, demand products of the soil and personal services; in case of necessity or resistance can even take them by force, leaving all adjustments to the political arrangements of the future. A definite limit to the right of taking cannot be laid down, for there is no measure of rights in war. (4) Bluntschli (§ 653), after speaking of what the population of an occupied province ought to be required to do for an army of occupation, adds, "All these services furnish ground, according to circumstances, for compensation. We must distinguish between services which can be demanded simply on the score of war, and obligation of the population to pay taxes—the extent of which is either defined by legislation or by practice, and in regard to which, in these particulars, much must be left to the discretion of the commander—and services which go beyond this measure, and therefore, by natural law, are to be called for only as giving a right to compensation. But," he adds, "this duty of compensation is hard to be reduced to rule, and harder still to be carried through in practice." (5) Calvo (§ 905) admits, with most authors, that an army occupying an enemy's territory may demand from the communes or from the inhabitants that which is necessary for its support and movements, but these requisitions ought to be limited to things absolutely indispensable. (6) Gen. Scott in Mexico refrained from requisitions, paid for provisions, and took nothing by force without indemnifying those who held the property, except on rare occasions, when it was impossible to act otherwise. (Comp. esp. *Calvo*, § 903.) (7) The project of an international declaration concerning the rules and usages of war, adopted at Brussels in 1874, which differs somewhat from the project submitted by Russia at the same congress, but not, as we think, for the better in respect to requisitions, contains the following provisions: *Art. 40.* "As private property ought to be respected, the

enemy shall not demand from communities, nor from their inhabitants, articles or services except such as relate to the necessities of war generally acknowledged, and are proportionate to the resources of the country, and which do not imply for the population the obligation to take part in the war against their country." *Art. 41.* "The enemy levying contributions, whether as an equivalent to imposts or to objects to be furnished in kind, or by way of fine, shall proceed therein, as far as possible, only according to the rules of repartition and the plan of imposts in use in the occupied territory. For every contribution a receipt shall be given to the person making the payment." *Art. 42.* "Requisitions shall be made only with the authorization of the commander of the locality occupied. For every requisition an indemnity shall be granted or a receipt delivered." A part of the Russian project which was not accepted is worthy of notice: § lii. "The enemy can demand from the local population all the imposts, services, and dues, in kind or in money, to which the armies of the legal government have a right." (Comp. the *Introd. to Internat. Law*, by the author of this article, § 130.)

T. D. WOOLSEY.

Resa'ca de la Pal'ma, a ravine which crosses the Matamoras road about 3 miles N. of that place; the position taken by the Mexican general Arista to resist the further advance of Gen. Taylor's army. Although the latter was outnumbered three to one, the Mexicans were routed after a short conflict (May 9, 1846), and driven across the Rio Grande.

Resec'tion [Lat. *resectio*], or **Excision of Joints,** an operation devised to supplant amputation of a limb where a joint is hopelessly diseased by removing the diseased part only, and thus giving the patient a limb which, although of limited use, in the majority of cases is better than an artificial one. The operation, as a rule, is a much safer one than amputation, but there are various circumstances which must be considered before it is resorted to, else in many cases amputation would have to be performed secondarily. A large or important joint should never be excised while any chance of recovery without such surgical interference remains. Excision should always be preferred in the upper extremity when it promises motion of any of the joints. In the hip it should always be done, if possible. In the knee it is less often done, because of the stiff joint remaining, which is much inferior to one of the perfected artificial limbs; and besides, the injuries to the knee requiring operation are generally very extensive, and often after excision has been practised amputation has to be resorted to, thus subjecting the patient to two operations, both of them severe.

EDWARD J. BERMINGHAM. REVISED BY WILLARD PARKER.

Reserva'tion [Lat. *reservare*, to "keep back"], **Mental,** a form of speech by which the speaker conceals the truth by withholding some words which are necessary to convey his meaning fully; as, for instance, when a man to the question, "Have you seen that man before?" answers "No," though he is an intimate friend of his, adding by a mental reservation the words "not to-day." This form of casuistry, which, together with equivocation, was largely practised by the Jesuits and defended by their moral philosophers, is treated in a most brilliant manner and with crushing superiority by Pascal in his *Provincial Letters.*

Reserve' [Lat. *reservare*, to "keep back"], a portion of an army kept back or so stationed that it may be used as a support or *reserve* to those portions immediately engaged in battle; or, more generally, a portion of the military force of a nation reserved from active operations in face of the enemy, in order to meet exigencies or to support, in case of need, armies actually engaged. (See WAR.)

Reserve, tp., Parke co., Ind. P. 1387.

Reserve, tp., Ramsey co., Minn. P. 429.

Reserve, tp., Allegheny co., Pa. P. 1600.

Reservoir' [Fr.], an artificial basin for storing water. Atmospheric vapor precipitated in the form of rain or snow is the ultimate source of all supplies of water. The descent of water from the atmosphere is intermittent, occurring at comparatively rare periods, often with long intervals of dry weather. Without reservoirs, either natural or artificial, the flow of water-courses would be intermittent in an almost equal degree, and a continuous supply of water for motive-power or other uses would be unknown. Natural reservoirs consist of (1) Accumulations of snow, and, in elevated regions, of ice, which by gradually melting tend to equalize the flow of streams. (2) Natural lakes and ponds, which during violent rains receive more water than they discharge. (3) Swamps and extensive level areas, which by reason of their flatness retain the water falling on them or flowing from higher ground, allowing it to escape very slowly. (4) The vast layers of porous gravel and sand forming so large a portion of the earth's exterior, into which rain-water sinks and slowly reappears at lower levels in the form of springs.

Notwithstanding these equalizing agencies, the flow of streams varies between very wide limits, never remaining uniform for any considerable time. The greater part of the water of heavy rains finds its way directly into the water-courses, causing a useless and often destructive increase of their volume. During intervals of dry weather the natural reservoirs, except the first named, furnish a constantly-diminishing supply. Moreover, the progress of agriculture and the increase of population tend to impair the efficacy of natural reservoirs. The occupation of extensive districts by buildings and paved streets, and the drainage of swamps and fens, throw great volumes of storm-water directly into streams which would be otherwise held back for longer or shorter periods.

A manufacturing establishment depending entirely upon water for its motive-power must be proportioned in accordance with the least quantity of water that the stream can furnish. Without artificial reservoirs this is never more than a fraction, and often but a small fraction, of the average quantity conveyed by the stream. The minimum quantity of water carried by Merrimack River at Lowell, not counting the aid derived from artificial reservoirs, is not more than one-third the average flow. In the drainage-ground supplying the city of Brooklyn the minimum flow was less than one-fourth the total rainfall. On the Croton River, at the dam built for the New York waterworks, the minimum was not more than one-twelfth the total rainfall. Some streams in granite districts do not flow much longer than the rain lasts, being torrents at that time and practically dry at all others. The Weser in Germany carries 75 times as much water in extreme flood as in extreme low water, and the Ems 130 times as much. These facts exhibit in a striking light the utility of storage reservoirs. By retaining flood-water for use in times of scarcity they offer the means of increasing from twofold to tenfold the natural available water-power and water-supply of streams. Their application and extension will also be attended with results no less salutary as regards agriculture and inland navigation. Their tendency is ever to restrain the extravagance of nature, preserving lands from submersion, and maintaining streams in moderate flow—a condition so essential to the requirements of commerce.

Reservoirs are usually formed by constructing a dam across the valley or channel of a stream; the outlet of a natural lake often presents a favorable locality. Such localities are often very unfavorable to the construction of dams, the ground being composed of sedimentary or alluvial material to a great depth; and such works are often among the most difficult of engineering. When not founded upon rock, such dams are usually made of earth with a wasteway of stone for discharging superfluous water. The best construction consists in cutting a trench across the valley down to rock, and filling it with clay or impervious material called puddle, which is clay mixed with suitable gravel. In this country, from economical considerations, a row of sheet-piling is ordinarily substituted for the puddle trench. The body of the dam is composed of binding gravel, or gravel containing some mixture of clay. It has a central wall or else an inner facing of puddle carefully mixed and compacted. The water is drawn from the reservoir generally through iron pipes. They are sometimes laid in the earthwork of the dam, but preferably in a gallery excavated in the natural earth. They are sometimes laid over the top of the embankment and operate as syphons. The wasteway is arranged to let the water escape before it rises high enough to run over the earthwork. It is usually constructed of heavy stones, so as to conduct the water by a series of low falls down to the level of the stream.

There are in Massachusetts over 300 reservoirs in connection with water-power; many exist in other parts of New England. A large number also exist in the State of New York for supplying the canals. A vast system of reservoirs exists in India, constructed for purposes of irrigation. One is mentioned having a dam or embankment 12 miles in length; the Cummum Tank had an area of 8 square miles. Its embankment was upward of 100 feet high. The Lake of Minery is 20 miles in circumference. Its embankment is over a mile long, covered with lofty trees. It is 2000 years old, and still in use. These vast works were made of earth scraped up with rude instruments and carried on the heads of men, women, and children. Many years were occupied in their completion.

Terrible accidents have sometimes resulted from the breaking of imperfectly-constructed reservoirs. By the failure of the Dale Dyke reservoir at Sheffield, England, in Mar., 1864, some 300 lives and an immense amount of property were destroyed. This reservoir was constructed

for furnishing water to mills at Sheffield. It contained about 78 acres, and its embankment was some 95 feet high at the highest part. By the breaking of a reservoir at Williamsburg, in Hampshire co., Mass., May 17, 1874, over 150 lives were destroyed and more than $1,000,000 worth of property. This reservoir contained about 100 acres. The dam at Estrecho de Rientes, in Spain, gave way Apr. 30, 1802, laying waste a large extent of country, drowning some 600 people, and destroying property valued at $7,000,000. J. P. FRIZELL.

Reshd, town of Persia, cap. of the province of Ghilan, about 2 miles from the Caspian Sea, is well built and contains many bazaars and caravanserais. It is the chief entrepôt for the trade in silk, large quantities of which are sent from here to Russia, Persia, and Turkey; iron goods and metal ware are imported. Its port on the Caspian Sea is Enzelli, and the communication between this place and Reshd is the worst possible. There is no road, the soil is a swamp or a sheet of mire, and when in dry seasons this threatens to become too easy to pass, the inhabitants bring about an artificial inundation in order to extort a higher price from travellers. P. 23,500.

Reshid' Pa'sha (MUSTAPHA MEHEMET), b. at Constantinople in 1802; educated by his brother-in-law, Ali Pasha, and entered the civil service of the Turkish government, in which he subsequently held the highest positions and played a most conspicuous part. As a man of great attainments and a just appreciation of modern civilization, he became the leader of the party of reform, and allied himself closely with France and England against the stubborn old Turkish party and the influence of Russia. At the death of Mahmood II., in 1839, and the brilliant victory of Ibrahim Pasha at Nisib over the Turks, he was recalled from Paris, whither he had gone as ambassador, and placed in charge for the second time of the ministry of foreign affairs. By the hattisherif of Gulhane (Nov. 3, 1839), a sort of constitutional charter, he created considerable sympathy in Europe for the cause of the sultan, and shortly after he succeeded in forming the quadruple alliance which saved Turkey and compelled Mehemet Ali to give up all his conquests outside of Egypt. Nevertheless, he had to resign his office in 1841, baffled by the intrigues and machinations of the old Turkish party. He was grand vizier from 1846 to 1852, and was recalled to power in 1853 on account of the increasing difficulties with Russia. Again a brilliant epoch opened in his life, but toward the close of the Crimean war he was superseded by some of his own party; his partiality for England, his distrust of France, and the great vigor the latter power displayed overthrew him. By English influence he came into power a fifth, and even a sixth time, but he was not able again to impress his enemies and satisfy his friends, and his influence was wholly gone when he d. Jan. 7, 1858. Many of his civil reforms, especially the commercial treaties he concluded with England and France, have proved very beneficial to his country.

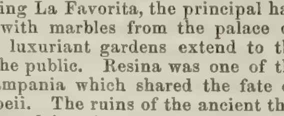
Resi'na, town of Italy, province of Naples, on the sea-shore between Portici and Torre del Greco, and enjoying the same enchanting climate, with similar advantage of position. In its neighborhood are many beautiful villas, the best known being La Favorita, the principal hall of which is encrusted with marbles from the palace of Tiberius at Capri; the luxuriant gardens extend to the water and are open to the public. Resina was one of the flourishing towns of Campania which shared the fate of Herculaneum and Pompeii. The ruins of the ancient theatre and a few statues and inscriptions are all that remains of its former greatness. P. 12,000.

Resinar', town of Austria, in Transylvania, carries on an active trade in grain, wool, wood, and all kinds of agricultural produce. P. 5700.

Resins. See GUM-RESINS and ROSIN, by PROF. C. F. CHANDLER, Ph.D., M. D., LL.D., M. N. A. S.

Resist'ance [Lat. *resistere*, to "withstand"] **of Fluids.** When a solid body floats or is immersed in a fluid, both being at rest as regards one another, the lateral pressure upon each side of the body is balanced by an equal pressure upon the opposite side. The pressure acting from B toward A (Fig. 1) is exactly equal to the pressure acting from A toward B. As soon, however, as the

FIG. 1.



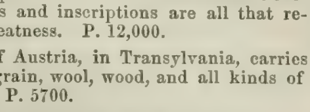
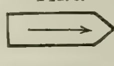


FIG. 2.

body commences to move this equality of pressures no longer exists. The pressure on the forward side A becomes greater than before; that on the rear becomes less. The particles of fluid in front of the body must be put in motion, and flow right and left to allow the body to pass. On the other hand, the movement tends to leave a void in rear of the body. Both of these actions operate as resistances to the movement. The resistance depends very much upon the form of the moving body. A form which requires sudden movement and abrupt change of direction in the particles of fluid meets with great resistance. A body shaped like Fig. 2 meets with greater resistance than one shaped like Fig. 3, which does not produce so abrupt a movement of the fluid, and still greater than Fig. 4, which pushes the fluid gently aside, and allows it to fall into its place in the rear without any abrupt change of movement.

FIG. 3.



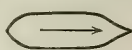
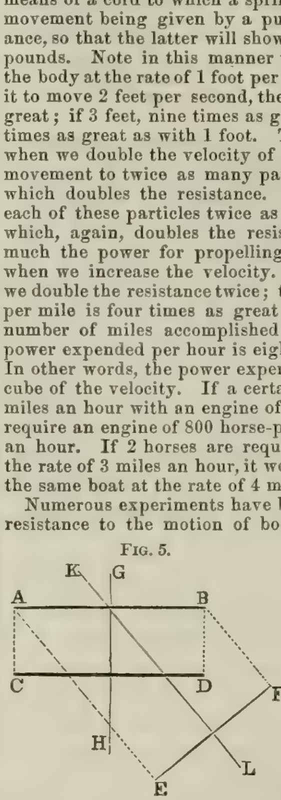


FIG. 4.

The resistance is proportional to the square of the velocity. To explain this proposition more fully, suppose we communicate movement to a floating body of any form by means of a cord to which a spring balance is attached, the movement being given by a pull on the hook of the balance, so that the latter will show the amount of the pull in pounds. Note in this manner the pull required to move the body at the rate of 1 foot per second. If, now, we cause it to move 2 feet per second, the pull will be four times as great; if 3 feet, nine times as great; and if 4 feet, sixteen times as great as with 1 foot. The reason for this is, that when we double the velocity of the body we communicate movement to twice as many particles of water as before, which doubles the resistance. We also communicate to each of these particles twice as great a velocity as before, which, again, doubles the resistance. We see here how much the power for propelling boats must be increased when we increase the velocity. By doubling the velocity we double the resistance twice; that is, the power consumed per mile is four times as great as before. But since the number of miles accomplished per hour is doubled, the power expended per hour is eight times as great as before. In other words, the power expended is proportional to the cube of the velocity. If a certain steamboat could run 10 miles an hour with an engine of 100 horse-power, it would require an engine of 800 horse-power to move her 20 miles an hour. If 2 horses are required to tow a canal-boat at the rate of 3 miles an hour, it would require 5 horses to tow the same boat at the rate of 4 miles an hour.

Numerous experiments have been made to determine the resistance to the motion of bodies of different forms in water. Some results, believed to be approximately correct, are given below. The resistance is given for a velocity of 1 foot per second. For any other velocity the resistance must be multiplied by the square of the velocity. It is expressed in pounds per square foot on the projection of the body upon a plane perpendicular to the direction of its motion. This phrase will be understood by reference to Fig. 5. Suppose the body to be a flat plate A moving in the direction G H. Thus, its projection on the plane perpendicular to the direction of its motion is C D. If it be moving in the direction K L, its projection is E F.

FIG. 5.



	Pounds.
For a thin horizontal plate rising vertically upward	2.72
" sphere	0.42
" right cylinder with height equal to diameter, moving endwise	1.77
" cylinder of the same proportions terminated by a right cone, the height of the cone being twice its diameter	1.39
About 4 times do.	1.03
" 8 " "	0.91
" 12 " "	0.84
Same cylinder with its forward end rounded spherically	0.77

Dubuat found for a thin vertical plate moving horizontally a resistance not more than half that given above. From very careful experiments made by Morin, an officer of the French engineer corps, the resistance to boats in a canal, the canal being three or four times the width of the boat, is about one-fifth of a pound per square foot of immersed section for a velocity of 1 foot per second. This shows that the width or depth of the canal affects the resistance, as vessels in the open sea do not meet with more than half as much. A curious fact in the towing of boats was observed by Morin. A wave always accompanies the boat, usually

spreading from the middle of the boat, or thereabouts. When the wave, by the slackening of the speed, moved forward and stood at the prow, the resistance was very much increased, being in most cases more than twice as great as when the wave was in its ordinary position.

The resistance of air follows practically the same law as that of water, the only difference being that which results from its elasticity. The movement of a body in air has the effect to condense the air, to some extent, in front, and to rarefy it in the rear. When, therefore, a body moving in air changes its velocity, the resistance changes in three ways: (1) By changing the quantity of air put in motion; (2) by changing the velocity with which it is put in motion; and (3) by momentarily changing in some slight degree its density or weight. Nevertheless, except for very rapid movement, as in the case of war-projectiles, it is for common purposes sufficiently accurate to say that the resistance is proportional to the square of the velocity. Experiments upon the resistance of air have been made by many investigators, especially, in later times, by M. Thibault, an officer of the naval service of France, and by Gen. Morin, above referred to. The former attached flat plates or vanes to the extremity of a long arm turning upon a vertical axis, to which a rotary movement was communicated by a cord and weight. Morin observed the time occupied by similar plates in falling from a considerable height. From these experiments it results that the resistance to a plain surface at a velocity of 1 yard per second is about 0.1295 pounds per square yard. For any other velocity this resistance must be multiplied by the square of the velocity in yards per second. To be very exact, we must add to this result one-fifteenth of a pound per square yard, whatever the velocity may be. This is correct when the surface is perpendicular to the line of its motion, as, for instance, when the surface A B (Fig. 5) moves in the direction of G H. It is also nearly correct when the surface is considerably inclined to the line of its motion—that is, when the surface moves quartering, as when the plane A B moves in the direction K L. In this case E F must be regarded as the width of the surface, since it displaces the same quantity of air as A B when moving in the line K L. When the surface is inclined to the direction of motion at an angle less than 45°, the resistance is less than indicated above.

The resistance on a convex surface is less than that on a plane surface, and that on a concave surface is greater than on a plane. For a hemispherical dish the resistance is two and a half times as great with its concavity in front as with its convexity. A very useful application is made of this property in the construction of an instrument for measuring the velocity of the wind. It consists of two hemispherical cups attached to the opposite ends of an arm which is mounted at the centre upon a light vertical axis. The cups are turned in opposite directions, so that the wind acts always upon the hollow of one and the back of the other, causing the axis to rotate with a greater or less velocity depending upon the velocity of the wind. The resistance on such a cup moving back foremost with a velocity of 1 yard per second is about one-tenth of a pound per square yard of area—in the opposite direction, one-fourth of a pound. The area is the projected area—that is, the area of the rim.

A parachute is a very large and strong umbrella designed to enable a man to descend from a great height. It meets with the same resistance as the cup moving with its rim in front. As its velocity increases by the action of gravity, the resistance increases until it becomes equal to the weight, after which the descent is uniform. A man dropped from a balloon at a great height and provided with a parachute, supposing man and parachute to weigh 160 pounds, would descend with an increasing velocity till the resistance of the air amounted to 160 pounds, after which he would descend uniformly till he reached the ground. Supposing the diameter of the parachute to be 12 feet, he would reach the ground with a velocity of 21½ feet per second, and would receive no greater shock than in jumping from a height of 7 feet. J. P. FRIZELL.

Resolu'tion [Lat. *resolutio*], in musical harmony, the movement or progression of a dissonance into any one of the consonant harmonies for which it creates in the ear an expectation. (See MUSIC.)

Respira'tion [Lat. *respirare*, to "breathe"], the special function of the lungs, the process which has for its ultimate object the supplying of red blood-globules with oxygen for transmission to the various parts of the body. To accomplish this result, atmospheric air must be introduced frequently and continuously, an extensive surface of contact for air and blood must exist, and the effete products of the chemico-vital interchange must be exhaled. Respiration includes the physical acts of inspiration and expiration, but physiologically consists in the revivifying of the blood by the oxygen of atmospheric air, and the steadily reinforced nutrition of the body which results. Respiratory action of the lungs is involuntary, although it may be voluntarily modified. The *besoin de respirer*, or involuntary incentive to breathe, is the result of impressions received by the medulla oblongata from the several regions of the body, which constantly demand oxygen, and transmitted to the respiratory muscles of the thorax and abdomen. From eighteen to twenty respiratory acts take place per minute, at each of which an average of about 26 cubic inches of air is inspired and expired. This definite volume of air which ebbs and flows is termed *tidal air*. In addition, fully 100 cubic inches of air, unaffected by respiratory movements, remain in the smaller bronchi and air-sacs, and are termed *residual air*. Tidal inspiratory air is fresh and pure; it enters as far as the fourth bronchi, and becomes a part of the relatively impure residual air. Tidal expiratory air contains carbonic acid gas, which is exhaled and removed from the body. Each inspiratory act, therefore, adds an increment of oxygen to the bulk of air in the lungs; this oxygen, by the law of diffusion of gases, permeates the residual air and reaches the air-sacs. The air-sacs are thin-walled; indeed, their walls are essentially a network of capillary vessels held together by a film of elastic tissue. In the aggregate, the walls of the innumerable air-sacs constitute a surface of many hundred square feet, upon which the *rete mirabile* or delicate network of capillary blood-vessels is spread. The pulmonary artery brings impure or venous blood to this extensive surface, carbonic acid gas is exchanged for oxygen, and the purified, reddened, oxygenated blood is returned by the pulmonary vein to the left side of the heart, thence to be propelled through the entire circulation. The red blood-globules are the carriers of oxygen, and the full object of the preliminary respiratory efforts and the intermediate chemico-vital interchange is really attained as these red globules yield their quota of oxygen to the cells and tissues which constitute the body.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Respiration in Plants, a term under which were formerly comprised two distinct groups of phenomena—viz. (1) the disengagement of oxygen from carbonic acid by green tissue in the sunlight; and (2) the formation of carbonic acid in plants by the process of oxidation. In some treatises the first is called *chlorophylline respiration*, and the second *general respiration*. The first is associated with assimilation, while the word *respiration* is best restricted to those processes which are characterized by the production and evolution of carbonic acid. It was formerly doubted by many botanists whether healthy plants ever give off carbonic acid, but it is now understood that plants have a true respiration analogous to the respiration of animals. (The phenomena of respiration in plants are described under VEGETABLE PHYSIOLOGY.) ASA GRAY.

Res'pirators, mouth-pieces of fine gauze and cloth, to be worn by patients with diseased or weak lungs to prevent the ingress of cold and damp air or foreign matter, as smoke, dust, or the grit of stone. But little used in this country, they are employed in England and in many vocations, as by grinders, stone-carvers, and wherever the air is permeated by impalpable particles.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Respi'ratory Sounds, the sounds produced by inspiration and expiration, as heard by the method termed auscultation, the application of the ear to the chest directly, or indirectly through the medium of the stethoscope. If the entire period of a respiratory act be represented by ten, inspiration will occupy five-tenths of this period; expiration immediately follows during the succeeding four-tenths; and finally a period of silence and rest from breathing during the supplementary period of one-tenth. During the entire period of the inspiratory act the ear applied to the healthy chest detects a clear, full, breezy or blowing sound, gentle at its commencement, full and well defined at its middle, and graduated and faint as it is terminating. The inspiratory sound is soft and low-pitched in adults; in children is ruder and exaggerated, possessing tubular or friction quality. Expiratory sound is comparatively faint, occupying but a small part of the period of the expiratory act. It also is soft and low-pitched, but more feeble and distant than inspiratory sound, since the recedence of expired air from the chest-wall conducts the sound-waves away from the ear of the listener. Expiratory sound is loudest at its commencement, just as the transition from inspiration has taken place, and gently graduates until it ceases. Inspiratory sound is the result of air-friction with the system of bronchial tubes through which it passes. Hence inspiration is a compound sound, possessing an element of laryngeal origin, elements of

sound developed in the trachea, the large and small bronchial tubes, and especially where the tubes bifurcate; and finally an important element developed by the entrance of air into the numberless air-sacs or pulmonary vesicles. This "vesicular" element of inspiratory sound is a test of the healthy lung. Dr. Leaming further describes a continuous vesicular sound or murmur, which he terms the "true respiratory," the product of incessant expansion of pulmonary vesicles by calorified residual air, incident to the oxygenation of the blood and diffusion of gases—sounds which the trained ear detects as the most certain evidence of healthy functional lung-action. Departures from the normal respiratory sounds are evidences of bronchial, pleural, or pulmonary disease. The sounds are harsh in early bronchitis, replaced or accompanied by "râle" or musical sounds in advanced bronchitis; they are masked or completely obscured by pleurisy; their inspiratory and expiratory periods have changed relations and qualities in asthma and emphysema; and in pneumonia, tuberculosis, and other consolidations of the lung respiratory sounds are brought to the ear with increased intensity and clearness, and much raised in pitch. (For detailed description of respiratory sounds in health and disease see the works of A. Flint, Sr., on the *Respiratory Organs*.)

E. Darwin Hudson, Jr. Revised by Willard Parker.

Respiratory System, in animals. See Comparative Anatomy, by Prof. E. D. Cope, A. M., M. N. A. S.

Responden'tia [Lat. *respondere*, "to promise again"], a contract for the loan of money on the security of a ship's cargo or some part thereof, made by the owner of the goods or by the ship's master, with the stipulation that if the goods are wholly lost during the voyage by any of the specified perils, the lender shall lose his entire claim; if not, then he shall receive the sum loaned with the agreed interest. Since this species of contract is in effect an insurance of the cargo by the lender, who takes upon himself all the risks of the voyage, the law permits him to bargain for and to recover more than the ordinary legal rate of interest; and the parties may agree upon any interest proportioned to the exigencies of the case and the risk assumed. This contract in many of its features resembles a bottomry bond, but differs therefrom in the following particulars: One is a loan on the ship, the other on the cargo; in one the money borrowed is payable on the arrival of the ship at her port of destination, in the other, upon the arrival of the goods. In a bottomry bond the vessel itself is always hypothecated, and there is thus created a maritime lien upon her which can be enforced in admiralty by a suit *in rem*. In a respondentia contract there is often no such hypothecation of the goods, and consequent lien, and the lender relies upon the personal credit of the borrower for his payment. By the form of the instrument commonly used in the U. S. the cargo is expressly hypothecated, so that the maritime lien upon it arises; and if it is in existence when the ship arrives at her destination, the creditor can proceed against it by a proper suit in admiralty. The master of a ship may under very special circumstances borrow money upon a respondentia bond, but in that case the necessity both for the loan and for the hypothecation of the goods must be clearly shown, or else the owners thereof are not bound by the master's act. John Norton Pomeroy.

Restigouche' [an Indian word, indicating its division into five head-streams, like the fingers of a hand], a river which separates New Brunswick from the province of Quebec on the N. It is 200 miles long, drains 4000 sq. m., is navigable for large ships 16 miles to Campbelton, and reaches the Bay of Chaleurs at Dalhousie. It is a tidal estuary for some 24 miles. Its lower course is broad and majestic. It is a good salmon-stream, and its basin supplies much timber.

Restigouche, a large county of New Brunswick, the northernmost in the province, bounded N. W. and N. by the province of Quebec, from which it is partly separated by Restigouche River. On the N. E. it is washed by the Bay of Chaleurs. Along the rivers there is very fertile land, but the greater part of the county is an almost uninhabited wilderness. Cap. Dalhousie. P. 5575.

Restora'tionists [Lat. *restauratio*], a name applied to those Christians of whatever sect who entertain the belief that the wicked who die in an impenitent state will, after suitable punishment and repentance, be restored to divine favor, and that all the human race will at last become for ever holy and blessed.

Resurrec'tion [Lat. *resurrectio*, "rising again"]. The resurrection is the future general raising by the power of God of the bodies of the dead. It is a doctrine peculiarly of revelation. Hints of it appear in the Brahmanic and Stoical theories of "returning cycles," the "great year" of Plato, and the Egyptian mysteries. It was definitely taught by the Zoroastrians. It is implied, alluded to, or foretold in the Old Testament (Job xix. 26 (?); Ps. xvi. 10; xlix. 15; lxviii. 18; Isa. xxvi. 19; lxvi. 24; Ezek. xxxvii.; Hos. xiii. 14; Dan. xii. 2). It was believed by most of the later Jews, and appears in the Apocrypha (Wisd. iii. 7; 2 Macc. vii. 9, 14, 23, 29). It was a formal doctrine of the Pharisees, but was disputed by the Sadducees. It was clearly revealed in the New Testament by Christ and the apostles, has been accepted by all parts and ages of the Church, and is a prominent doctrine of Mohammedanism.

As held now, this doctrine rests on the incontrovertible historical fact of the resurrection of Christ. He rose on the third day after his death in the body, which, though changed as to its mode of being, was the identical body which was crucified. He was seen often in different places and circumstances by many witnesses. The proofs of Christ's resurrection rest on his predictions and references to it as a miraculous attestation of his truthfulness; on the testimony and assertions of the apostles, who had been intimate with him for three years, who were cool-headed, and showed their sincerity by dying for the truth of that which they asserted; on the testimony of disciples and friends, who were persons of the highest character and piety; of soldiers, and indirectly of Jews and enemies, who tried to hush up the facts, not to deny them. They rest also on the universal belief of the early Church, the gift of the Holy Spirit according to Christ's promise, the powers given to the apostles, the institution of the Lord's Day, and the Christian religion. It is impossible that in this matter there should have been invention, mistake, collusion, self-deception, or imposture. The fact is beyond doubt. It was the fulfilment of prophecies and promises, the vindication of the past, Christ's triumph over pain and evil, the divine seal, the consummation and confirmation of Christ's work on earth, part of his exaltation, the introduction to his heavenly work and mediatorial kingdom.

The New Testament teaches that all the dead are to rise at the last day to judgment—the good to bliss, the bad to punishment. It speaks of the resurrection of the dead, or from the dead, or of the *body* (σῶμα), not of the *flesh* (σάρξ, *caro*). The creeds and symbols of the Church have generally used the grosser form, the resurrection of the *flesh*. The Gnostics and Manichæans rejected the phrase, because, like the Oriental heathen and the Platonists, whom they resembled in a measure, they despised the body; they taught a merely spiritual resurrection. Most of the Fathers held the gross view, against which the early infidel attacks were directed. Origen first reaffirmed the distinction between the resurrection of the body and the flesh, between the essence and the phenomenal form. Augustine held at first to the spiritual view, afterward to the sensuous, though not in its grosser form. The Alexandrian and Eastern schools held the spiritualizing view—the Western schools, the literal. The Reformers mainly returned toward Origen's interpretation.

The doctrine is maintained by reference to Christ's rising—to the express words of Christ and his apostles (they were false if that was not a fact). It is confirmed by the fact that in a human person there is body as well as spirit. It has been illustrated by the analogies of the renewal of life in seeds and plants, the seasons, the morning, the waxing moon, and the butterfly, etc.

Opponents of the doctrine have maintained that (1) Christ's body was stolen; (2) was resuscitated from a swoon; (3) the belief arose from subjective visions, or (4) grew up as a myth, or (5) from the determination of the disciples not to be disappointed in their projects or hopes, or (6) to meet the prejudices of the Jews; or (7) it was a conscious imposture, or (8) an allegory of the soul after death, or (9) of the regeneration of society, or (10) of the rising from sin, or (11) of the rising of souls from Hades to judgment.

The resurrection of Christ is treated as the fountain, type, and power of a new life—the cornerstone of the Christian system, without which everything falls. It is related closely to every doctrine, and has always been a chief point of attack. The doctrine of the resurrection meets our desires and our intense belief in our indestructible personality. It is part of the antidote of the fall, from which, under the covenant of grace, the whole of human nature is to be redeemed and united to Christ. It gives dignity to the body which was created by God, redeemed by Christ, and is the "temple" and organ of the Holy Spirit. It gives hope and comfort—relief, in part, from the terror of death. It shows the power, love, and truth of God; fulfils the promises and prophecies; confirms the inspiration of the Scriptures; assures us of immortality; shows that the soul and body, united in sin and redemption, will be united in judgment and glory or shame. It confirms the divinity of Christ and his atonement, and is

intimately related to justification, faith, repentance, sanctification, and the whole Christian system. It is the foundation of the Christian week and year.

The resurrection implies the continued identity of the body—that the future body is in essence identical with the present body, one being the veiled germ, the other the glorious development. Concerning identity, it has been taught that (1) all the particles of matter that have ever been in the body are brought together again; (2) only the particles present at death; (3) certain more enduring parts are preserved, as an indestructible corporeal germ from which is made by divine power an organ of the soul adapted to its higher condition; (4) some of the particles remain, however few; (5) there is a "vital germ;" (6) a spiritual, "ethereal, luminous" body is evolved at the moment of death; (7) that the plastic formative principle of life (*anima, psyche*) is continually gathering and casting off the matter it needs for a body wherever it may be. The continuance of the vital principle constitutes identity, however the particles of matter may change, as in a flowing stream. In the case of Christ and those alive at his coming, the body then present supplies the material; in the case of the dead, the anima or psyche gathers in matter as it needs and makes the psychical body. The fundamental "form" or principle of bodily organism, which here appropriates earthly materials, shall in the resurrection appropriate higher materials. (8) That identity is in the spirit (νοῦς), the rational, immortal principle which shows itself in the body which it occupies and stamps with its own personality. Identity in an inorganic body—*e. g.* a stone—is in its substance and form; in an organic body, in the whole organism; in a person it rests in the consciousness.

The resurrection body is (1) spiritual (*soma pneumatikon*), as opposed to the "natural" (*soma psychikon*); (2) is like Christ's body; (3) is glorious, powerful, incorruptible, immortal.

The doctrine, held by some, of two resurrections at different times—one of the righteous, to which the New Testament specially refers, and the other of the wicked—rests on (1) the declaration Rev. xx. 5, 6; (2) the use of the phrase "resurrection *from* the dead," used fifty times, and always referring to the good; the phrase "*of* the dead," referring to the bad; (3) on the New Testament distinctions concerning the resurrection of the just and unjust, the resurrection to life or condemnation; (4) the longing of the apostle to attain the first; and (5) on the order given 1 Cor. xv. 23. ISAAC RILEY.

Resurrection, Congregation of the, a society of Roman Catholic priests founded in 1836 at Rome by Rev. J. Kajsiewicz, who d. in 1873. They have a few missions in the U. S.

Resuscita'tion [Lat. *resuscitatio*], or **Artificial Respiration,** consists in motion of the ribs and exchange of air produced by external instead of internal and vital force. The natural exchange of air in respiration is effected by a mechanical process: and when the muscles which conduct it are deprived of their nervous stimulus by poisoning of the nerve-centres, that mechanical process can be kept going or be recommenced by mechanical means, and thus life be rekindled from apparent death. By compression of the ribs the chest-cavities are diminished, and a proportionate quantity of foul air is forced out by the mouth. On relinquishing that compression, the ribs by their own elasticity bound back to their former position, the chest-cavities are enlarged, and the air (if that be the surrounding medium) is sucked in to prevent a vacuum. Whatever the method, it is upon this principle alone, with the observance of proper alternation and rhythm, such an exchange of air can be effected as to be a substitute for natural breathing. Its use is in suspended animation from suffocation, as in drowning and hanging, also from vapor of chloroform or other noxious gases, in which, death occurring from exclusion of air, a supply of air to the lungs is the one remedy.

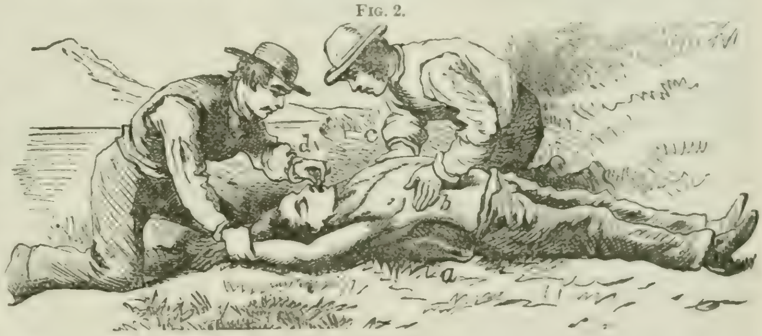
The following are the rules known as the "direct method" for artificial respiration, which have been awarded the first prize of the American Medical Association, and as published by it, by the National Lifeboat Institution of England, and also by the Life-Saving Society of New York. Rule 1, in suffocation from other causes than drowning, is superfluous:

Rule 1 (Fig. 1). *To drain off Water from Chest and Stomach.—Instantly* strip the patient to the waist. Place him face downward, the pit of the stomach being raised above the level of the mouth by a large, hard roll of clothing placed beneath it (*c*). Throw your weight forcibly two or three times, for a moment or two, upon the patient's back, over roll of clothing (*b*), so as to press all fluids in the stomach out of the mouth.

FIG. 1.

Rule 2 (Fig. 2). *To perform Artificial Breathing.—Quickly* turn the patient upon his back, the roll of clothing being so placed beneath as to make the breast-bone the highest point of the body (*b*). Kneel beside or astride patient's hips. Grasp front part of the chest on either side of the pit of the stomach, resting your fingers along the spaces between the short ribs (*b*). Brace your elbows against your sides, and, steadily grasping and pressing forward and upward, throw your whole weight upon chest *c* and *b*, gradually increasing the pressure while you can count *one—two—three.* Then *suddenly* let go with a final push, which springs you back to your first position. Rest erect upon your knee while you can count *one—two:* then make pressure again as before, repeating the entire motions at first about four or five times a minute, gradually increasing to about ten or twelve times. Use the same regularity as in blowing bellows and as is seen in natural breathing, which you are imitating. If another person be present, let him with one hand (*d*), by means of a dry piece of linen, hold the tip of the tongue out of one corner of the mouth, and with the other hand grasp both wrists and pin them to the ground above the patient's head.

FIG. 2.



After-treatment.—After breathing has become natural, dry the patient briskly. Wrap him in blankets only, and let him be kept perfectly quiet. Provide free circulation of air. Give brandy and water—a teaspoonful every five minutes the first half hour, and afterward occasionally as may seem expedient.

(1) *Avoid delay.* A *moment* may turn the scale for life or for death. Dry ground, shelter, stimulants, etc., at this moment are nothing: artificial breathing is everything—is the *one* remedy; all other means are secondary. If the breathing has but *just ceased*, a smart slap on the face or stomach will sometimes start it again, and may be tried incidentally. (2) Prevent friends from crowding around the patient and excluding currents of air; also from attempting administration of any stimulant before patient is well able to swallow; the first promotes suffocation—the second, fatal choking. (3) Avoid impatience of results. Any time within two hours you may be on the very threshold of success without there being any sign of it.

Sylvester's method, used by the Royal Humane Society, is as follows: The body being placed upon the back, with the head slightly elevated, the arms, grasped just above the elbows, are carried outward and upward from the chest almost perpendicularly, and retained in their position for about two seconds. They are then lowered and brought closely to the sides of the chest, where they are held for the same length of time, in order to expel the air as during the act of expiration, the effort being aided by pressure applied to the inferior and lateral portions of the chest. These alternate movements of elevation and depression are repeated from twelve to fourteen times a minute, and are performed with all possible gentleness. Another method, by Leroy's compressor, is in use by the Royal Humane Society. A piece of flannel or muslin six feet by eight is divided for two and a half feet from each end into strips two inches wide. The untorn central portion is placed under the back of the patient, the ends interlacing being drawn in opposite directions by assistants. Mouth-to-mouth insufflation, in children especially, is easily practicable and very useful. The most effective course is by laryngotomy, an elastic tube and bellows to alternate compression with gentle but complete insufflation.

The length of time persons have been under water, or have remained apparently dead after leaving the water, and yet been resuscitated, is uncertain. The reported time is so remarkably long in some cases as to justify efforts for resuscitation for at least an hour, the patient having breathed within half an hour or perhaps an hour. In experiments by a committee of the Royal Medico-Chirurgical Society of London in 1862, dogs after complete submersion a minute and a half never recovered. After respiratory acts had ceased, the heart continued to act never more than four minutes. In the human subject these periods doubtless may be much longer, governed to a great extent by the continuousness of submersion, the rate of the circulation at the last moment of consciousness, the temperature of the water, the amount of it which enters the lungs, etc. As thousands of human lives have been saved from apparent death by this process, it is better to continue it after hope is vain than by any chance to relinquish it while success might perhaps have been possible. B. HOWARD.

Retaliation. See INTERNATIONAL LAW, SUMMARY, by PRES. T. D. WOOLSEY, S. T. D., LL.D.

Retene ($C_{18}H_{18}$), a hydrocarbon polymeric with benzene (C_6H_6), discovered in 1837 by Fikentscher and Trommsdorff, occurs in fossil pine-stems, in peat and lignite, and associated with fichtelite. It is found among the products of the destructive distillation of very resinous pine and fir wood, and is produced with other bodies when acetylene or the product of the distillation of rosin (colophony) is passed through a red-hot tube. It is extracted from fossil wood or lignite by means of alcohol, and is purified by solution in bisulphide of carbon, then in benzol, and in combination with picric acid. The picrate is recrystallized, decomposed with ammonia, and the retene recrystallized from alcohol. It may also be obtained from the semi-solid products of the latter part of the distillation of pine-tar. (*Zeit. f. Chem.* [2], v. 73.) Retene appears in soft, shining, unctuous laminæ, inodorous and tasteless. It melts at 98°–99° C. It evaporates at ordinary temperatures, and when melted gives off white fumes which condense to a woolly sublimate. It boils at about the boiling-point of mercury, and distils almost unchanged. It is insoluble in water, slowly soluble in cold, readily in boiling alcohol, easily in warm ether, in fixed and volatile oils, in benzol, and in bisulphide of carbon. With strong sulphuric acid in the cold it forms disulphoretic acid ($H_2C_{18}H_{16}(SO_3)_2$). It combines with picric acid, forming beautiful orange-yellow needles. By the action of bichromate of potassa and sulphuric acid it yields dioxyretistene ($C_{16}H_{14}O_2$), a brick-red powder, acetic acid and phthalic anhydride. (See Watts's *Dict.* and *Suppl.*) C. F. CHANDLER.

Reten'tion [Lat. *retentio*] **of Urine,** a condition in which the urine cannot be evacuated from the bladder at all, or only with great difficulty, the former being known as complete, the latter as incomplete, retention. It should not be confounded with *suppression*, in which the urine has not been excreted by the kidneys, and consequently the bladder is empty. The symptoms consist of a great and urgent desire to pass water, and partial or complete inability to so; this is accompanied by repeated straining efforts and violent pain, and extreme distress and restlessness; the countenance assumes an anxious expression, the pulse is quick, and the skin dry. The bladder is more or less distended according to the protraction of the trouble, and its position may be ascertained by percussion above the pubes. If this condition is not speedily relieved, it results in rupture of some portion of the urinary tract and extravasation of the contents of the bladder into the surrounding parts. Here the urine acts as a foreign body, and causes an inflammation which soon terminates fatally.

As the treatment of this condition varies with its cause, we shall have to consider them together. The causes are numerous, and may be classified as those due to—(*a*) mechanical obstruction; (*b*) paralysis of bladder, partial or complete; (*c*) hysteria; (*d*) miasm. The agents mechanically obstructing the flow of urine are numerous. Organic stricture of the urethra is a very common one, but it causes complete retention only when, after exposure of some kind or over-indulgence in spirituous liquors or sexual excitement, there is congestion or spasm added to it, and the urethral canal thus made impervious. The attempt should here be made to use a small catheter, but if this cannot be done, the warm bath, local abstraction of blood, and the administration of ether or chloroform should be superadded. Should these means fail, the only resource left is to "tap" the bladder, either through the rectum or above the pubes. This is done at the present time by means of the *aspirator*. The relief, however, is only temporary; the stricture still remains, and some operation must be resorted to for its relief. Spasmodic contraction of the muscle surrounding the neck of the bladder or of the muscular coat of the urethra sometimes exists as a cause of retention; when such is the case, the warm bath, purgatives, opium, and chloroform are the remedial agents. Inflammation along the urethral canal (gonorrhœa) often has retention of urine as a complication. Here it is caused by an intensely-congested and swollen mucous membrane, and the same treatment as for muscular spasm may be adopted. Amongst the other mechanical causes the most important are—(*a*) a small calculus impacted in the urethra; (*b*) small tumor in the urethra; (*c*) clotted blood in the urethra or bladder; (*d*) foreign bodies, as pieces of bougies, catheters, etc., in the urethra; (*e*) tumors of any kind, external to the urethra, which press upon it. This last cause operates quite frequently, and it embraces all those cases of retention due to chronic enlargement of the prostate, inflammation or acute congestion of the prostate, abscesses in the perineum, pressure of a loaded rectum, a displaced uterus, the head of the child during labor, or a pelvic tumor of any kind upon the neck of the bladder. The treatment should always be directed to the removal of the cause, and where this requires any great amount of time, we have the catheter and aspirator as palliative means. Paralysis of the bladder, causing retention, may be due to voluntary retention repeated and long kept up, apoplexy, injury to the spine, acute over-distension of the organ, shocks to the system from capital operations, and in certain high fevers, as typhoid, typhus, etc. The treatment in all these cases should be by the catheter. Hysterical retention is a disease of the mind, and depends wholly upon the volition of the patient. (See HYSTERIA.) Gross mentions a form of retention which is periodical in its nature, and which he ascribes to malarial influences, and accordingly adopts the treatment of miasmatic diseases, as quinine, etc.

EDWARD J. BERMINGHAM. REVISED BY WILLARD PARKER.

Rethel', town of France, department of Ardennes, on the Aisne, is an old city, but well built and handsome, and carries on a large trade and extensive manufactures of flannels, merinoes, and other woollen fabrics. P. 7312.

Re'thel (ALFRED), b. at Aix-la-Chapelle in 1816; studied at Düsseldorf under Schadow, and at Frankfort under Veitt; visited Italy in 1844–45; painted after his return the four great frescoes from the history of Charlemagne in the city hall of his native city, and produced several grand and very interesting designs—*Hannibal crossing the Alps, Dance of Death,* etc.—but became insane in 1852. D. at Düsseldorf Dec. 1, 1859.

Retina. See EYE and HISTOLOGY.

Retort' [Lat. *retortus*, "thrown or twisted back"], a chemical apparatus originally made of glass, and made by taking a globular or spheroidal vessel with a long tubular neck, and bending this neck, close to the spheroid, over to an obtuse angle; hence the name. Retorts are plain or tubulated, the latter being perforated at the upper side of the bend, and a glass neck fused fast, through which a tube may be introduced, and solid or liquid substances put in, and which may be closed with a stopper. The term is applied likewise in modern usage to almost any apparatus in which *solid* substances, such as coal, wood, bones, etc. are submitted to destructive distillation; for example, gas-retorts. H. WURTZ.

Retrograda'tion [Lat. *retro*, "back," *gradi*, to "step"], in astronomy, an apparent or real motion of a celestial object from E. to W., or contrary to the order of the signs in the heavens. Motion from W. to E. is called direct. The motion of all the bodies of the solar system

is direct, but that of some of the comets is retrograde. The planets, however, seem at times to have a retrograde motion, which is a consequence of the fact that their velocities in their orbits differ from that of the earth. The inferior planets move more rapidly than the earth, and the superior less rapidly. It happens, therefore, that the inferior planets have a motion apparently retrograde for some time before and some time after their inferior conjunctions. The apparent motion of the superior planets is retrograde for some time before and some time after their oppositions. Between the periods of direct and retrograde motion there are times when these bodies are apparently stationary, but the stations are of brief duration. The mean periods of retrogradation are—for Mercury, 22 days; for Venus, 42; for Mars, 73; for Jupiter, 120; for Saturn, 140; for Uranus, 152; for Neptune, 158½.

F. A. P. BARNARD.

Retrospec'tive [Lat. *retrospicere*, "to look back"] **Laws.** Those statutes which relate back in time, and affect rights, duties, capacities, conditions, relations, or circumstances which lie in the past, and have become established prior to their passage, are termed "retrospective" or "retro-active." They are so plainly opposed to justice and equity that in determining the general principles by which all legislation is to be construed the courts have firmly established the doctrine that all statutes shall be presumed to act prospectively only, and shall not be regarded as retrospective unless their clear and imperative intention, derived from their express terms, forbids such an interpretation. Retrospective laws, as a class, are not generally prohibited by the State constitutions, nor are they by the Constitution of the U. S., although in the organic law of Vermont and of one or two other commonwealths there is a provision forbidding such legislation. One species of retrospective laws, those which are criminal or penal in their nature, and are technically termed *ex post facto*, are interdicted by all the American constitutions. (See EX POST FACTO.) If a retrospective statute should interfere with vested rights of property or of personal security, or should impair the obligation of contracts already made, it would be void by the operation of other constitutional provisions, which declare that no person shall be deprived of life, liberty, or property without due process of law, and that no State shall pass laws impairing the obligation of contracts.

JOHN NORTON POMEROY.

Return' [Fr. *retourner*], in law, is a highly technical term, and signifies the sending back of a writ or other process to the court from which it issued by the officer to whom it was addressed, according to the command contained in the instrument itself. It actually consists of a written account or history of what he has done in executing the process, made and signed by such officer, endorsed upon or attached to it, and filed with it in the office of the clerk of the court. In the common-law practice there were generally certain fixed days on which the ordinary writs were to be returned, but they have been abandoned by the procedure of most of the American States.

JOHN NORTON POMEROY.

Retz, de (GILLES DE LAVAL), SEIGNEUR, generally called **Marshal Retz,** b. in 1404 at Machecoul, department of Loire-Inférieure, France; distinguished himself in the wars of Charles VII.; fought at the side of the Maid of Orleans; was made a marshal of France, but retired subsequently from public life to his castle of Retz. Implicated in a process with the duke of Bretagne, the procedure disclosed the most hideous crimes committed by him in his castles. During fourteen years he had enticed several hundred children into his castle and sacrificed them to his lust and superstition, he being addicted to magic and a worshipper of Satan. He was strangled and burnt in 1440. He bore the surname *la Barbe Bleu.*

Retz, de (JEAN FRANÇOIS PAUL DE GONDI), CARDINAL, b. at Montmirail, France, in 1614; educated for the Church, though against his will, and led as a young abbé a very improper life. His brilliant gifts nevertheless enabled him to advance in his ecclesiastical career. In 1643 he took the degree of D. D. at the Sorbonne, and was appointed coadjutor to the archbishop of Paris, Henri de Gondi. He now began to preach, and soon became exceedingly popular among the Parisians. In the embroilments of the Fronde he appeared as one of the leaders of the revolution against Mazarin and the queen, and exercised great influence by his eloquence and audacity. But he seems to have been entirely reckless, without any fixed purpose. In 1650 he allied himself with the court, gained a cardinal's hat, and commenced to intrigue against the opposite camp. He had forfeited all confidence, however, and in 1652, Mazarin ordered his arrest. He was imprisoned first in Vincennes, then at Nantes, but escaped and fled to Spain, afterward to Italy. After the death of Mazarin he was permitted to return to France in 1661, on condition that he should give up his claims to the archbishopric of Paris. He received the abbacy of St. Denis, and here he lived in great splendor and gayety, but without participating in public life, occupied with studies and the payment of his enormous debts. D. at Paris Aug. 24, 1679. His *Mémoires* were first published at Nancy in 1717; the most complete edition is that by Aimé-Champollion (4 vols., Paris, 1859).

Retzsch (MORITZ), b. at Dresden Dec. 9, 1779; studied at the Academy of Art in his native city; was appointed professor of drawing in 1824. D. June 11, 1857. He acquired some reputation as a miniature portrait-painter, but his most celebrated works are his illustrations to Goethe, Schiller, Fouqué, and others, which were reproduced both in England and France.

Reuchlin' (Hellenized CAPNIO), (JOHANN), b. at Pforzheim, Baden, Germany, Dec. 28, 1455; educated in the chapel of the margrave of Baden, and followed in 1473 the young margrave to the University of Paris, where he commenced his studies in Greek. During two years' residence at Bâle he wrote and published his Latin dictionary, *Breviloquus sive Dictionarium, singulas Voces Latinas breviter explicans;* and during a second visit to France in 1478 he studied law at Orleans. In 1481 he lectured on jurisprudence and belles-lettres at the University of Tübingen, received the title of imperial councillor from the emperor, and lived subsequently for several years at the court of the elector palatine, Philip, at Heidelberg. To this period belong his first studies of the Hebrew language and his satirical comedy, *Sergius, sive Capitis Caput,* which was much read, and whose satire against the clergy was heartily enjoyed. In 1498 he went to Rome, his patron, the elector palatine, having fallen under the papal ban, and he succeeded in procuring his absolution. After his return he was appointed president of the Suabian confederate tribunal, but he nevertheless found time to continue his studies of Hebrew, the results of which were his *Rudimenta Hebraica* (1506), *De Arte Cabbalistica Libri III.*, and *De Accentibus et Orthographia Hebræorum Libri III.* (1518). By these works he actually initiated the study of the Hebrew language, so important for a full and comprehensive conception of the Bible; and he exercised a similar stimulating influence by his handbooks, editions, and personal exertions in the study in Germany of Latin and Greek; that pronunciation of the Greek language known as Iotacism originated with him. But he was too liberal to escape clashing against the prejudices of his age. A converted Jew, Johann Pfefferkorn, proposed in 1510 that all Hebrew books, with the exception of the Bible, should be burnt. The Dominicans were in raptures over the proposition; the Inquisition immediately recognized it as a new weapon of persecution; the emperor acquiesced. Meanwhile, Reuchlin remonstrated, the emperor withdrew his consent, and the Inquisition and the monks flew into a fury. Reuchlin published *Speculum Oculare* (*Augenspiegel*), (1512) and *Defensio contra Calumniatores* (1513), while Ulrich von Hutten and Franz von Sickingen kept guard over his personal safety. In 1515 appeared the first part of *Epistolæ Obscurorum Virorum,* and when the Reformation soon after broke out the attention of the Roman Catholic clergy was attracted elsewhere. With Luther, Reuchlin felt a deep sympathy, but he declined an invitation to come to Wittenberg, sending in his stead Melanchthon, and maintained his connection with the Roman Catholic Church to the last. In 1520 he was appointed professor at Ingolstadt, but when the plague broke out in this city he determined to retire to Tübingen, but d. at Stuttgart June 30, 1522. His *Life* was written by Gehres (1815), Meyerhoff (1830), and Geiger (1871).

Reul'ing (GEORGE), M. D., b. in Darmstadt, Germany, Nov. 11, 1819; studied medicine in the University of Giessen, where he graduated with the highest honors; devoted himself as a specialist to diseases of the eye and ear, studying under Profs. Arlt, Jaeger, and Pollitzer in Vienna, Gräfe in Berlin, Wecker and Liebreich in Paris; and accepted in 1867 the position of first assistant to the eye hospital at Wiesbaden, which after one year he resigned to take charge of the eye and ear infirmary of Baltimore, Md. In 1869 he was elected professor of ophthalmology in the University of Baltimore, and is the author of contributions to the literature of his specialties. PAUL F. EVE.

Re'us, town of Spain, province of Tarragona, has large spinning and weaving factories, and extensive manufactures of silk, ribbon, leather, soap, and pottery. The vicinity is very rich in wine and corn. P. 28,171.

Reuss, two small principalities of Germany, belonging to an elder and younger line of the family of Reuss, and consisting of several separate territories situated between Prussia, Saxony, and Bavaria. The dominions of the elder line, Reuss-Greitz, comprise an area of 148 sq. m., with

45,094 inhabitants; and those of the younger line, Reuss-Schleitz, 297 sq. m., with 89,032 inhabitants.

Reuss, a river of Switzerland, rises in the canton of Uri, near St. Gotthardt, descends in its upper course 4500 feet through a series of wild cataracts and magnificent cascades, enters the southern end of Lake Lucerne, issues from the northern end as a clear, deep-green, navigable stream, and joins the Aar in the canton of Aargau at Windisch, after a course of about 100 miles.

Reuss (Édouard Guillaume Eugène), D. D., b. at Strasbourg (then a part of) France, July 18, 1804; educated at the seminary of his native city; studied theology at Göttingen under Eichhorn, Oriental philology at Halle under Gesenius, and pursued the latter branch at Paris under Silvestre de Sacy; taught biblical criticism and Oriental languages in the theological school of Strasbourg 1829–34; became extraordinary professor there 1836, and ordinary (regular) professor 1838; declined a call to the University of Jena; published (in German) a *History of the Books of the New Testament* (Halle, 1842; 4th ed. 1864), *Histoire de la Théologie chrétienne au Siècle apostolique* (2 vols., Strasbourg, 1852; 3d ed. 1864; English translation Edinburgh, 1872), *Histoire du Canon des Saintes Écritures dans l'Église chrétienne* (1863), and has prepared a new French translation of the entire Bible, several parts of which have appeared. Prof. Reuss has edited for many years a German review which appears at Jena (*Beiträge*, etc.), has contributed largely to Colani's *Revue de Théologie*, and is considered as one of the most learned and liberal theologians of the French Protestant Church. He continues to reside at Strasbourg since its annexation to Germany, which measure he energetically condemned.

Reu'ter (Fritz), b. at Stavenhagen, Mecklenburg-Schwerin, Nov. 7, 1810; studied law at Weimar and Jena, but was arrested in Prussia in 1834 for political agitation and sentenced to death. The sentence was commuted to imprisonment for thirty years, but in 1840 he was pardoned and restored to liberty. He now devoted himself to literature, and his poems and novels (12 vols.), written in the Low German dialect, are distinguished by freshness, humor, and plastical power, and were received with great applause. He settled first at Trepton in Pomerania, afterward at Eisenach, where he d. July 12, 1874.

Reut'lingen, an old but well-built and handsome town of Würtemberg, is situated on the Echatz, in a fertile district rich in corn, wine, and fruit, and carries on a lively trade and extensive manufactures of woollen and linen fabrics, hosiery, leather, and cutlery. P. 14,237.

Rev'al, town of European Russia, government of Esthonia, on the southern side of the Gulf of Finland, has a good harbor and is strongly fortified. It was formerly a port of great commercial consequence, but of late its trade has greatly declined, being absorbed by that of St. Petersburg and Riga. P. 27,325.

Revalen'ta Arab'ica, a dealer's name for a dietetic preparation highly vaunted for the use of invalids. It is simply the meal of lentils, and its name *revalenta* is an imperfect anagram of *Ervum lens*, the botanical name of the lentil-plant. In reality, it is very nutritious, but much more suitable food for a well person than an invalid.

Reveille, tp., Scott co., Ark., has 1 newspaper. P. 882.

Revel', town of France, department of Haute-Garonne, manufactures woollens, oil, liqueurs, and earthenware. P. 5386.

Revela'tion. In the ordinary sense of the word, "revelation" means the religion of Israel and of the Church as it is set forth in the Hebrew books of the Old Testament and the Greek books of the New. This religion bears the name of revelation because its God has directly interfered in the history of mankind by apparitions and the incarnation of his Son, by visions and inspiration, and by miracles which he has either wrought himself or given his servants to work. The several aims of these different modes of revelation are —(1) to render faith in the invisible God vivid and firm in the heart; (2) to teach the truth to fallen humanity, which is incapable by itself of discovering it; (3) to guide mankind in its advance toward the goal which has been assigned to it; and (4) to deliver us from our spiritual bondage by taking away our sins and destroying the works of the devil (1 John iii. 5–8).

There can be no revelation of God to the materialist who denies him, or to the pantheist who confounds him with the world, or to the deist who makes him the slave of his own laws, the great drone of the universe, the great mute of the heavens. On the other hand, it is quite evident that the true God, the living and personal God, the God infinite in power as in wisdom and love, the God divinely free, can reveal himself to his creatures whenever he chooses. "This question" (to use an expression of J. J. Rousseau), "when seriously treated, would be impious if it were not absurd. But to punish him who should answer it in the negative would be to do him too much honor; it would suffice to lock him up." If the God of the theist reveals himself whenever he pleases, the Christian God does so in virtue of his very essence. According to the teachings of Jesus Christ and his apostles, which transfer us into a world of mysteries whose very existence reason alone would never have suspected, God, in the true sense of the word the Father, who dwelleth "in the light which no man can approach unto" (1 Tim. vi. 16), and whom even the archangels themselves cannot behold, has *with* him (John i. 1) two beings, equal to him, the Son and the Spirit, through whom he reveals himself eternally to the universe. Revelation is thus the normal mode of his activity. The Son is his objective and sensible revelation, his other self, the express image of his person (Heb. i. 3), his visible picture, his Word. Through him he spoke to nature in the time of the creation. Through him he speaks and shows himself in the heavens to the angels eternally—on earth to mankind at rare intervals until the time shall come whose light are God and the Lamb eternally (Rev. xxi. 23). The subjective revelation of the Father is the Spirit, the God by whom God explains to his creatures internally the words of his Son, and communicates to them substantially his "divine nature" (2 Pet. i. 4). Thus, the Spirit unites to the Father, and makes re-enter into his bosom the creatures which the Father made issue forth from thence through the Son; he is the final synthesis of the finite and the infinite.

I. This double revelation of God, objective and subjective, is necessary to man in his normal state before the Fall. Without it his faith would have been wavering and incomplete. A few words concerning the fundamental structure of human nature will justify this assertion. The physical and moral life of man is circumscribed by these three terms: the Ego, or the organs of the body and the faculties of the mind; the non-Ego, or the world in which man lives; and the appropriation of the non-Ego by the Ego. Thus, in the domain of physical life there is an organ of digestion within, materials of nutrition without, and finally the process of assimilation. In the field of the affections there is a heart with a craving for love, beings capable of being loved, and finally the feeling of love by which the heart gives itself to another heart, takes that heart up into itself and becomes one with it. In practical life there is on the one side a will seeking an object on which to exercise itself; on the other, nature and human society meeting this desire of activity; and finally, the labor by which the non-Ego is appropriated and transformed. In the same manner also the intellectual life of man remains incomplete until a thorough assimilation is added to its deduction and induction. It is not enough to deduct, like the spider, from the depths of one's own being the light and fragile tissues of abstract truth, or to accumulate, like the ant, by induction, an immense quantity of facts; man must, like the bee, transform his booty into his own substance, comprehend the external, concrete facts by the aid of his innate ideas, and taste that mysterious joy which is engendered in the human soul by the wedding of the Ego to the non-Ego—that is, by the discovery of the essence of things, of their laws, their final causes, their system, their history. The case is exactly the same in our religious life. From our instinctive need of a God, from our sense of the absolute, from our aspirations toward the infinite, from our imperious demand for unity, from our ideas of cause and order, two or three metaphysical proofs of the existence of God can be deduced. But such a deduction gives us only the logical evidence of the fact; of its reality it can tell us nothing. Leverrier demonstrated by his mathematical calculations the existence of the planet Neptune, but it did not enter the rank of actual facts until the telescope showed it glittering in the place which had been assigned to it. Induction only—that is, the senses, the direct observation, and the historical testimony—gives certainty. Thus, it was necessary that God should reveal himself to men (as he does to the angels) through his Son, and make himself seen and heard among them, in order that there should remain no doubt in their hearts of his existence, nature, and perfection. Nevertheless, the example of the Israelites at Sinai shows us that man can hear with unspeakable awe the Eternal promulgating his holy laws, and yet entertain profanity, rebellion, and idolatry in his heart. Induction with its certainty is not sufficient, either. Assimilation alone, which here is the work of the Holy Spirit, gives full understanding of the divine revelations, unshakable conviction, and that living faith which initiates the soul into the life of prayer, holiness, hope, and love.

II. To this proof of the necessity of a revelation, drawn from the fundamental nature of man, must be added another furnished by his intellectual and moral state after the Fall. Sin has so enslaved the spirit under the flesh, and

so degraded and blinded it, that, like a compass out of order, it cannot serve as a guide to man in his pursuit of truth. The whole human race, a forlorn traveller surrounded with the hallucinations of a diseased brain, denied the true God in order to adore myriads of imaginary beings, which, on account of their mischiefs and crimes, deserved better to fall under the axe of the executioner; and at last, when reason, tired out by so many impious and absurd myths, unchaste festivals, human sacrifices which were nothing but mere murders, endeavored to find their way back to truth, wise men arrived at the most different results, which contradicted and destroyed each other. The last word of this immense labor of the philosophers was—in India, Booddhism or the atheistic morality of charity; in Greece, the atheistic morality of the haughty and egotistical Stoics and the mean materialism of Epicurus; in Rome, the skepticism of Cicero; and in our days in the West, the positivism of Auguste Comte, which declares all that surpasses observation by the senses is inaccessible to reason. Thus reduced to his own resources, the fallen man ignores or doubts or denies God and his glory, no less than the soul and its future destiny, and with his best will he cannot possibly find the true God, or at least not acquire the certainty of having found him. Created by God in his image and called to become holy like him, our deeds, good or bad, draw down on us an exact remuneration from his justice, which is infinite, like his power and his love. Thus, in the dark night which our corrupted heart and bewildered reason have produced in us we feel persuaded that, since we have no master in heaven, but have sprung from earth like a plant or were sired by an ape, we can give to ourselves such laws as we please; that since we are nothing but matter, our liberty is an illusion and our moral responsibility a bad dream; and in this manner we spend our whole life in aggravating the frightful sentence of condemnation which one day the divine justice will certainly pronounce over us. But God, who is love, has had pity on the human race. Liberating our spirit from the slavery of the flesh, and leading us back to the road of holiness, he completed the primitive revelations to Moses and the Hebrew prophets by Jesus Christ and the apostles, and in the course of time he collected all these revelations into an inspired book in which all nations and all individuals can find those religious and moral truths which are necessary to salvation. In this book are laid down answers to all the questions which the philosophers have put in vain to themselves concerning God, man, the origin of all things, and the future destiny of the world. There is the source from which we can draw truth unmixed with error. There is the rock, not to be shaken, on which we can raise the building of our life, spiritual and practical.

III. We mentioned above the primitive revelations. Indeed, since the life of man is faith, and since faith is incomplete without revelation, God must have shown himself and spoken to the first man before the Fall and in the very moment of the Creation as Moses records it in ch. ii. of Genesis. Perhaps it was at this very time that Adam received from God the apocalyptic vision of the six days, which has been preserved in its authentic form on the first page of our sacred books, and of which remnants are found in the New World as well as in the Old, and with all races and tribes, savage as well as civilized. Everything seems to indicate that this revelation was the foundation of the primitive religion, as the Deluge was the foundation of the religion of the Noachides, the miracles of the Exodus and Sinai the foundation of the religion of Israel, and the expiatory death and resurrection of the incarnated Word the foundation of the Christian religion.

In the vision of the six days God made himself known to humanity as the God of progress interfering in the history of terrestrial nature by physical miracles, and revealing himself from epoch to epoch by creative words. He begins with chaos and ends with man, who was the first in his idea, though the last in reality. He lit the light in primordial darkness; separated the luminous and solar substances from the opaque and planetary; detached from these the materials which constitute our globe; and precipitated the waters of the universal sea into deep basins whence arose the land. Into this realm of the minerals, where reigned the mechanical and chemical forces, his word threw from on high the germs of organic life, animal and vegetable. Vegetable life predominated at first on all the firm land (during the Silurian period). Then, after the definitive organization of the solar system, the aquatic and atmospheric animals became the masters of our planet (during the Secondary period); and it was not until after them that, in virtue of the divine law of progress, the land animals began to multiply and reign (during the Tertiary period). At last, after sowing the germs of organic life on the fields of the physical and chemical forces, God implanted in a living soul (this is the Hebrew name of an animal) his own image, the sense of the absolute, the reason, the spirit (Gen. ii. 7; i. 27), and formed of these two elements humanity, which was given whole with the first man. On earth Adam was the eye which saw the God of revelation, the ear which heard him, the intelligence which comprehended him, the heart which loved him, the will which served him, and the lips which invoked and glorified him.

However, if Adam closes the history of the earth, he opens that of the world of freedom. By the aid of St. Paul we can distinguish behind and across the tragical vicissitudes of fallen humanity the peaceful wanderings of normal humanity. As the mineral rises toward the plant, the plant toward the animal, the animal toward man, so man aspires to God, and ought to reach him. But his nature, although psychical, is so inert that he would never advance or reach his goal if not urged by God. Thus, the miracles of the physical creation are succeeded by the miracles of the historical creation, and to the reign of man the Author of progress adds the reign of the God-man. The first Adam was the synthesis of animality and reason; the second or the latter Adam is the synthesis of humanity and the divine nature. The first was created in the image of God; the second is the image itself become man. The first was only a living soul; the second is the vivifying Spirit which descended in tongues of fire on his first disciples, and thus initiated them into the mysteries of spiritual life (1 Cor. xv. 45). Jesus Christ, the great revelation of God, can thus be considered as the last stage of this progression which through Adam, animal, plant, mineral, descends into the dark waters of the earth, yet without form and void.

Again, Jesus Christ opens a new era—that of spiritual humanity or the Church—and we know from prophecies that future revelations of God and his Son shall unite during the millennium into one holy organism, in which each of them, faithful, docile, and happy, still finds his place and his part. But the progress which God initiates in the history of mankind by his miraculous interventions will not stop at this point; eternity keeps in store for our race infinite felicities when "God may be all in all" (1 Cor. xv. 28).

Thus, the revelations and interventions of God connect by a geometrical progression of admirable regularity the history of man with that of the earth, the last days of our race with those of its origin, and the future eternity with the past eternity.

IV. The normal history of humanity before the fall was troubled and violently changed by the power of sin. We shall presently consider what are the revelations of God which became necessary on account of this our state of fall, and which all tend toward the redemption wrought out by the second Adam, who became our Saviour by being sacrificed on the cross.

Man had hardly issued from the hands of his Creator when, through a revelation full of wisdom and love, Jehovah gave full satisfaction to the legitimate cravings of our physical nature, our flesh, by inviting Adam to eat the fruit of all the trees in the garden with the exception of one. This restriction, which of all imaginable laws was the easiest to observe, purposed to give to the first man a consciousness of his moral nature and high vocation. His spirit rising above the appetites of the flesh, he would have learned to control himself, tasted the inner joy of the victory of the soul over temptation, and conquered his freedom for ever. Sooner or later he would have eaten the fruit of the tree of spiritual life (sacramental or symbolical), and the action of the Holy Spirit would have confirmed his native immortality and rendered it indestructible. But Satan intervened and seduced the ancestors of the human race. In the feeling of their degradation they fled from the holy God, and by their crime they drew down on themselves the punishment of the infinite justice. Their fall having broken their connection with the divine and only source of life, death was the punishment of their sin; diseases proceeding from the disordered passions of the flesh prepared death from afar; Nature added her plagues. Thus, earth became a hospital and a cemetery, and the human race fell into an abyss of unspeakable sufferings, from which it could never have been delivered by its own power. It was necessary that God should interfere in order to save it. Consequently, he revealed himself to Adam and Eve on the very day after their fall. As victims of the perfidy of Satan, God considered them more pitiable than criminal, and promised them a Saviour who should be born of a virgin (in accordance with numerous pre-evangelical myths of the demigods) and destroy the work of the devil, but who in bruising the head of the seed of the serpent should be bruised himself on the heel (Gen. iii. 15). This Saviour, who was

the first in the divine decrees, but should not appear in reality until the last times, became the final object of all the following revelations. The promise of his appearance, made to Adam and Eve, hovered, so to speak, like a bird over their descendants. After the Deluge it alighted on the head of Shem, for from him Japheth should one day learn to know and serve Jehovah (Gen. ix. 27). Among the Semites, God chose Abraham in order that He in whom "all families of earth shall be blessed" might issue forth from the people of Israel (Gen. xii. 3). On his deathbed Israel saw the Prince of Peace, unto whom "shall the gathering of the people be," issue forth from the tribe of Judah (Gen. xlix. 10); and subsequently Nathan announced to David, the descendant of Judah, that in his family should be born the Son of God, whose kingdom should last for ever (2 Sam. vii.). Meanwhile, having delivered by the most striking miracles his chosen people, the people of Messiah, from the servitude of the Pharaohs, Jehovah gave to it on Sinai a law which by its salutary discipline was suited to awaken a steadily-increasing longing for the great Liberator. At the same time the sacrifices and the feast of propitiation prefigured the atonement of Golgotha, the high priest the eternal sacrifice of Christ, and the tabernacle the spiritual constitution of the Church. To the Law were afterward added the prophets, who announced the divinity of Messiah (Micah, Isaiah); his birth by a virgin (Isaiah) at Bethlehem (Micah); the date of his appearance and the short duration of his ministry (Daniel); his entrance into Jerusalem on a colt the foal of an ass (Zechariah); his betrayal by Judas Iscariot for thirty silver coins; his crucifixion (David); his expiatory death and resurrection (Isaiah); his precursor (Malachi); the new covenant sealed by the sending down of the Holy Spirit (Joel, Jeremiah, Ezekiel); the admission of the Gentiles into the Church; and the final and universal kingdom of true faith, justice, and peace.

These magnificent promises of pity from the side of God were accompanied by frightful menaces of justice, menaces of captivity, dispersion, and cruel sufferings to the rebel Israelites, and still more terrible menaces, even of complete ruin, to the idolatrous nations contemporary with the chosen people. The first destroyer of these nations and of Israel was a Chaldean king. He opened the era of universal monarchies, which aspired to submit the whole earth to the same law and the same yoke. In his astonishing visions Daniel counted four such kingdoms—those of the Chaldeans, Persians, Macedonians, and Romans. They form "the times of the Gentiles" (Luke xxi. 24), which probably comprise a period of $2 \times 3\frac{1}{2}$, or 7×360, or 2×1260 years. The period will end with the return of the Jews to their own country, which will follow shortly after the establishment of the Christian kingdom over the whole earth.

If we examine more closely the revelations of God to the Israelites, we find that they conform from one age to another with the spiritual state of the race of Abraham. To the father of the faithful, to the pious Isaac, to Jacob, whose faith remained victorious in the world, Jehovah was, so to speak, the friend of the family: he appeared to them at night in their dreams, during the day in the guise of a traveller. But when the problem became to implant for ever the faith in the hearts of a nation gross, carnal, headstrong, and half idolatrous, this same Jehovah heaped miracles on miracles and surrounded himself on Sinai with the whole awful apparel of his power. In the same manner the oldest prophets—from the time of the Judges, when the faith of the Israelites was still very little introspective—were simply seers, hardly to be distinguished from the pagan diviners. After the time of Samuel, when the people had increased both in intellect and piety, the seers become *nabi*, from whose hearts flow inspired words, holy canticles, the first psalms. Afterward, when an awakened reason had produced a philosophy in Israel, the *nabi* became prophets with vast views, to whom God revealed the destinies of the nations—yea, of humanity. But at last prophecy ceases like the miracles, as if to put into stronger relief the divine figure of the Messiah, whose every word is in a certain sense a prophecy, and whose miracles are counted by thousands. The progress is evident from Moses, through Samuel and David, to Isaiah, or from the Law written on stone tablets, and miracles which through the senses overwhelm the spirit, to the inspiration of the psalmists springing from the depths of their pious souls, and the prophecy which addresses itself only to the heart and through the conviction.

But that which most specially strikes our attention are the intermissions of the revelations of the Eternal to the Israelites. The revelations are accumulated at the beginning of each period, like so many lessons given by the preceptor to his disciple, and then they cease entirely, in order that the disciple, having become of age, may put them in practice under his own responsibility. Thus, in the patriarchal age, or the infancy of Israel, Jehovah reveals himself a score of times to Abraham, Isaac, and Jacob; then he conceals himself to their descendants, who have to try their own moral power. Joseph glorifies him by his faith and chastity, and his age is for the Hebrews in Egypt a time of prosperity. But their piety weakens, idolatry creeps in among them, and for a whole age they are the miserable slaves of the Ramsessides. They would certainly have perished if they had not cried to their God. But Jehovah reappeared on their entering the age of youth in order to organize them into a religious and civil society; and we have already mentioned the profusion of miracles by which he compelled them to believe in him and in Moses. Then he remained silent after the conquest of Canaan, and the generation to which Joshua belonged served the Eternal faithfully. But the Israelites soon turned away from him, and during his long silence under the Judges they relapsed every now and then into idolatry. Thus, the second period of the history of Israel ended, like the first, with a captivity, that of the Philistines, which would probably have been their final ruin if the Eternal had not interfered a third time, raising up Samuel among them. Samuel is the Moses of a time in which the Israelites arrived at their age of maturity and the full development of their intellect. He is also much less a miracle-worker than the first of the great prophets, the founder of the school of the *nabi*. Without any striking miracles he leads the Israelites back to the observation of the Law of Sinai; he explains to them its spiritual meaning (1 Sam. xv. 22), and thus he calls forth a powerful and lasting revival throughout the whole nation. One of the fruits of this revival is the lyric poetry of the psalmists, in which the pious soul expresses its innermost experiences. Shortly after, with Solomon, the wise men appear, who represent in short sentences (*proverbs*, the *gnomes* of the Greek) such observations as the light of the divine revelation has led them to make on human life and character. The times of David and Solomon correspond to those of Joseph and Joshua, and mark the culminating point of the history of Israel.

In the last days of Solomon the decline of the people begins. It splits into two. Faith in the Eternal struggles hard against the hybrid worship of the ten tribes and against the idolatry of the Phœnicians. Jehovah interferes from time to time by several prophets, by a miracle, by a certain concourse of providential circumstances. But it is evident that the two kingdoms advance more or less rapidly toward their ruin. Under Ahab and Jehoshaphat the true believers, the pious residue of the chosen people, separate from the old Israel, which degenerates and perishes; and yet a divine and immortal Child shall issue forth from this womb attacked by an incurable disease. But as all creation presupposes a powerful intervention by God, we see Elijah and Elisha, by whom God created the invisible Church of the old covenant, work a multitude of miracles, and among them several rivalling those of Sinai. These wonders ceased with the death of Elisha, and the nascent Church found its nourishment in the symbolical visions of the prophets.

The kingdom of Judah was destroyed by the Chaldean Nebuchadnezzar, and the mature age of the chosen people ended, like its youth and infancy, in a captivity, that of Babylon—an event which to any other nation would have proved its sure ruin. Then the true God had no temple in which his worship was celebrated, no palaces in which reigned the princes of his choice, no free people serving him. The false gods seduced his people, and the sceptre of the earth passed from the hands of Israel and David to those of the pagan monarchs who oppressed Israel during the times of the Gentiles. Nevertheless, the empire of these idolaters was not founded without the Eternal predicting by Daniel the downfall of the symbolic statue, and convincing them by striking miracles of his sovereign power. Nebuchadnezzar himself, the winged lion, was nearly converted to Jehovah, and strove to assume the heart and shape of man—of the man bearing within himself the image of God (Dan. iv.). But in accordance with the law of the first revelations the miracles and prophecies ceased with the first empire.

At the close of the third age of Israel, as at that of its second and first ages, the Eternal interfered in order to deliver it from captivity. But it was not necessary for this purpose to have recourse to acts of power; it was sufficient to act in secret by the Spirit (Zech. iv. 6) on the heart of Cyrus, who voluntarily sent the Jews back to their country. Ripened through adversity, the Jews were able, at least to some extent, to restore by their own strength, together with Jerusalem and the temple, their worship and social institutions. Jehovah, giving his aid in proportion to their need, sent three prophets as auxiliaries to Ezra and Ne-

hemiah. Then, for the fourth time, he left the chosen people to itself, and from Malachi to John the Baptist, as from Jacob to Mosès, there was no direct intervention by God in the history of Israel.

Under the persecutions of Antiochus the Jews proved themselves worthy of the confidence which their God put in them by their heroic courage in suffering martyrdom, and in defending, arms in hand, their faith and their liberty. The times of the Maccabees correspond to those of Solomon, Joshua, and Joseph. But soon after the hypocritical formalism of the Pharisees and the incredulity of the Sadducees took hold of all hearts, and as in the time of the Deluge faith had disappeared from the earth, so, when the precursor of Messiah appeared, God counted only a few in Judah as his—Zacharias and Simeon, Anna and Elisabeth.

The Messiah is at once—(1) the incarnate Word, or the absolute revelation of God to man; (2) the last Adam, or the vivifying Spirit toward which the normal humanity aspired; and (3) the Saviour of fallen humanity, the great expiatory Sacrifice which on the cross and by his life and blood has purified man from his degradation, and atoned for his crime by the three hours of darkness and unspeakable sufferings—the victor of the serpent, sin, and death, the resurrection of all the children of Adam.

The supreme word by Jesus Christ to his apostles was, "Go ye, therefore, and teach all nations, baptizing them in the name of the Father, and of the Son, and of the Holy Ghost" (Matt. xxviii. 19). It was the third command from God to humanity: (*a*) Adam received the order to subdue nature (Gen. i. 28) by agriculture, industry, commerce, etc., and his posterity acquits itself of this task by inventing the steam-engine, the electric telegraph, etc. (*b*) To this order was added that given to Noah, of punishing the murderer (Gen. ix. 6)—that is to say, of establishing judges and creating a state—and the nations issued from Noah are still busy up to this very day with the solution of the problems of political science. (*c*) While thus psychical humanity devotes itself to the various works of civil society, following the example of Noah and Adam, spiritual humanity labors, by preaching the gospel, to gather all the nations into the holy Church of Jesus Christ, uniting them spiritually into one body by the bands of one common faith, while the universal monarchies endeavored to accomplish the same by arms and violence.

The creation of the Church, effected by the effusion of the Holy Spirit on the first Pentecost, demanded the miracle and the prophecy, as did the creation of the people of Israel on Sinai, and the creation of the invisible Israel at the time of Elijah. Nor were these gifts lacking among the apostles and the first Christians. But the Church soon lost again the supernatural gifts of the Spirit. The prophetic inspiration ceased in the second generation; the miracles lasted longer, but became less frequent. Having mixed itself up with the pagan world in the time of Constantine, the history of the Church is a long struggle between contradictory powers, not evincing the same rhythm as that of Israel, and we do not find here the renewal of the supernatural phenomena at the opening of each age which we have noticed in the times of the patriarchs, of Moses, Samuel, Elijah, and Ezra.

The prophecies of Jesus Christ and his apostles contain a history of the Church foreshadowed. The meaning of the book of Revelation is much disputed, however, and we shall not try here to impose our interpretation on the reader. We confine ourselves to the statement that two classes of martyrs are discovered here (Rev. xx. 4)—those of pagan Rome (Rev. vi. 9) and those of the papacy (Rev. xii. 11)—and that the actual history will terminate with a general apostasy under the most sanguinary of the Antichrists. Then once more there shall be no faith on earth (Luke xviii. 8), and Jesus Christ shall appear in his glory to destroy his enemies and save his Church. His arrival in his glory shall open the millenary era of his universal reign, when Israel shall be the heart, the centre, the sanctuary of the Church—when war shall cease to stain the earth with blood, and each family shall sit happily under "its own vine and its own fig tree" (Mic. iv. 4). The thousand years passed, the powers of darkness shall make a last effort in order to destroy the city of God. But the Eternal shall save it by a last intervention. At last the earth shall be consumed by fire, all the souls shall appear before the tribunal of God and Jesus Christ, and the work of redemption shall be accomplished by the eternal felicity of the redeemed.

If we view the revelations of the God of Adam, Abraham, and Christ as a whole, we must acknowledge that they supplement and presuppose each other, forming a true system of transcendental doctrines on Trinitarian divinity, creation, man, and the history of mankind; that they consist less of teachings than of acts of power, and work out rather than narrate the education and redemption of our race; and, finally, that they force themselves on our conviction by their unity, originality, and holiness, and by the full satisfaction they give to the innermost needs of our soul. It is moreover very remarkable that the records of these revelations have come down to us through about forty writers who succeeded each other during the thousand years from Moses to Malachi, and of whom the last were the disciples of Jesus Christ. They are all animated by the same spirit, which could not proceed from the finite and corrupted nature of man. They aim not at their own glory or that of their nation, but solely at that of God; and in their judgments they censure with complete impartiality the chosen people and the idolatrous nations, the priests and the kings, the poor and the rich. Let us add that they work, each by himself, on the construction of an edifice whose plan is so little clear to themselves that they seek in vain to comprehend it (1 Pet. i. 11).

The infidels object that the historic nations have all had their divine revelations like Israel, their prophets and their miracles, and that their sacred books have the same authority as the Bible. But the contrast between the chosen people and the Gentiles is so complete that it is difficult to establish a comparison between them with that seriousness which all scientific discussion demands. Thus, the miracles of the Old Testament are always announced in advance, in order that the witnesses should not attribute them to chance, and they form a necessary part of the whole work of the redemption of the world by Jesus Christ, succeeding each other according to a certain rhythm which testifies to the wisdom of their invisible Author. On the other hand, the wonders of the pagan world follow each other without rhythm or reason; they appear *ex improviso*, like falling stars, and amuse us by their puerility. They are monsters such as are exhibited to the curiosity of the public in our market-places or preserved in the jars of our museums. Now it is an aërolite with a Latin inscription, comets, rains of blood; then, again, it is statues which cry, laugh, refuse to be moved; sometimes it is apparitions of ghosts, voices issuing from the temples, not to speak of the absurd tales of the Chinese annals. One must have lost entirely his sense of truth in order to find the slightest resemblance between these wonders and the biblical miracles. Furthermore, to place in the one scale the oracles from the Egyptian temples, whose ingenious acoustic tricks have been discovered, or the answers, so shrewdly equivocal, by the Pythia of Delphos, or the art of the haruspices and augurs, of whom Cicero says that they could not look at each other without laughing—and on the other scale the biblical prophecies, extending from the pre-evangelical times down to the book of Revelation by St. John—would that not be to weigh imbecility against genius? The sixteen books of the Hebrew prophets contain not one single prediction which finds a rival in any other literature in its spirit of divine holiness, in understanding of the ways of providence, in its picture of the moral state of the people, and in truly sublime poetry. The only book which in any way can be compared with them is the *Invariable Mean* of the school of Confucius. But it does not pretend to possess the gift of prophecy. On the contrary, of all the historic nations of the Orient, the Chinese is the only one which confesses that it has received no revelations of its gods. This book, of all pagan books the most astonishing, contains an ideal and fantastic picture of the final establishment of peace and order on earth by the saint of the last days, the Son of Heaven and born of a virgin, like all the pre-evangelical saints from the primitive and mythical times of China.

Who can, without smiling, compare the incarnation of the Word in Jesus Christ with those of Vishnu in a fish, a turtle, a lion, a dwarf, or a frivolous libertine called Krishna? If Hercules resuscitated Alceste and rose to heaven from his funeral pile, did he still live at the time of Tiberius? and where are the eye-witnesses who have written his biography? Some one may mention Apollonius of Tyana, the contemporary of Jesus Christ. But the rhetorician who related his miracles 150 years after his death, does he deserve any credit when he invents the most absurd fables concerning the countries which his hero visited?

Furthermore, what resemblance is there between the Bible and the sacred books of the pagans? Those of the Chaldæan Oannes, the Egyptian Thoth, the Phœnician Taauth, the Etruscan Tagés, the Druids, have all perished. We possess not one line of them; time has pronounced its legitimate verdict of eternal oblivion on them. The Chinese *King* is neither revealed nor inspired; we may skip that. There remain, then, the sacred books of the Hindoos, the Zend-Avesta, and the Koran. But in the songs of the *Rig Veda* what do the Aryans of the Indus demand of their gods but terrestrial boons (Matt. vi. 32)?

and the *Laws of Manu*, what do they aim at but to strengthen the power of the Brahmans? The Zend-Avesta is much superior to these laws. Zoroaster educates his pupils to purity of thought, word, and action; but what absurd rites! what perpetual fear of the devs! and with the faithful what a high idea of his own justice! what entire absence of any feeling of culpability and repentance, of any need of expiation, pardon, and regeneration! what glaring contradiction between our reason, with its imperious claim on unity, and the dualism of Ormuzd and Ahriman! Moreover, this religion lies now in its death-throes, while Christianity is still going on conquering the whole world by its missions.

As for the Koran, in this book Mohammed preaches to the Orientals a deism fatalistic, enthusiastic, warlike, and poetical, just as in his *Profession de Foi du Vicaire Savoyard* Rousseau preaches to the Occidentals a deism logical, cold, prosaic, very pacific, and a little hypocritical. The founder of Islam confessed openly that he had not the gift of miracles, and when he pretends that the *suras* or chapters of his book were brought to him by the angel Gabriel, they prove their human origin only too plainly by their excessive poverty of ideas and the entire absence of any new view of God, man, and his history. The truths which Mohammed proclaims he owes to the Jews and Christians, and when he suppresses the mysteries of the Trinity, the atonement, and regeneration, it is, according to his own confession, in order to make Islam more easily accessible to the vulgar intelligence; and he gives voluptuous pictures of a merely sensual paradise in order to inspire his partisans with contempt of death. And when that which has been borrowed is left out of consideration, what a contrast between the Koran, the work of one single man, often exhausting us by its monotony, and the Bible, the work of a multitude of inspired writers, which the greatest geniuses have never grown tired of searching; between the Koran, which, born under a burning sky, makes proselytes only under the equator, and the Bible, the book of all humanity, translated into all languages, propagating itself in all zones and among all races, the joy of young and old, of the young girl and the soldier, of the mechanic and a Pascal, of a Leibnitz and the Hottentot; between the Koran, which escapes the control of science by not containing one page of history, and the Bible, which sees its cosmogonic revelations confirmed by geology, its annals by the inscriptions of the Nile and the Tigris, its old prophecies by the grand events of our century; between the Koran, which keeps the spirit of man within the narrow limits of the finite and the mischievous prejudices of a half-paralyzed conscience, and the Bible, which, commanding us to become holy as God is holy, raises us toward the ideal, the absolute!

But the only irrefragable proof of the divinity of the biblical revelations is the inner experience which the Holy Spirit gives us of their perfect harmony with all the needs of our primitive nature and of our state after the Fall. We owe to them the knowledge of the true God, the certainty of our moral dignity, the vivid feeling of our culpability and degradation, the grace which fills our heart with indestructible peace, a divine life which makes us victor over the world and over sin, a glad patience under afflictions, a steady hope of a better existence, and that love of God and man which alone gives our life its full worth. But in order to experience the truth of the gospel it is necessary to follow the method which Jesus Christ himself has defined when he says, "If any man will do his will, he shall know of the doctrine, whether it be of God, or whether I speak of myself" (John vii. 17). FRÉDÉRIC DE ROUGEMONT.

Revela'tion, Book of. The word "revelation" (in Gr. *apocalypsis*) signifies properly the removal of a veil. To know the present, man has his senses; to know the past, he has the study of history; but the future is hidden from him by a thick curtain; and if the human eye is to penetrate into this new world otherwise than through vague and uncertain presentiments, if the future is to be disclosed to man like the present and the past, it is necessary that this curtain should be removed, and that at the same time an inner sense be created through which he can enter into contact with the new sphere. Thus a revelation takes place. In psychological respects such a process does not involve anything impossible, or even improbable. We pass our thoughts into the spirit of our fellow-man by the aid of a sound, the word. Why should not God, the Father of spirits and a spirit himself, have a means by which to pass his plans into the spirit of his privileged creature? This means we learn to know through the prophecies of the Old Testament. It is the prophetic picture. God places before the inner eye of the prophet, opened by the Spirit, a vision—that is, a picture—in which the future presents itself under a certain aspect. The prophet looks at the picture, and although he does not always succeed in comprehending it, he can at least describe it as he sees it, while the future itself, as it enters into reality, furnishes the commentary to the prophecy. What Jew could have understood the admirable picture described by Isaiah (ch. liii.) of the Servant of Jehovah growing up before him as a tender plant, then bruised for the iniquities of the world, but at last triumphing over death and realizing the plans of the Eternal? Without the life and death of Christ for an explanation the meaning of this picture cannot be understood. Thus, God placed before the inner eye of John (compare i. 10, "I was in the Spirit on the Lord's day"), in a picture comprising a series of scenes and forming a complete drama, the future of the Church viewed under a certain aspect. In the fourth Gospel John describes the first appearance of his Master, the apparition in the weakness and poverty of the flesh; in the book of Revelation he describes the second appearance of his Master, the apparition in the divine power and glory. People often imagine this second apparition of the Lord as a sudden act. But if so, how could Jesus say to the Sanhedrim, just about to condemn him, "Hereafter shall ye see the Son of man sitting on the right hand of power and coming in the clouds of heaven" (Matt. xxvi. 64)? The very moment of the ascension of Jesus is the starting-point of his return; in that moment begins his second appearance. But it is necessary here, as in the question of any voyage, not to confound the coming with the arrival. The arrival is the last moment of the coming; it is instantaneous; and so it will be in the case of Jesus. He says himself, "For as the lightning that lighteneth out of the one part under heaven shineth unto the other part under heaven, so shall also the Son of man be in his day" (Luke xvii. 24). The coming, on the contrary, may occupy a very long time. It may be accelerated or deferred by human freedom, which may accomplish or neglect the conditions demanded by the arrival. It resembles in this respect an elastic substance expanding and contracting according to the state of the temperature.

The coming of the Lord, thus comprehended, presents itself under a double aspect. Jesus returns to the world and to his Church. Under the first view he appears to John as the Judge who approaches—under the second, as the Bridegroom who comes to find his bride. The Judge announces himself by a series of chastisements of a steadily-increasing severity. The Bridegroom prepares his arrival by a series of graces, in like manner steadily increasing; and these two modes in which the coming Lord manifests himself alternate in the apocalyptic picture as they do in the real history, so that the picture is composed of a constant succession of sombre and terrible scenes—the procession of the Judge; and of bright and joyful scenes—the procession of the Bridegroom.

There are in a voyage three points to observe: (1) the moment of departure; (2) the way; and (3) the arrival. Such is also the general division of the book of Revelation. (I.) After indicating the subject by these words, "I am Alpha and Omega, the beginning and the ending, saith the Lord, which is, and which was, and which is to come" (i. 8), John fixes the point of departure in the first three chapters; it is the state of the Church at the moment in which he writes. The state is depicted in the letters which he addresses from the Lord to the seven chosen churches of Asia Minor. (II.) From ch. iv. to xix. 10 he describes the coming itself—that is, the chastisements of the Judge, who calls the world to repent before the final judgment, and the graces of the Bridegroom, who elevates his Church to perfection for the wedding-day. (III.) Finally, from xix. 11 he describes the arrival with all its consequences, both for the world and for the Church, and he finishes with a proper conclusion, intended to make the reader feel the importance of the book.

(I.) In the picture of the appearance of the Lord in ch. i. all the emblems may be noticed of those divine attributes which he manifests during the course of his coming and at the moment of his arrival. He is surrounded with seven candlesticks, representing the various churches which have succeeded the one candlestick of the ancient people of God, now rejected. The seven churches are chosen, as the symbolical number *seven* makes one suspect, to represent the totality of the Church. For this purpose they must correspond to all the spiritual states which a Church of Jesus Christ can present on earth—from the state of equilibrium between good and evil to the almost complete triumph of the one or the other. In the first, Ephesus, good and evil balance each other. In the third, Pergamos, evil excels. In the fifth, Sardis, death reigns in spite of the noise of her life. In the seventh, finally, Laodicea, her state is such that the Lord is about to vomit her out of his mouth. To these four churches there is said, "Repent, or—" There is a similar gradation in the second, fourth, and sixth churches. In Smyrna, the second, faithfulness reigns; at Thyatira, the fourth, it not only reigns,

but progresses. At Philadelphia, finally, the sixth, her state is such that she seems ready to be crowned. The second series is distinguished by the absence of the announcement, "Repent, or—"* There is not, and there never will be, in Christendom a Church which does not conform to one of these divisions, and find a place somewhere in these moral statistics traced out by the very hand of the Lord himself.

(II.) The opening of the second part, in which the glance of the prophet begins to turn from the present to the future, is given in chs. iv. and v. in two pictures—that of the glory of God and that of the glory of the Lamb. In the first may be noticed the four animals or living beings which support the throne of God, and the twenty-four elders who surround it. The former represent the forces of nature under the emblem of the four beings which are at the head of the living world. In the pagan world these forces, deified by human folly, were on the throne. Here they are reduced to their proper place, bearing the throne, and they serve in executing the orders which emanate from it. The twenty-four elders represent the Church already triumphant—twelve for the faithful among the Jews, and twelve for the faithful among the pagans. A sea of glass extends around the throne; it is perhaps the emblem of the luminous immensity of the divine plans. An emerald rainbow environs the throne; it is the emblem of the grace which mitigates the awful aspect of the divine majesty. Then appears the Lamb on the throne, "as it had been slain. In the right hand of Him that sits on the throne is a book written within and on the back side, sealed with seven seals." It is the symbol of the decree of God with respect to the world and the Church. This decree must be understood and executed by some one, which is the meaning of the act of breaking the seals. No one is able to accomplish this act until the Lamb itself, endowed with the seven eyes of all science and the seven horns of all power, seizes the book and commences to break the seals. Then the execution of the divine plan shall begin. This whole scene is the dramatic representation of the idea that it is Jesus Christ, glorified after his elevation, by whom God rules the universe. What a joy for the Church! what a consolation for the faithful in their sorrows! In ch. vi. the seals are finally opened. At the opening of the first, a white horse comes forth, mounted by the angel of victory: it is the emblem of the victories which the gospel shall achieve over the whole world. At the second, a red horse appears, bearing the angel of war, recognizable by the great sword which is in his hand. At the third, a black horse comes forth, and the angel whom it carries holds in his hand a scale for measuring food: it is the symbol of famine. From the fourth, a pale horse issues, and on him sits the angel of Death, and hell follows with him. It is the symbol of pestilence and of epidemic diseases in general. These three plagues, war, famine, and pestilence, shall destroy one-fourth of humanity. On the opening of the fifth seal the departed souls of the martyrs raise a loud cry, calling for judgment. A superior degree of glory is accorded them, but new persecutions (those of the last days) are announced. With the sixth seal an earthquake wakes the world, and gives to all human beings a presentiment of the approach of the judgment. Here the first series of chastisements ends. But it seems to us that the calamities announced by the opening of the seals cannot be applied simply to one war, one famine, one earthquake, any more than the victory of the gospel, represented by the white horse, can be applied to one particular victory. They are more properly the categories of the ordinary chastisements which God uses in order to call the world to repentance, at the same time that he orders the gospel to be preached on earth. Jesus had said previously (Matt. xxiv. 7), "For nation shall rise against nation, and kingdom against kingdom, and there shall be famines and pestilences and earthquakes in divers places." The second, third, fourth, and sixth seals are pictures embodying these abstract expressions. With respect to the first seal, it corresponds to the following words of the same chapter (verse 14): "And this gospel of the kingdom shall be preached in all the world for a witness unto all nations." The fifth seal corresponds to the following prophecy from verse 9: "Then shall they deliver you up to be afflicted, and shall kill you." The meaning of this picture of the six seals seems thus to be clear. After the establishment of Christianity in the whole empire the earth shall be visited by plagues destined to break the stubbornness of the pagans and dispose them to receive the promises of grace. The seals represent the measures of general severity by which God supports from time to time the preaching of the gospel among the nations of pagan origin. To this sombre picture of the plagues of God corresponds in ch. vii. a bright picture of assistance and grace. It comprises two scenes. The one relates to the Jewish people; the express enumeration of the twelve tribes does not permit us to take the word Israel in this passage otherwise than in its proper sense. Twelve thousand persons of each tribe are marked with the seal of God. For what purpose? That is sealed which one wishes to set aside as his private property. Thus, it is here the flower of Israel which God keeps in reserve in order to employ it for some important purpose in the struggles which shall follow. And indeed, in ch. xiv. we find these one hundred and forty-four thousand men on Zion's hill surrounding the Lamb—that is, they have been converted to Christ in the interval, and are now ready to put themselves at the head of the Church in the battle against Antichrist (ch. xiii.). For the present (ch. vii.) they are simply set aside as Jews, to perform this function when the proper time comes. In the second part of ch. vii. the prophet witnesses the arrival at the celestial glory of an innumerable multitude of faithful from among the Gentiles, "of all nations, and kindreds, and people, and tongues," verse 9. They have traversed the furnace of persecution victoriously by their faith. John celebrates here the establishment of the gospel in the world of the Gentiles, and shows the radiant crown to the believers in order to sustain their hope during the bad days which shall follow. The book, however, containing the decrees of God is composed of seven leaves closed by seven seals, and of these the seventh has not yet been opened. In ch. viii. it is broken, but it does not contain any particular event. It encloses the whole subsequent vision of the seven trumpets. There is an apparent gradation from the image of the seal to that of the trumpet, and from the image of the trumpet to that of the vial. The seal represents simply the divine decree as inevitable. The trumpet announces the execution as very near; it is a signal. The vial introduces the decree as identical with its execution. The six trumpets which are heard in the eighth and ninth chapters call down on the inhabitants of the earth a second series of plagues still more frightful than the first one: (1) a rain of hail and fire on the productions of the soil; (2) the corruption of the waters of the sea by a volcano precipitated into it; (3) the fall of a star which makes all the fresh waters of the earth bitter; (4) the eclipse of the stars and the waning of light on earth. The third of that population which still remained on earth after the first series of plagues shall perish. An allegorical explanation of these plagues leads very easily into empty subtleties. It must be remembered that the vision represents a world which itself approaches its dissolution while its inhabitants move toward the judgment. Jesus thus describes the period which shall precede his return (Matt. xxiv. 29): "Immediately after the tribulation of those days shall the sun be darkened, and the moon shall not give her light, and the stars shall fall from heaven, and the powers of the heavens shall be shaken," which words cannot be taken figuratively; indeed, the first four trumpets just mentioned are only an amplification of these words. The last three trumpets are distinguished by a particular name, and are called the three woes (ix. 12), as if all the preceding did not deserve such a name. There is first (5) a cloud of locusts of a strange nature which rises from the bottomless pit and covers the earth for five months, rendering life intolerable to man; next, (6) an invasion by a hostile army coming from the extreme east and ravaging the countries of the west. The first of these plagues can hardly relate to anything but the spiritual world, since the locusts rise from the depths of the abyss and represent an invasion of the earth by diabolical spirits. The five months are borrowed from a circumstance well known in the East; it is exactly the time which the great invasions of locusts ordinarily occupy. But that which proves conclusively that the question is here of a fact relating to the spiritual world is the circumstance that this trumpet corresponds with the fifth seal, which also relates to a scene from the spiritual but celestial world. With respect to the invasion represented by the sixth trumpet, it reminds us of the great migrations of the Eastern people, which the world has witnessed so often, and which could very well be repeated once more before the close of history. The extreme Orient conceals in its interior masses of population still fresh, which on a signal from God may rise and throw themselves over Europe, which is weakened physically and morally by its vices. The sounding of the seventh trumpet, which shall call up the last and most terrible plague, Antichrist, is preceded, as was the opening of the seventh seal, by a bright and joyful picture. It concerns especially the Jews (ch. xi.), like the first of the two scenes of ch. vii.

* It is very remarkable that the churches of the second series, Smyrna, Thyatira, and Philadelphia, have never ceased to exist as Christian churches; while since the second century there does not exist a trace of the others, with the exception of Pergamos.

This introductory picture is presented under the image of a small book—that is, a small vision by itself enclosed in the grand prophecy of the Revelation. John is commanded to eat this book—that is, to appropriate wholly its contents. He sees Jerusalem occupied by the Gentiles; even the fore-court of the temple is in their power. But the temple, properly speaking, is withheld from them, and here are kneeling the true worshippers of Jehovah. In the city itself two prophets preach repentance to Israel. They are gifted with the power of miracles, as formerly Moses and Aaron. But the Pharaoh of the last times is also here, the beast—that is, Antichrist (verse 7)—which proves clearly that this vision of the little book is an anticipation of the great prophecy itself; also the words, "I will give power" (verse 3), "the beast shall overcome" (verse 7), etc., are to be explained in this way. This master of the world kills them, but in the lapse of three days they are resuscitated and raised to heaven, while an earthquake destroys a tenth part of the holy city, and a part of the inhabitants perish; the survivors give the glory to God. If we are not wholly mistaken, this vision relates to the grand and decisive event of the final conversion of the people of Israel. Jerusalem crowded with Gentiles, even in the fore-court of the temple, represents the Jewish people in its present state of dispersion and subjection, for not only politically, but also in religious respects, this people identifies itself more and more with other nations. It renounces its ancient peculiar customs; it abandons even the faith of its ancestors in the revelation and miracles of Jehovah. Our rationalism has crept into it; the great defection broods in it as in us. But the temple is guarded by God himself. It is the faithful portion of Israel which remains attached to the faith of their ancestors, and shall continue so until this Jewish piety shall be transformed into faith in Christ. Among the infidel Israel powerful agents of God shall fill the ministry of prophecy. They shall succumb to the hatred of Antichrist, but their defeat and their glorification shall be the signal of the conversion of the whole people, which from that moment shall be the great force of the Christian army. This is what the vision announces to the Church in order to encourage its faith in the moment in which the last struggle shall begin.

This is opened by the sounding of the seventh trumpet, which calls forth Antichrist, the last of the three woes (compare xi. 14 and 15), the establishment of his dominion. But this supreme apparition of evil is still preceded by a picture relating to the Church during this great crisis (ch. xii.). One Church is here represented under the image of a woman travailing in childbirth. A dragon is waiting for the child in order to devour it, but the child is taken away into heaven and the woman flees to the desert, where she is miraculously fed—as formerly Israel under similar circumstances—for three years and a half. Then the archangel Michael, the celestial champion of monotheism, whose name signifies "Who is like God?" struggles with the dragon, and precipitates him from the heavens to earth, where he causes to issue forth from the womb of the ocean —that is, from among the mass of the people—a monster, the beast with the seven heads, which represents Antichrist. This beast is followed by another, of a less terrible form, having the horns of a lamb; it is the false prophet. The first beast exercises a royal power over the whole world; the second employs his spiritual ascendency over mankind in order to allure them to render homage to the power of the first (ch. xiii.). The Son about to be borne by the Church is the Lord himself, as the King and Judge of the world. His removal to heaven signifies that his reign, which seemed so near its realization, is still deferred for a time, in order to make room for that of his rival, Anti-Messiah, to whom is accorded the short period of three years and a half. The Church itself shall be externally suppressed during the reign of this adversary, but it shall nevertheless be miraculously preserved during this time of trial, as was the Protestant Church of France during the century of persecution which followed the Revocation of the Edict of Nantes. This external destruction of the Church shall take place simultaneously with another event, of a directly opposite character, the fall of idolatry over the whole world, which is the grand fact represented by the victory of the archangel Michael over Satan. And, singular to say, this very fact shall be the occasion of the arrival of Antichrist; for it is in order to avenge the destruction of his worship among the pagans that Satan calls forth this person and endeavors to suppress the worship of Christ in Christendom. This is, no doubt, the meaning of the words of the angel in xii. 10–12.

There are two leading opinions of the person of Antichrist. Some consider him merely as a poetical personification of a principle, of the spirit of rebellion against God and Christ, which shall go on increasing till the final triumph of the gospel. Others recognize in him a real man, who shall concentrate in his own person to the utmost extent the spirit of apostasy. The second chapter of the Second Epistle to the Thessalonians, in which his apparition is described, speaks decidedly in favor of the second explanation. Antichrist is here designated as the man of sin, who shall place himself as a god in the temple of God; he is called the wicked man whom the Lord shall destroy by the breath of his mouth. His theological system may be summed up in the three following theses: (1) there is no personal God without and above the universe; (2) man is himself his own god—he is the god of this world; (3) "I am the true representative of humanity; by worshipping me mankind worships itself." But even from this general point of view there still remain certain differences of opinion. According to some, this person has already appeared on the stage; he is the pope. It is evident, however, that the pope has never actually substituted himself for God or Christ; on the contrary, he rests his authority on that of Christ and God. The pope may be said to be on the way which ends with the arrival of Antichrist, but he is not yet Antichrist himself. Others hold that the Antichrist announced in the Revelation is only an empty supposition, which has never been revealed. The author of the prophecy, they say, thought of the emperor Nero, that matchless monster, the first persecutor of the Church, whose death the world could not believe in, and whom the terrified Church feared to see return suddenly and assume the part of the man of sin and the universal suppressor. The number 666, which, according to xiii. 18, is the number of the beast, was explained in accordance with this view. The letters of the two words K A I S A R N E R O N, when taken as ciphers and counted in Hebrew, give indeed the sum of 666. This fear was never realized, however, and thus the Revelation became an unfulfilled prophecy on this capital point. But it is difficult to understand how under such circumstances the book can have survived in spite of the discredit which fell on it immediately after its appearance, and how the author, if he was a serious man, could suffer it to circulate without retraction. It must also be noticed that in order to obtain the sum of 666 from this name, it must be written *Kesar*, and not *Kaisar*, which is against custom and orthographical rules. Finally, it would be somewhat strange if the name which was to be figured out of the number had been put down in Hebrew, while all the rest of the work is in Greek. In speaking of the man of sin, St. Paul, far from identifying this person with the Roman emperor, hints that, on the contrary, it was the imperial power which prevented Antichrist from appearing. "Ye know," he says (2 Thess. ii. 6), "what withholdeth that he might be revealed in his time." The apostle considers Antichrist as the realization of the false Messiah, the terrestrial king, the new Solomon, whom the carnal Israel expects. And what was it that prevented the Jews of that time from putting forth this false Messiah, the object of their hearts' longings? It was the Roman legions, which on the mere nod of the emperor would have invaded the Holy Land and put down any attempt at insurrection. It is the powers instituted by and inherited from the Roman empire, which up to this very day have prevented Antichrist, the false Messiah of the Jews, from appearing; but he will not fail to come forth as soon as these powers fall; the Jewish people will then have acquired that preponderance in all civilized states which is necessary before it can give its insatiable ambition the reins. In continuing our study of the Revelation we shall see whether this explanation, borrowed from the Second Epistle to the Thessalonians, is in harmony with the rest of the book. With respect to the number 666, numerous solutions of this enigma have been given, but none which is thoroughly satisfactory. A peculiar fact has lately attracted attention. The Greeks do not designate numbers by particular signs called ciphers, but by the letters of the alphabet, to which a numerical value is assigned. Thus, 600 is expressed by the letter χ (*ch*), 60 by ξ (*x*), and 6 by ς (*s*). The name of Christ (*Christos*) is represented by the first and last letters, χς, and these two letters represent the two numbers 600 and 6. If between these two letters the letter ξ, which signifies 60, is introduced, the sum of 666 is obtained; and the three letters, χξς, represent the abridged form of the name of Christ, but in such a manner that the first and third letters are separated by the ξ, the emblem of the serpent. Thus, in Greek 666 is the emblem of the Messiah, of Satan, or of Antichrist. It may also be noticed that, according to the symbolism of numbers employed in the Revelation, the number 7 always expresses the divine plenitude, and that God, as the Father, the Son, and the Holy Spirit, must consequently be represented in ciphers by 777. Thus, the number 666 would signify the creature's highest though still impotent effort at attaining divine glory and power, and the representation would comprise the three persons which form the diabolical trinity—namely, Satan,

or the dragon, the beast, or Antichrist, and the second beast, or the false prophet. Satan cannot become God, nor can Antichrist attain the dignity of the Son-Messiah, or the false prophet equal the Holy Ghost. Nevertheless, it is no doubt wise to apply to our age that which in the second century the pious Irenæus said to his: "If the author of the prophecy would have made the name known to this time, he would have designated it more plainly." Irenæus mentions several explanations propounded in his time, of which the least improbable is the word *Lateinos*—that is, Latin, Roman, the Roman emperor. The Greek letters of which this word is composed give, indeed, when added together as ciphers, the exact sum, 666.

As for the false prophet, he is evidently the personification of worldly wisdom, natural inspiration. There is, says St. Paul (1 Cor. ii. 12), a spirit of the world which, like the Divine Spirit, can exalt by his breath such as make themselves his organs, and communicate to them a power by which they allure the multitude and rule their time. History affords instances enough. The most striking would be that second beast, with the lamb's horns, which knew how to assume the most alluring forms of piety, but which employed all its gifts to draw men to the feet of Antichrist. Jesuitism in the service of the papacy is a fact which throws some light on such a combination.

It is impossible to pass by a striking analogy which presents itself at this point. The false prophet works only in order to exalt the false Messiah, and the false Messiah only in order to make the power and reign of Satan triumphant on earth; it is the accomplished mystery of iniquity. Human wickedness has spoken its last word. And certainly, when commencing with the fall of man, history could not end before this supreme explosion had taken place. But, on the opposite side, what do we see here? The Holy Ghost works only in order to glorify Christ, and Christ only in order to make the power and reign of God triumphant on earth; it is the mystery of piety in its perfection. Its splendor cannot manifest itself fully unless by its victory over the opposite mystery. The whole revelation, as the whole history, is only the sum-total of this antithesis.

After this dark picture presented in ch. xiii. the Lord encourages the Church by a bright picture in ch. xiv. It is the aspect of the one hundred and forty-four thousand Israelites who were sealed in ch. vii., and who now have been won over to the faith, and surround the Lamb as a picked guard just as the battle draws near. Then an angel, flying across the heavens with the gospel in his hand, announces the extension of the mission to all the nations of the earth; the promise of the fall of Babylon, the capital of the empire of Antichrist; the promise of an immediate celestial felicity to the martyrs who prefer death to infidelity; and finally, the promise and the threat of the near judgment under a double aspect—namely, as a harvest, God gathering in his fruits, and as a vintage, his adversaries being trodden in the wine-press of his wrath. As the seventh seal enclosed the seven trumpets, thus the seventh trumpet, which occasions the appearance of Antichrist, encloses the seven vials, or the last plagues reserved for the ruin of the empire of the false Messiah. They are announced in ch. xv. and enumerated in ch. xvi. In an introductory picture the faithful Church appears traversing the sea of the fire of persecution, but singing in the midst of the flames the hymn of Moses, which formerly Israel sang after the passage of the Red Sea, and to which the Church adds the hymn of the Lamb. Then the vials are poured: (1) A malignant sore falls on the worshippers of the beast; (2) the waters of the sea become foul; (3) the waters of rivers and springs become corrupted; (4) the sun changes into a devouring fire; (5) thick darkness invades the empire of the beast; (6) the Euphrates is dried up in order to allow free passage to the kings of the East, who are united by a diabolical instigation and come to associate with the beast; (7) an earthquake, accompanied by a tremendous hailstorm, destroys Babylon, the capital of the beast. In this way God redeems the promises of brilliant prosperity and a new golden age by which the beast has seduced the world. One-fourth of mankind perished by the seals, one-third of the remainder by the trumpets, one-half by the vials. And while thus the plagues of God are going on increasing in intensity, what are men doing? After the first six seals they trembled and cried, "Mountains, fall upon us!" It looked like the commencement of repentance. But after the first six trumpets obstinacy seized them, and they did not repent of their murders and poisons and impurities and robberies (ix. 21). After the vials are poured the obstinacy becomes madness (xvi. 9); "They blasphemed the name of God; they gnawed their tongues for pain, and blasphemed the God of heaven."

In ch. xvii. Babylon appears personified. It is a queen arrayed in purple and gold, the great whore. She is sitting on the beast. This beast has seven heads, of which five have fallen, the sixth is still alive, and the seventh shall come, but only for a short time, after which the beast itself, which "was" and "is not," and who "is of the seven, and goeth into perdition," shall appear as the eighth head. The seven heads of the beast are seven hills, on which Babylon, considered as a city, is built. Then suddenly the beast turns against Babylon with the kings, his allies, pillages her, and burns her; ch. xviii. is a song of triumph chanted over her ruins. With respect to the explanation of ch. xvii., one of the most important passages of the Revelation, it seems to us that there can be a choice only between two different meanings. According to the explanation which considers the emperor Nero as the Antichrist, expected as the last persecutor of the Church, the seven heads of the beast are the first Roman emperors. The five sovereigns already dead, Augustus, Tiberius, Caligula, Claudius, and Nero, are the five heads which have fallen. Galba is the sixth; it *is* now, and the book of Revelation must consequently have been composed during the short reign of that prince in the year 68. The seventh shall be an emperor as yet unknown, but whose reign shall be very short. Finally, Nero, restored or resuscitated, shall reappear as the beast itself. It "has been" as far as Nero has reigned; it "is not" as far as he has disappeared; it is of the seven, and returns only in order to go to perdition. But in order to sustain this very ingenious explanation it would be necessary to demonstrate that the book of Revelation was composed in the year 68, two years before the destruction of Jerusalem; and that is an opinion which seems to us to present insurmountable difficulties. How can we suppose that in 68, hardly ten years after the foundation of those churches in Asia Minor to which the letters of the second and third chapters are addressed, these churches could have had a religious history of considerable length, and could have developed such a distinct moral character as the letters present to us? How can we believe that in these few years, and after such a powerful spiritual creation, Sardis could have become "dead," Laodicea lukewarm and exciting the disgust of the Lord, and four among them so depraved that they deserved to have their candlesticks overthrown? Such a fall and such threats—do they not presuppose an existence of at least one generation from the foundation? Let us add that the letters of St. Paul and St. Peter, addressed to these countries about the year 63 (Ephesians, Colossians, Philemon, 1 Peter), do not give the least hint of any such decline. It should consequently have taken place in the course of five years. Moreover, the ministry appears to be already constituted otherwise in these churches than in the apostolical churches, and in a manner in which it does not appear in the history of the Church until about the beginning of the second century. There is a bishop (the angel of the church), whom the Lord makes responsible for the state of the church. Furthermore, the council of elders which, according to Acts and the Epistles, governed the Church at the time of the apostles, have already a permanent president at its head. Finally, we find in the first chapter the expression the "day of the Lord" used to designate Sunday, but this designation, which was in common use during the whole course of the second century, would have been entirely inappropriate, on account of its technical character, in times preceding the destruction of Jerusalem. The name of Sunday was then still the Jewish term, "the first day of the week."

These traits suffice to show that the book of Revelation could not have been composed until toward the close of the first century; and this conclusion is positively confirmed by Irenæus, who came from Asia Minor, and had known Polycarp and other presbyters who had seen John. "The vision of the Revelation," he says, "belongs almost to our time, the reign of Domitian" (81–96). Hence it follows that we have to seek for another explanation of the beast and its seven heads.

The beast does not represent the Roman power exclusively. The image is taken from the animal world, as are the images employed by Daniel, in order to characterize the brutal nature of the pagan state. The beast represents the political power, as far as it is hostile to God, through the whole course of history, from its first appearance in Egypt, where it held the people of God captive and tried to exterminate it at its birth, to Antichrist, its supreme apparition, who will try finally to annihilate the reign of God, just approaching the last state of its development. In depicting the beast for the first time in ch. xiii., John gives it the form of the leopard (the emblem of the Greek empire with Daniel), the feet of the bear (the emblem of the Medo-Persian empire with the same prophet), and the mouth of the lion (the image of the Babylonian empire). The beast of the Revelation is not only a peculiar

phase of the anti-divine power, but at the same time the complete manifestation of the same principle; and that is the reason why it combines in itself all the emblems of the preceding monarchies. What are the seven heads which preceded Antichrist? The holy history must answer, for it is not proper to seek for the solution of apocalyptic questions outside of Scripture. The first state which came in hostile contact with the reign of God, manifesting itself through his chosen people, was Egypt, which endeavored to destroy it in its cradle. The second was the Assyro-Babylonian empire, which suppressed it for a time—first, by the destruction of the kingdom of the ten tribes, then by the destruction of Jerusalem. During the Babylonian captivity Israel, and with it the reign of God, disappeared for a time from human view. The third was the Persian empire, which held the restored Israel under its authority; and the fourth the Greek monarchy, or more especially that among the states originating from this monarchy which made Israel feel the yoke the heaviest, the kingdom of Syria. During this period Antiochus Epiphanes (the little horn of ch. viii. of Daniel) tried to suppress in Israel the worship of God and substitute that of Zeus and the pagan Olympus. Antiochus is the Antichrist of the old covenant. The fifth—and on this point the book of Revelation seems to us to have been misunderstood up to this moment—is the Jewish state, degenerating under the sceptre of the Herods and the pontificates of Annas and Caiaphas, and repeating against the Church, as St. Paul makes us understand it in Rom. ix., the crime of the Pharaohs against Israel. The representatives of the theocracy, Herod and the Sanhedrim, tried to annihilate first the person of Jesus, then his Church, and to suppress the preaching of his gospel. Thereby the Jewish state ranked itself among the powers hostile to the reign of God, and it became by its unexpected attack one of the heads of the beast. It is the fifth; and that is the reason why John, who wrote after the fall of Jerusalem, can say, "five have fallen." He adds, "the sixth is." It is the Roman empire, which in the moment when John wrote stood in its full power—a circumstance which explains how so great a number of interpreters can have taken it for the beast itself. The seventh, which shall last only for a short time, is the political power which is called to put an end to the Roman dominion. Is this power the barbarians who in the Middle Ages destroyed the empire? It seems more probable to us that the Roman power is considered in this prophecy, as with Daniel, as comprising the whole political order up to our day. In the vision of the statue (Dan. ii.) the European states are nothing but the iron toes of the colossus, the Roman empire; and in the vision represented in Dan. vii. nothing but the ten horns of the beast without name, which swallows all, and which also represents the Roman empire. The seventh head is that power of short duration which shall destroy the whole political system of Europe and prepare it for the arrival of Antichrist. This conforms to the teachings of Paul (2 Thess. ii.). The apostle announces here that the Roman empire, which for the moment prevents the power of Antichrist from appearing, shall be thrown down in order to give room for the man of sin. The seventh head, then, shall destroy the last remnants in the actual world of the Roman order of things.

And who shall be Antichrist himself, the eighth head? John says (xiii. 3) of one of the heads of the beast that it was wounded to death by a thrust of the sword, but its wound shall be healed, and its restoration shall astonish the world and bring it before the feet of the beast. This wounded head, is it not the people of Israel, mortally hit by the Roman sword, but which shall rise again as the last but highest anti-divine political power? In xvii. 10 it is said of the beast that it "was," that it "is no more," and that it shall return, but only to disappear. Israel *was* once an independent political power; it *is* no more a nation organized as a power, but it shall reappear as the last monarchy, and after so many powers have succeeded each other the astonished world shall see the Jewish empire unite once more. This idea is in harmony with that of Paul (2 Thess. ii.), who, as we have seen, considers the man of sin as the realization of the terrestrial and carnal Messiah whom Israel is still expecting. Any one who knows Europe knows also what a peculiar aspect matters have there begun to assume. The Jews are not only the bankers of the kings and the directors of the commerce of the whole world, but they have become the governors of the ideas of the century, the spiritual kings of the European peoples. The greater number of influential journalists are Jews; and, as Mr. Heman, who knows thoroughly the aspirations of this people, says, "The distinctive feature of the Jews is their indefatigable tendency to place themselves at the head of modern life." Not long ago a Jewish journal called Judaism the "lighthouse of the future." To believe in humanity, which is God, and do good toward our brethren, that is the religion preached by these Jews, who reject their old monotheism at the same time they trample on the divinity and mediation of Christ. They exult already in seeing so great a number of Christians follow them, and they will soon proclaim this doctrine as the true religion of humanity. Then the throne of the man of sin shall be decked, and nothing remains but that the new Solomon shall be seated. How will he use his powers? He shall persecute the Church, the true spouse; then he shall turn his power against Babylon, the whore, those Gentiles to whom Christianity has been only an external varnish, not a new nature, and whose centre shall still be the city of the seven hills. Judaism has a debt to pay to Rome, the old agent of its ruin, and it will not fail to take revenge. Finally, it will turn its fury against those two preachers of repentance who shall rise among Israel (ch. xv.) and by their miraculous power make the plagues of the seven vials described in ch. xvi. shower down over its empire.

III. We approach the moment when Christ shall arrive and free his Church from the hands of the enemy. It is described in all its magnificence in ch. xix. It is this event which St. Paul announces (2 Thess. ii. 8): "And then shall that Wicked be revealed whom the Lord shall consume with the spirit of his mouth, and shall destroy with the brightness of his coming." It shall be the termination of that long coming which the biblical writers could not predict, because, as Jesus said to his apostles, God held the moment at his own free disposal. This supreme act is accompanied with the resurrection of those among the faithful who have died, and the glorification of those who are still alive; and it is followed by a state of affairs in which the reign of God can be perfectly realized among mankind, and Christianity develop all its blessings, spiritual and terrestrial. It is the reign of a thousand years, the sabbath of humanity on earth after its long week of work. Nothing in this apocalyptic picture compels us to assume that the Lord himself shall be visibly present on earth during this whole epoch; it is his Spirit that shall reign and glorify him. At the end of this period Satan, who as yet is only bound, shall try once more to destroy the work of God, but he shall only give the signal of his own final punishment, which is accompanied by universal judgment (ch. xx.). The terrestrial state founded on the day of creation (Gen. i.) now gives place to the new heavens and a new earth (Rev. xxi.), in which God is all in all. Anticipating the sight of this admirable spectacle, John prostrates himself and invites all the faithful to cry with the Spirit and the spouse, "Lord, come—come soon!" (ch. xxiii.). What a vast drama! What a magnificent conclusion to the Scriptures opening with the Genesis! The first creation made man free; the second shall make him holy, and then the work of God is accomplished.

The question is now, Who is the man to whose eyes the whole plan of God has been thus unveiled and the book with the seven seals unfolded? He calls himself simply John (chs. i. and xxii.). But could any other than the apostle of this name designate himself in this manner, especially in Asia Minor, where the apostle had ended his life? The difference of style between the Revelation and the fourth Gospel is objected. It is not so great, however, as pretended. There are even profound affinities in this as in all other respects between the two works; and if there exists a relative contrast, it may be explained by the fact that in the book of Revelation John continually imitates the prophets of the Old Testament, and reproduces to some extent, verbally, the most striking of their pictures, while in the Gospel he pursues with entire freedom his own manner of writing. The keen critic Winer has observed the same difference in the writings of the historian Josephus. As long as he reproduces the history of the Old Testament his style has an Aramaic tint, but it becomes purely Greek as soon as he begins to narrate independently of the biblical text. The difference of tendency is another objection. In the Gospel, it is said, the author is distinguished by an insurmountable aversion to the Jews, while the author of the Revelation turns his whole animosity against the pagans. But it is overlooked here that these two works are the two halves of one complete drama—the first representing the struggle of the Lord with the Jews during the times of his humiliation, the other describing his struggle with the world of the Gentiles from the realm of his glory. Israel has had its times, which terminated with the coming of the Son of God (Luke xix. 42). When Israel rejected the Saviour the times of the Gentiles commenced (Luke xxi. 24). In the Gospel the end of the times of Israel is narrated; the Revelation describes the end of the times of the Gentiles, which is also the end of the whole. There is, indeed, nothing surprising in the circumstance that in the apocalyptic picture the Gentiles play precisely the same part as the Jews in the Gospel—namely, that of resisting God. In the same manner, the Church corresponds in the

Revelation to the disciples in the Gospel, and the glorified Christ to Christ in his humiliation. In both cases the struggle is between Christ, faith, and infidelity; and this observation suffices to prove that both works emanated from the same idea.

The Fathers tell us that toward the close of his life, during his residence in Asia Minor, the apostle John was exiled to the isolated rock of Patmos by Domitian, who had a fancy for that kind of punishment. Here, alone, on a Sunday which well deserved to be called by him the "day of the Lord," the inner veil was removed from before his soul, and the second coming of Him whose first apparition he had seen with the eyes of his body was revealed to him. He had seen the tomb of his Master empty and the Lord after he had risen, thus drawing from death itself his greatest triumph. He had seen the mustard-seed, deposited in the earth by the hand of Jesus, how it grew and became a tree under whose foliage many nations already sought shelter, and from Patmos he saw how the branches of this marvellous tree spread far to the East and to the West. He had seen the threats of his Master fulfilled, as well as his promises: Jerusalem had fallen, and the people of Israel had been dispersed like a cloud of dust over all the countries of the earth, while the Judæo-Christian Church, taking refuge on the other side of the Jordan in accordance with the order of its Master, had escaped the catastrophe. He had seen the pagan world rise against the nascent Church, and the purest blood which ever ran through human veins shed in streams in the streets and places of the capital of the world. He had seen how famines, pestilences, and earthquakes, accumulated in this epoch by Providence, succeeded each other like so many scourges by which God chastised the corrupted world and supported the work of redemption. He had seen eight sovereigns seated on the throne of the Roman empire, which was the actual representative of the beast, of the terrestrial power hostile to God, and the man who reigned just now combined in his government all the atrocities of his predecessors. It is in the midst of such experiences and such remembrances we must imagine the apostle in order to comprehend the intuitions which the prophetic spirit awakened within him on that day of profound internal concentration, when he worshipped alone on the desert rock and saw the action on the world of the Gentiles, of the Lord in his glory, and of his gospel; the threefold series of plagues which God holds in reserve in order to break the revolt; the increasing obstinacy of the incurable portion of mankind; the double part played by the dispersed Israel, which at the same time becomes the kernel of the army of Christ and the powerful instigator of the final revolt; the humbling of paganism; the birth of the beast; the persecution of the Church; the refuge which the Lord has prepared for it during its days of distress, and the manna with which he nourishes it in the desert; and then suddenly the suppression making place for the triumph, and the throne of the beast tumbling down before the Spirit of Christ appearing on the clouds. Thus, the ray of revelation, transforming the past and the present into one sublime picture, announces to John the things to come, in accordance with the promise of Jesus preserved by John himself (John xvi. 13).

This book of mysteries has received various explanations, and some of them very different from that which we have traced out here. The traditional interpretation seeks in the vision for a detailed picture of all the events of the history of the Church from the first century to the return of Christ. Faber, Bengel, Elliot, Gaussen, De Rougemont, and many others have in this way produced wonders of exegetical ability and historical learning. But the method carries along with it a signal of warning in its character of arbitrariness. The same vision—that of the locusts, for instance, in ch. ix.—designates, according to one, the great invasion by the Arabs in the seventh century; according to another, the invasions by the Persians under Chosroes; according to a third, the introduction of the Talmud among the Jews; according to a fourth, the introduction of monachism, etc. Such a diversity rises simply from the imagination having been set free and working without any fixed rule. It is, moreover, inadmissible that it should be necessary to possess the whole treasury of learning belonging to a professor of history in order to understand a book which God has given to his people for the purpose of edification. The modern rationalists have broken with this method of interpretation for many reasons, good and bad: first, no doubt, because it presupposes divine inspiration, but also because their whole system leads them to seek the key to the interpretation of a book in the circumstances under which it was written. Hence, the interpretation of the beast as the Roman empire, and of the head wounded to death, but reappearing as Antichrist, as the emperor Nero. But we have already seen what insurmountable difficulties this method of explanation involves; and it seems very singular that a book so holily conceived and so severely planned should be a mere tissue of fancies and hallucinations.

There remains the method which we have followed, and which recognizes in the Revelation a picture of the general progress of the Church, to whose understanding no other premises are necessary than such as may be drawn from the Scriptures themselves. There is still room for individual views. Thus, Bossuet saw in the destruction of the beast the fall of the Roman empire; Hengstenberg considers the reign of a thousand years as the predominance of Christianity from Charlemagne to our days; Mr. Darby holds that the whole history of the Church from the apostolic age up to that preceding the return of Christ is omitted in the picture, and must be placed in the interval between the third and fourth chapters, so that the whole vision (iv.–xix.) relates exclusively to the future, to that which precedes immediately the coming of the Lord. We cannot here enter into a discussion of these individual points of view, but we hope that the reader, following the outline which we have given, will find in the Revelation points sufficiently precise to indicate the course of the religious progress of humanity, and at the same time sufficiently elevated to enlighten and fortify his heart under all the various events of his life. There is the same power in this vision as in that through which God revealed to Moses in six successive pictures the origin of the world. At every moment of our life we find ourselves in contact with the religious bearing of this vision in Genesis. At every moment, too, but especially when we are under the cross, our soul gathers new life from the spirit of the apocalyptic expectations. And it is solely for this purpose of edification, and not in order to satisfy our curiosity, that God has permitted us to see, on the one hand, through the eyes of Moses, the stream of the times issuing forth from eternity, and on the other, through the eyes of John, the times returning to the sea of eternity. Christ is coming (the Old Testament); Christ has come (the gospel); Christ shall come again (the Revelation),—such is the sum of the history of mankind. FRÉDÉRIC GODET.

Revel'lo, town of Italy, province of Cuneo, at the foot of Mombracco, about 8 miles from Saluzzo. It was strongly fortified in mediæval times, and the lords of Saluzzo frequently took refuge here. Many old churches, castles, towers, palaces, etc., more or less ruinous, but of much historical and architectural interest, may still be seen in and near the town, and even remains of the Roman period are not wanting. P. 5400.

Rev'enue [Fr. *revenu*; Lat. *revenio*, to "return"], income or annual proceeds from land or other property. In modern usage the term is confined more specifically to the income of a state or nation derived from duties, taxes, and other sources for public use. The general principles pertaining to the subject are presented under FINANCE and TAXATION (which see). The following statements embody facts concerning the revenues of some leading nations:

Argentine Repub..	$23,996,893	Honduras	$3,000,000
Austria, fl............	393,677,697	Hungary............	$7,943,000
Belgium, fr...........	205,985,000	Italy, lire.............	1,364,147,325
Bolivia.................	$2,929,574	Japan, rios...........	[illegible]
Brazil	$64,886,326	Mexico..................	$14,[illegible]
Chili	$13,594,410	Nicaragua............	$1,200,000
China	$300,000,000	Paraguay.............	[illegible]
Colombia..............	$4,000,000	Persia, tomans......	4,912,500
Costa Rica............	$2,812,585	Peru	$23,511,408
Denmark, rix dols.	24,944,985	Portugal, milreis..	[illegible]
Ecuador...............	$1,500,000	Russia, rubles	[illegible]
Egypt...................	£10,571,048	Sandwich Islands..	[illegible]
France, fr............	2,563,460,624	Spain, pesetas......	[illegible]
Germany, reichs-marks..............	449,428,000	Sweden, crowns...	[illegible]
Greece, drachmas..	35,882,000	Turkey, purses	[illegible]
Guatemala	$2,615,677	United States (1874-75)...........	$288,000,000
Great Britain.......	$386,678,284	Uruguay	[illegible]

A. L. CHAPIN.

Reve're (GIUSEPPE), b. at Trieste in 1812; studied thoroughly the ancient classical languages, and among other Oriental tongues Hebrew and Arabic. He has written vigorous sonnets and several well-known historical dramas in prose—*Lorenzino dei Medici, Piagnoni ed Arrabbiati Sampiero, Il Marchese di Bedmar*; also two volumes of humorous prose, which remind one of the *Reisebilder* of Heine, and which are entitled *Bozzetti Alpini* and *Marine e Paesi*. Revere lives in retirement in Rome.

Revere' (PAUL), b. at Boston, Mass., Jan. 1, 1735; served in the campaign on Lake George as lieutenant of artillery 1756; became a goldsmith, and afterward a copper-plate engraver; produced prints illustrative of the repeal of the Stamp Act, of the "Boston Massacre," and the landing of the British troops at Boston; was a member of the "tea-party," and at the instance of Gen. Warren ren-

dered an important service to his country by secretly leaving Boston at ten o'clock on the night of Apr. 18, 1775, and riding through Charlestown to Concord to announce the British expedition of the following day, which was resisted at Lexington and Concord. (See Longfellow's poem, *The Midnight Ride of Paul Revere.*) In the same year he engraved the plates and printed the bills of the paper-money of Massachusetts; afterward set up a powder-mill; became lieutenant-colonel of State artillery; participated in the Penobscot expedition of 1779; established a foundry of cannon and church-bells; erected extensive works for rolling copper at Canton, Mass., still maintained by his successors as the "Revere Copper Co.," and became grand master of the Masonic order, in which capacity he assisted in laying the cornerstone of the Boston State-house 1795. D. at Boston May 10, 1818. In his honor the town of North Chelsea, Mass., took the name of Revere, Mar. 24, 1871.—His grandson, PAUL JOSEPH REVERE, b. at Boston Sept. 10, 1832; graduated at Harvard 1852; became a colonel in the Army of the Potomac. D. at Westminster, Md., July 4, 1863, of a wound received at Gettysburg.—His brother, E. H. R. REVERE, b. July 23, 1827, surgeon of a Massachusetts regiment, was killed at Antietam Sept. 17, 1862.

Rev'erend [Lat. *reverendus*, "venerable"], a title bestowed upon Christian ministers and often upon Jewish rabbis. Archbishops are called "most reverend;" bishops and inferior mitred prelates, "right reverend;" deans, archdeacons, and vicars-general are styled "very reverend;" and other clergy are styled "reverend."

Rever'sion [Lat. *revertere*, to "turn back"], in law, is the residue of an estate in certain land left in the grantor or his heirs, or in the heirs of a testator, when a lesser estate in the same land has been granted or devised, and the right to the possession of the land by virtue of it commences at the termination of such prior and particular interest. When an estate is created by deed or by will out of a greater one, leaving in the original owner or his heirs an ultimate estate immediately expectant on the one so created, this ultimate estate is a reversion. For example, if an owner of land in fee should lease it for a term of years, or should convey it for the life of the grantee, an ownership would still remain in him, and he or his heirs or assigns would be entitled to possession as soon as the lease or the life-interest should end. By the operation of an ancient English statute a similar reversion is left in the absolute owner who has conveyed his land in fee tail; but after the whole interest in fee simple has been conveyed it is plain that no estate is left in the grantor. A reversion always results, therefore, by operation of the law, and is never created by the provisions of a conveyance; it is an interest *left* in the owner, and not conferred upon him. As long as the prior and lesser estate exists, the reversion, although vested in respect of interest, is future in respect of possession; but when such prior estate terminates, the reversioner is at once entitled to the possession, and his ownership is in fact no longer a reversion. A reversion being a vested estate, it may be conveyed or devised, and if in fee it will pass to the heirs of an intestate owner. When land has been leased, not only may the covenants of the lease be enforced by and against the original lessor and lessee, but by virtue of ancient English statutes, which have been generally enacted in this country, they may also be enforced by and against the assignees of the reversion and of the term or lease. JOHN NORTON POMEROY.

Reviews. See PERIODICALS.

Revilee', v., Sarber co., Ark.

Réville' (ALBERT), D. D., b. at Dieppe, France, Nov. 4, 1826; became a leading minister of the French Protestant Church at Nimes and Luneray, and in 1851 pastor of the Walloon church at Rotterdam, Holland. He has published many translations of religious works from the English and the German; is author of *De la Rédemption* (1859), *Essais de Critique réligieuse* (1860), *Études critiques sur l'Evangile selon S. Matthieu* (1862), *La Vie de Jésus de M. Renan devant les Orthodoxes et devant le Critique* (1863), *Notre Christianisme et notre Bon Droit* (1864), *Histoire du Dogme de la Divinité de Jésus Christ* (1869), several volumes of sermons, and many essays in theological reviews.

Revolv'ers [Lat. *revolvere*, to "return"], breech-loading small-arms, usually pistols. Revolver rifles of Colt's pattern have been in service in the U. S., and the GATLING GUN (which see) is also a revolver. Samples of revolvers made in the early part of the seventeenth century are known, but the Colt's revolver was the first of practical value. (See SMALL-ARMS.) P. V. HAGNER.

Re'wah, state of India, subsidiary to Great Britain, presidency of Bengal, comprises an area of 10,300 sq. m., with 1,200,000 inhabitants, and extends between lat. 24° and 42° N., and between lon. 81° and 82° E. The soil is not very productive, but well cultivated. The capital, Rewah, has about 7000 inhabitants, but is utterly decayed.

Reward' [L. Lat. *rewardum*], a recompense or compensation, generally a specified sum of money, offered either by a public officer or by a private person for the performance of some act in which the public is interested in the first case, and the private individual in the other, and payable to the one who does the prescribed act. By far the most common example is that of a pecuniary payment offered to the person who shall discover the perpetrator of some crime, or shall apprehend the criminal, or shall furnish evidence sufficient for his conviction, or shall procure the return of property that has been lost or stolen. Many classes of statutes have provided for the payment by the State of a certain sum, or sometimes a fixed portion of the penalty, in all cases to the informer through whose means a conviction of the offender is obtained; and in the criminal prosecutions based upon such statutes the informer may generally be a witness, although he expects, and will be entitled to receive, a reward upon a conviction. Other statutes authorize the offer of rewards by sheriffs or other administrative officers in special cases of aggravated offences when evidence is difficult to be obtained, the facts obscure, and the criminal or his whereabout is unknown. If a private individual offers in a public manner to pay a certain sum upon the performance of a designated act—as, for example, the recovery of lost or stolen property or the arrest or conviction of a criminal—any person who complies with the terms of the offer, except the criminal himself, becomes entitled to the payment, and can enforce it by action against the party making the offer; the offer and the performance constitute an executed contract. JOHN NORTON POMEROY.

Reybaud' (MARIE ROCH LOUIS), b. at Marseilles Aug. 15, 1799; educated for commercial business; travelled much in India and other Eastern countries; settled in 1829 at Paris, and devoted himself to literature; became a contributor to the *Constitutionnel, Corsaire, Némésis*, and other papers; edited *Histoire scientifique et militaire de l'Expédition française en Égypte* (10 vols., 1830–36); published from 1836 to 1840, in the *Revue des Deux Mondes*, his *Études sur les Réformateurs, ou Socialistes modernes*, which in 1841 received the great Montyon prize from the Academy; published in 1843 *Jérôme Paturot à la Recherche d'une Position sociale*, a romance in 1 volume, which made a great sensation; became a member of the Academy in 1850, and continued to write a multitude of romances, economical essays, political pamphlets, and literary and social criticisms, which, however, did not attract much attention.

Reyk'javik, the capital of Iceland, on the south-western coast of the island, in lat. 64° 8' N., lon. 21° 55' W., at the head of Faxafjord, is the seat of the government, has a college with a library of 10,000 volumes, an important annual fair, and regular steam communication with Leith and Copenhagen. It was founded in 874. P. about 1400.

Rey'nard the Fox, a satirical epic published in the Low German dialect at the close of the fifteenth century (*Reynke de Vos*, Lubeck, 1498). It gives in rhymed verses a humorous account of the adventures of the Fox at the court of the Lion, and became very popular in Germany and the adjacent countries. Of its relation to earlier fictions of a similar character Jacob Grimm has given a very interesting account in his *Reinhart Fuchs* (Berlin, 1834). Translations into High German have been made by Soltau (1803) and Simrock (1845–52). Goethe gave in 1794 a version of the poem in hexameters, to which Kaulbach made a series of illustrations in 1847.

Reyn'olds, county of S. E. Missouri, on head-waters of Big Black River, has a rough and broken surface, abounding in iron, lead, limestone, and granite; products, corn and tobacco. Cap. Centreville. Area, 700 sq. m. P. 3756.

Reynolds, v., Dale co., Ala. P. 560.

Reynolds, tp., Lee co., Ill. P. 742.

Reynolds, tp., Montcalm co., Mich. P. 457.

Reynolds, tp., Randolph co., West Va. P. 657.

Reynolds (GEORGE GREENWOOD), LL.D., b. at Amenia, N. Y., Feb. 7, 1821; graduated at Wesleyan University in 1841; was admitted to the bar in 1844; has practised law in Milton, Poughkeepsie, and Brooklyn, N. Y.; was a judge of the city court, Brooklyn, N. Y., 1860–66; elected again in 1872 to the same office for fourteen years.

Reynolds (IGNATIUS ALOYSIUS), D. D., b. near Bardstown, Ky., Aug. 22, 1798; educated at St. Mary's College, Baltimore, Md.; became a Catholic priest; was succes-

sively vicar-general of Kentucky, rector of St. Joseph's College, and president of the Nazareth Female Institute of Kentucky, and was consecrated bishop of Charleston Mar. 18, 1844. D. at Charleston Mar. 6, 1855.

Reynolds, or **Rainolds** (John), D. D., b. at Pinhoe, Devonshire, England, in 1549; studied at Merton College, Oxford, 1562; was admitted to Corpus Christi College 1563; became fellow 1566; lectured on Aristotle; was appointed reader of the theological lecture founded by Sir Francis Walsingham 1586; was dean of Lincoln 1593; refused a bishopric in order to accept the presidency of Corpus Christi College 1598; was eminently distinguished as a Hebraist, regarded as the leader of the Puritan party, and was said by Hallam to have been "the most eminently learned man of Queen Elizabeth's reign;" was often called a "living library" and a "third university;" took a prominent part in the Hampton Court Conferences of 1603, where he maintained the necessity of a new version of the Bible; executed a small portion of King James's version, and revised much more in the weekly meetings of the translators held at his chambers. D. at Oxford May 21, 1607. His works consist chiefly of separate sermons, controversial treatises against the Church of Rome, academical discourses, and some writings upon biblical criticism, the most elaborate being one successfully directed against the admission of the Apocrypha as part of the Old Testament canon—*Censura Librorum Apocryphorum Veteris Testamenti*, posthumously printed (Oppenheim, 2 vols., 1611).—His brother, William Reynolds, b. at Pinhoe about 1540; was educated at Oxford; became a Catholic; was professor of divinity and Hebrew at Douay and Rheims; took an important part in the translation of the Rheims Testament; translated from English into Latin all the works of Thomas Harding; wrote several theological and controversial treatises, and became chaplain to the Beguin nunnery at Antwerp, where he d. Aug. 24, 1594.

Reynolds (John), b. in Montgomery co., Pa., Feb. 26, 1789; removed in childhood to Kaskaskia, Ill.; served in campaigns against the Western Indians 1812–13; became a lawyer at Cahokia; was appointed a justice of the supreme court of Illinois 1818; was frequently a member of the legislature; governor of the State 1830–34; commanded the Illinois volunteers during the Black Hawk war in May and June, 1832; sat in Congress as a Democrat 1835–37 and 1839–43, and was Speaker of the Illinois house of representatives 1852–54. For some time he edited the Belleville *Eagle*, a daily paper; published *The Pioneer History of Illinois* (1848), *A Glance at the Crystal Palace and Sketches of Travel* (1854), and *My Life and Times* (1855). D. at Belleville, Ill., May 8, 1865.

Reynolds (John F.), b. in Pennsylvania, 1820; graduated at the U. S. Military Academy, and appointed brevet second lieutenant of artillery July, 1841; in garrison until the war with Mexico, in which he served with Gen. Taylor's army in the defence of Fort Brown and in the battles of Monterey and Buena Vista, winning the brevets of captain and major for gallantry in both actions. After the close of the war he continued to serve in garrison and on frontier duty until Sept., 1860, when he was selected as commandant of cadets at West Point; in May, 1861, was transferred to the infantry with rank of lieutenant-colonel (colonel June, 1863), and in August appointed brigadier-general of volunteers, and assigned to command of a brigade of the Pennsylvania Reserve Corps, which he commanded in the Virginia peninsular campaign of 1862 at Mechanicsville, Gaines's Mill, and Glendale, where taken prisoner; exchanged in August, he commanded a division in the second battle of Bull Run, and in Maryland campaign of Sept., 1862, was selected to command the Pennsylvania militia for the defence of the State, for which he received, through the governor, the thanks of that State. In Nov., 1862, was promoted to be major-general of volunteers, and placed in command of the 1st corps of the Army of the Potomac, which was engaged on the left in the battle of Fredericksburg, Dec. 13, 1862. At Chancellorsville his corps was held in reserve, along with the 5th, and not allowed to engage the enemy, though both were anxious to do so. At the battle of Gettysburg, on the opening day (July 1, 1863), and at a moment when, having made the disposition of his troops in person, and after "urging on his men with animating words, he saw the successful charge under way, he was struck with a rifle-shot that caused almost instant death—a grievous loss to the Army of the Potomac, one of whose most distinguished and best-beloved officers he was; one whom, by the steady growth of the highest military qualities, the general voice of the whole army had marked out for the largest fame." (*Swinton.*) G. C. Simmons.

Reynolds (Joseph J.), b. in Kentucky 1822; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of artillery July 1, 1843. After serving in garrison and in Texas, he was in 1846 selected as assistant professor of geography, history, and ethics at West Point, and the following year became assistant professor of natural and experimental philosophy, and from 1849 to 1855 was principal professor. In 1857 he resigned to accept the chair of mechanics and engineering in Washington University, St. Louis, Mo., which he held until 1860. In 1861 he was appointed colonel and brigadier-general of Indiana volunteers, and June, 1861, was commissioned brigadier-general of U. S. volunteers, serving in West Virginia. He again resigned in Jan., 1862, but was reappointed Nov. 10, and Feb. 2, 1863, was promoted to be major-general of volunteers, serving with the Army of the Cumberland in numerous actions and in the battle of Chickamauga. At the battle of Chattanooga he was chief of staff of that army. Subsequently, he held various important commands in the South-west, and from Nov., 1864, to Apr., 1866, commanded the department of Arkansas. On July 28, 1866, he was appointed colonel of the 26th U. S. Infantry; transferred to 25th Infantry Jan., 1870, and to 3d Cavalry Dec. 15, 1870; brevet brigadier and major general for gallantry in the field.

Reynolds (Sir Joshua), D. C. L., b. at Plympton, Devonshire, England, July 16, 1723; educated at the free grammar school of his native place; studied painting under Hudson at London; settled at Plymouth as a portrait-painter 1743, and at London 1746; obtained the patronage of Capt. (afterward Lord) Keppel, who gave him a passage to the Mediterranean in his vessel 1749; spent nearly four years in professional studies in Italy; formed his style chiefly upon that of the great Venetian masters; returned to London 1753; soon took the first rank among British artists; attained an annual income of £6000; was chosen president of the Royal Academy at its creation 1768, at which time he was knighted; was intimate with Dr. Johnson, Garrick, Burke, Goldsmith, and other literary celebrities, with whom he was associated in founding the celebrated "Literary Club," 1764; delivered at the Royal Academy annual or biennial discourses on the fine arts, which were published in 2 vols., and was appointed principal portrait-painter to the king 1784. D., unmarried, at London Feb. 23, 1792. He figures largely in the numerous works illustrating the career of Dr. Johnson, and has had several biographers, of whom the best are Northcote (1813), Farington (1819), and C. R. Leslie, completed by Tom Taylor (2 vols., 1865).

Reynolds (William Morton), D. D., b. in Fayette co., Pa., in 1812; graduated at Jefferson College 1832; became a clergyman of the Lutheran Church; was professor in Pennsylvania College 1833–50; president of Capital University, O., 1850–57, and of Illinois State University 1857, and was ordained in the Protestant Episcopal Church 1864. Author of *Discourse on the Swedish Churches*, of several occasional essays, addresses, and pamphlets; edited the *Captivi* of Plautus (1846); founded and conducted the *Evangelical Magazine* (1840), the *Literary Record* (1845), and the *Evangelical Review* (1849–62).

Reyn'oldsburg, p.-v., Truro tp., Franklin co., O. P. 457.

Reyn'oldson, p.-v., Gates co., N. C. P. 988.

Reyn'oldsville, p.-v., Winslow tp., Jefferson co., Pa., on Allegheny Valley R. R.

Reze', town of France, department of Loire-Inférieure, manufactures linseed oil, spirits, ivory-black, soap, and artificial manures. P. 7209.

Re'zin [Heb., "firm," "stable," or "prince"], the eighth and last of a line of kings of Damascus, beginning with Hadad, contemporary with David. He began to reign about 745 B. C., and was slain by Tiglath-Pileser of Assyria (732 B. C.). R. D. Hitchcock.

Rhabdoste'idæ [Gr. ῥάβδος, a "rod," and ὀστέον, a "bone"], a family of mammals based upon extinct remains of Cetaceans, and supposed to be related to the Iniidæ and Platanistidæ of the present epoch. The type is chiefly known from the jaws; these formed a long rostrum, somewhat like the bill of the swordfish, the intermaxillary and maxillary bones being much produced and elongated, and forming a cylinder bearing teeth only on its proximal portion. The only known species is from the Miocene beds of Maryland. Theodore Gill.

Rhachitis. See Rickets.

Rhadaman'thus, in Greek mythology, a son of Zeus and Europa, the brother of Minos, king of Crete, settled in Bœotia, where he married Alcmena, and became after his death, on account of his supreme justice, one of the three judges of the lower world, the two others being Minos and Æacus. He was pre-eminently the judge of people who came from Asia.

Rhæ'tia, an ancient province of the Roman empire, was bounded N. by Vindelicia, E. by Noricum, S. by Gallia Cisalpina, and W. by Helvetia, and corresponded to the modern Tyrol and the Swiss canton of Grisons. Its inhabitants, the Rhæti, who lived as shepherds, were probably of Etruscan descent, and were subdued by the Romans 15 B. C. During the last days of the Roman empire, when the barbarian hordes swarmed around its frontiers and devastated its provinces, Rhætia became nearly depopulated. The language is ROMANSCH (which see).

Rhamphast'idæ [Gr. ῥάμφος, "crooked beak"], a family of carinate birds, including the toucans. They are distinguished by their bill, which is long, high, and com-

The Ariel Toucan.

pressed, decurved at the tip, and with the lateral margins serrated; the nostrils are inconspicuous, superior, and at the base of the upper mandible; no bristles are developed; the wings are rather short and rounded; the tail is moderate and more or less convex; the tarsi are rather robust and covered with broad scales; the toes in pairs, two being directed forward and two backward; the inner toes anteriorly and posteriorly, shorter than the outer; the claws strong and curved. They are somewhat related to the cuckoos. The species are peculiar to America, especially the tropical regions; a few, however, extend northward into Mexico, but none are found within the limits of the U. S. They are generally combined under two genera—*Rhamphastos*, in which the nostrils are concealed, including seventeen species; and *Pteroglossus*, with the nostrils exposed, comprising forty-five species. They frequent lofty trees, feeding upon various fruits, especially the banana, but also live partly upon insects, and even reptiles, as well as young birds and eggs. The female makes her nest in holes in the trunks of trees, and generally deposits therein two eggs. (See ARAÇARI.) THEODORE GILL.

Rhaph'ides, or **Raphides** [Gr. ῥαφίς, "a needle"], the crystals, often needle-shaped, of salts found within certain plant-cells. The phosphates, oxalates, and other salts of lime are those most commonly found.

Rhap'sodists [Gr. ῥαψῳδοί, from ῥάπτειν, to "stitch," to "string together," and ᾠδή, "song"], a class of wandering minstrels in ancient Greece whose occupation was the recital of the Homeric and other poetry. After these poems were reduced to writing these rhapsodists ceased to be the honored singers of the early days of Greece.

Rhat'any [Peruvian, *rataña*], a drug, being the root of *Krameria triandra*, a small woody shrub of a genus generally referred to the natural order Polygalaceæ, growing in the Bolivian and Peruvian Cordilleras. Rhatany-root is in pieces of various sizes, composed of a dark, reddish-brown bark and a central lighter-colored, woody portion. It has no smell, but a bitter, somewhat sweetish, and very astringent taste. The medicinal principle is a form of tannin, called rhatani-tannic acid. This is found only in the cortical part of the root, where it exists in the proportion of about 20 per cent. The physiological effects of rhatany are simply those of the tannin it contains, and preparations of the root are used in medicine almost exclusively as astringents in diarrhœal affections.
EDWARD CURTIS.

Rhea, in Greek mythology. See CYBELE.

Rhea, in ornithology. See RHEIDÆ.

Rhe'a, county of S. E. Tennessee, bounded E. by Tennessee River and W. by the Cumberland range of mountains, produces corn, tobacco, sorghum-molasses, and wool. Cap. Washington. Area, 507 sq. m. P. 5538.

Rhea Silvia. See ROMULUS.

Rhegium. See REGGIO DI CALABRIA.

Rhe'idæ [from *Rhea*, Ῥέα, a mythological name], a family of birds of the order or sub-order Ratitæ, containing the South American ostriches, and differing externally from the African ostriches simply by the three-toed feet, the more slender bill, and the want of caudal plumes. The bill is comparatively short, depressed gradually, and narrowed toward the tip; the nostrils large, oval and nearly in the middle of the bill; the wings are furnished with long, soft feathers; the tail is not apparent; the tarsi are long and covered in front with broad transverse scales; toes three, the lateral shorter than the middle; the claws compressed and curved. They are distinguished anatomically by the number of characters: as determined by Huxley, these are as follows: the maxillary processes of the palatines are short, and united with the inner and posterior edges of the maxillo-palatines; the latter are thin lamellar bones, which do not articulate with facets on the vomer; the vomer is normally long, and articulates behind with the palatines and pterygoids; the prefrontal processes are little ossified; the sternum is short and narrowed posteriorly, and presents a notch in the middle of its posterior edge; the humerus exceeds the distance between the shoulder-girdle and the ilium; the manus has three digits, two of which have claws; the sacral vertebræ do not unite by their bodies with the pubes or ischia, and their centra ossify late, and are elongated and slender; the pubes are free. The species of this group are confined to South America, where they inhabit the open plains and exhibit habits analogous to those of the ostriches of Africa. They are generally seen alone; they run with considerable fleetness, and generally against the wind, expanding their wings in starting to assist in making headway. They feed chiefly upon grass and roots. The females lay their eggs in combination, sometimes depositing together as many as eighty eggs; these are collected together by the male bird, who hatches them and attends for a short time to the young. Three species are now known to ornithologists: (1) The *Rhea Americana*, extending from Southern Brazil on the N. to the Straits of Magellan on the S.; (2) *R. Darwinii*, from the Straits of Magellan to the Rio Negro, or the boundary between Patagonia and Buenos Ayres; and (3) *R. macrorhyncha*, whose habitat is uncertain. (See NANDU.) THEODORE GILL.

Rheims [Lat. *Durocortorum*, afterward called *Remi*, the name of the people], a large old city of France, department of Marne, on the Vesle, is surrounded with walls and ramparts planted with trees and affording beautiful promenades; it is generally well built, and has many fine streets, squares, and public buildings. The cathedral, 466 feet long, 99 feet broad, and 144 feet high, built in the first part of the thirteenth century, is one of the finest Gothic edifices of Europe; its western front is especially magnificent. In this church most of the kings of France from Philippe Auguste (1180) to Charles X. (1824) were consecrated. St. Remigius, the apostle of the Franks, is buried in one of the suburbs. Rheims has very extensive manufactures of woollen fabrics and a large trade in champagne wines. P. 71,994.

Rhen'ish Confedera'tion. By the Peace of Presburg (Dec. 26, 1805) Bavaria and Würtemberg were erected into kingdoms, and their princes received sovereignty independent of the German emperor. Thus, the dissolution of the German empire was prepared, and on Aug. 1, 1806, sixteen princes of Southern and Western Germany threw off their allegiance to the emperor and formed a confederacy, the *Rheinbund*, under the protectorate of Napoleon. Aug. 6 the emperor, Francis II., abdicated the imperial dignity and crown of Germany, and assumed the title of emperor of Austria, and after the war between France and Prussia most of the princes of Central and Northern Germany entered the confederacy, which continued valid to the downfall of Napoleon.

Rhen'ish Prus'sia, the westernmost province of Prussia, bounded W. by Belgium and the Netherlands, comprises an area of 10,230 sq. m., with 3,579,347 inhabitants, of whom 2,628,173 are Roman Catholics and 906,867 Protestants. The surface is mountainous, covered by the Hundsrück, Eifel, and Westerwald; the northern part, however, is flat, and produces much corn and cattle. The mountains, with the exception of Eifel, which is rough and barren, are covered with fine forests and are rich in lead, copper, iron, and coal; and the valleys, especially those of the Rhine, Mosel, and Lahn, belong to the richest and most beautiful regions of Europe, famous for their excellent wine and for their enormous manufacturing industry.

Rhenish Wine, or **Rhine Wine,** a name for the wines of Germany, produced chiefly in the Palatinate and the Moselle valley, but especially in the Rheingau. The white Rhine wines are better than the red Rhine wines, have a peculiar, delicate bouquet and fragrance, and are dry, clear, and very durable; ripening in three years, they are at their best in four or five years, but will often keep sound for twelve years. The best red wine is the Asmannshäuser, the finest of all Johannisberger; the strongest is the Steinberger. Hochheim, Kloster-Erbach, Gräfenberg, Bacharach, Rüdesheim, and many other places produce, in dry seasons, excellent and costly vintages. The ordinary wines of the Rhine are often harsh and of a slaty flavor, derived from the soil; but they have greatly improved in both respects of late years.

Rheom'eter and **Rhe'ostat,** instruments for measuring and regulating the force of a current of voltaic electricity. (See ELECTRICITY.)

Rhet'oric [Gr. ῥητορική, sc. τέχνη], according to Aristotle, "the art of persuasion;" according to Whately, "the art of conviction;" according to Campbell, "the art of discourse." Campbell's definition is to be preferred, as more comprehensive than either of the others, although Aristotle justly emphasizes the highest end of all rhetorical study. All writers on the subject agree in regarding rhetoric as an art (that is, a body of practical precepts), rather than a science; but precepts imply underlying principles, and there has been much question with reference to the science or sciences on which rhetoric is founded. Some — notably, Whately—have said logic; others — of whom Blair may be taken as an example—would seem to say æsthetics; still others — following Theremin — would say ethics. If rhetoric is founded upon any single science, it is unquestionably logic; but in so far as rhetoric is founded upon logic it is only mediately, through grammar. Grammar receives the material of thought elaborated into concepts, judgments, and reasonings, expresses them with *correctness* (that is, with due regard to purity, propriety, concord, and precision), and turns them over to rhetoric to be woven into discourse with clearness, energy, and elegance, and in adaptation to the special ends that the writer or speaker has in view. Grammar has to do with the sentence, rhetoric with the discourse. Grammar regards correct expression as an end in itself; rhetoric regards expression as merely a means to an end. Instead of regarding rhetoric as founded on a single underlying science, it is perhaps preferable to recognize three departments of rhetoric, corresponding to the three "nomological sciences" recognized by Sir Wm. Hamilton: I. *Inventive rhetoric,* founded on logic, having to do with the matter of discourse, and helping us to attain to the true; II. *Æsthetic rhetoric,* founded on æsthetics, having to do with the "form" of discourse, and helping us to attain to the pleasurable; III. *Ethical rhetoric,* founded on ethics, having to do with the purpose of discourse, and helping us to attain to that which we esteem good. In this classification it will be seen that we recognize a department of rhetoric corresponding to each of the three divisions which are ordinarily made of the human faculties—the intellect, the sensibilities, and the will—while yet, as these faculties are but so many manifestations of the unit of consciousness, we have a sufficient basis of unity.

Rhetoric, taken as a whole, may be viewed either as constructive or critical. Critical rhetoric embraces the study of rhetorical precepts and the study of literary models. Constructive rhetoric consists in the practical application of rhetorical precepts and the imitation of literary models. Objections have been made to the study of either branch of the art, but they are trivial in themselves, and inconsistent with the practice of the best writers and speakers. The precepts of rhetoric are not the arbitrary enactment of any man or any body of men, but simple deductions from the generalized experience and observation of generations of writers and speakers, with which all who propose to write or speak will do well to familiarize themselves.

Rhetoric recognizes three forms of discourse:

1. *Representative discourse,* in which the matter is presented for its own sake, without especial purpose or especial regard to form. Under this head we treat of—(1) things—description; (2) facts—narration; (3) truths—exposition. Clearness, accuracy, and completeness are the prime essentials of representative discourse.

2. *Poetry,* in which the matter and the purpose are subordinate to the form. Under poetry the following classification may be recognized:

(1) The poetry of thought, or "didactic poetry."	descriptive	objective. / subjective.
	satirical.	
(2) The poetry of feeling, or "lyric poetry."	ode.	
	song	secular. / sacred.
	sonnet.	
	elegy.	
(3) The poetry of action, or "epic poetry."	proper epic	heroic. / mock-heroic.
	drama	tragedy. / comedy.

The prime essentials to poetry are—first, a poetic thought; secondly, poetic diction—to characterize either of which would fall under the province of a special discussion.

3. *Oratory,* which proposes an end to be attained, to which the matter and form of discourse are merely ancillary. The ancients recognized three kinds of oratory—the demonstrative, the judicial, and the deliberative. Blair proposes to recognize, instead, the eloquence of popular assemblies, the eloquence of the bar, and the eloquence of the pulpit. If we attempt a classification of oratory at all, it is better to make our basis of classification the *purpose,* rather than the *occasion,* of its exercise. Oratory is commonly regarded by rhetoricians as the normal type of discourse, embodying the fullest and loftiest ideal of the art. The orator generally seeks to bring something to pass; hence he appeals not to the intellect or to the feelings alone, but to the will. He must sway the whole man, or he must fail in the object which he has in view. It is especially necessary for him to study adaptation, and his discourse, while not deficient in clearness and not offensive to the taste of his hearers, must excel in energy.

Inventive rhetoric has to do with the choice of themes, the accumulation of material, and the disposition of material. It was much more fully treated by the ancient rhetoricians than by those of the present day, many of whom ignore it altogether, regarding it as a mere department of ethical rhetoric, which does, in fact, greatly limit it.

Ethical rhetoric has especial reference to the purpose contemplated in discourse. This purpose may be either—(1) *Enlightenment—i. e.* to develop in the mind a new cognition; (2) *Conviction—i. e.* to lead the mind to adopt a given opinion; (3) *Excitation—i. e.* to move the feelings; or (4) *Persuasion—i. e.* to determine the will to action. Excitation is not regarded as a distinct end of discourse by many rhetoricians, since, ordinarily, we seek to excite emotion only that through emotion we may influence the will. But the distinct recognition of excitation is essential to a complete analysis of ethical rhetoric: the methods of excitation may be separately studied; and excitation is sometimes (as in demonstrative oratory and in certain kinds of poetry and fiction) an end in itself. In all discourse—but especially in oratory—some one of the purposes mentioned above dominates. It is the function of rhetoric to show how discourse may, in matter and manner, be made subservient to that purpose. Rhetoric teaches us how best to enlighten, convince, move, or persuade our fellow-men. It is, then (since this is largely essential to success in any calling), of practical import not merely to the professional orator, but to mankind at large.

Æsthetic rhetoric has reference to "style," or the art of expressing, clearly, energetically, and elegantly, the products of inventive rhetoric in adaptation to the ends of ethical rhetoric. Under the head of style we recognize, as of prime importance—(1) naturalness; (2) adaptation; (3) clearness; (4) energy; (5) elegance. These characteristics of style are discussed, with greater or less fulness, in all rhetorical treatises. Clearness, which is the most important attribute of a good style, is admirably treated in a little manual entitled *How to Write Clearly,* by Prof. E. A. Abbott of the City of London School.

Figurative language (or language which deviates from the plain and ordinary method of describing an object or stating a fact) may be included under the head of "style," since it tends to promote clearness by associating the object or fact under discussion with more familiar objects or events; energy, by associating the object or fact under discussion with more exciting objects or facts; elegance, by associating the object or fact under discussion with more pleasing objects or facts. Under the head of "figurative language" we recognize *figures of speech,* which consist in a mere modification of the form of expression; and *figures*

of thought, which involve an essential modification of our conception. And these figures depend on three principles —(1) the principle of similarity; (2) the principle of dissimilarity; (3) the principle of association. Under the head of "figures of speech" we recognize—(1) alliteration, or the repetition of similar sounds at the beginning of successive words; *e. g.*

"Apt alliteration's artful aid."—CHURCHILL.

(2) Paronomasia, or the use of words in the same connection which are similar in sound, but dissimilar in sense; *e. g.*

"Not on thy *sole;* but on thy *soul*, harsh Jew."—SHAKSPEARE.

(3) Meiosis or Litotes, which consists in the representation of an object as less than it really is; *e. g.* "A citizen of *no mean* city."—PAUL. (4) Pleonasm, which consists in the use of more words to express one's meaning than are strictly necessary, and which should be sharply discriminated from "tautology," or the meaningless reiteration of our thought. (5) Hyperbole, which consists in representing an object as larger than it really is, or stating a fact more strongly than is consistent with literal truth; *e. g.* "The English gain two hours a day by clipping their words."—VOLTAIRE. (6) Climax, which consists in gradually rising, by more and more emphatic statements, to the fullest and most expressive utterance of our thought; *e. g.* "Jesus of Nazareth pours forth a doctrine beautiful as light, sublime as heaven, and true as God."—THEODORE PARKER.

Under the head of "figures of speech" fall also ellipsis, asyndeton, polysyndeton, aposiopesis, epizeuxis, epanalepsis, and interrogation—carefully to discriminate which would hardly fall within the scope of an article of this nature.

Under the head of "figures of thought" that are *founded on the principle of similarity* we have—(1) The simile, which is an expressed comparison; *e. g.* "*Like as* a father pitieth his children, *so* the Lord pitieth them that fear him." (2) The metaphor, which is an implied comparison; *e. g.* "I am the Good Shepherd, and know my sheep." Similes are more conducive to clearness, metaphors to energy. Either may be made conducive to elegance. The metaphor may be tested by reducing it to an equation of ratios; *e. g.* "The ship ploughs the sea" equals The ship is to the sea as the plough is to the land. Any metaphor which will not submit to this test is radically defective, introducing more than four terms or suggesting an unreal similarity. Under this head we recognize also (3) The allegory, which is an extended metaphor. Bunyan's *Pilgrim's Progress* is the best example. (4) The fable, which is essentially similar to the allegory, although briefer, more obviously didactic, and characterized by the free endowment of the brute (and even the inanimate) creation with the attributes of reason and speech. The fables of Æsop will at once suggest themselves. (5) The parable, which is a religious allegory. (6) Personification, which regards things inanimate as if they were animate; *e. g.* "The pyramids, doting with age, have forgotten the names of their founders."—FULLER. Under this head, too, are included prosopopœia, vision, and apostrophe.

Under the head of "figures of thought" that are *founded upon the principle of dissimilarity* we have contrast, antithesis, irony, which hardly require to be characterized or exemplified.

Founded on the principle of association we have metonymy, or a transference of names (Gr. μετά and ὄνομα), under which we recognize the substitution of—(1) The cause for the effect and *vice versâ; e. g.* "The Lord is *my song*. He is become my salvation." (2) The container for the thing contained; *e. g.* "He is a slave to the *bottle*." (3) The sign for the thing signified; *e. g.* "*The sceptre* shall not depart from Judah." (4) The instrument for the agent; *e. g.* "*The pen* is mightier than the sword."—BULWER. (5) The author for his works; *e. g.* "They have *Moses and the prophets*."

We must class under the combined heads of similarity and dissimilarity synecdoche, which includes objects that are similar in kind, but dissimilar in extent or degree. By synecdoche we put a part for the whole, as a "sail" for a ship, or a "blade" for a sword, etc. More specifically, synecdoche consists in the substitution of—(1) the concrete for the abstract; (2) the species for the genus; (3) the individual for the species; (4) the member for the individual; (5) the material for the thing made. Its employment is highly conducive to energy.

It falls within the province of rhetoric accurately to discriminate between the figures of speech which have been mentioned, and to give rules which shall facilitate their effective use.

The great masters of rhetoric among the Greeks were Aristotle and Longinus. Aristotle, indeed, may fairly be regarded as the father of the art. The second book of his *Art of Rhetoric*—in which he embodies a subtle analysis of the mental and moral characteristics to which the orator must adapt his discourse—is still of capital significance. The best modern commentator on Aristotle is Cope. Among the Romans the most eminent names are those of Cicero, Quintilian, and Horace. Of all the ancient rhetoricians, Quintilian is the most useful, and Horace the most attractive. Horace's *Epistle to the Pisos* (the material of which is largely borrowed from Aristotle) has been imitated by Vida in his *Poetics*, by Boileau in *L'Art Poétique*, by Pope in his *Essay on Criticism*, and has thus exerted a widespread influence on modern style. Volckmar, *Die Rhetorik der Griechen und Römer*, is a valuable compend of the results attained by the ancient rhetoricians.

Of English authors, mention should be made of Whately (best on conviction and persuasion), Blair (best on style), Kames (best on figurative language), and Campbell (best on the grammatical properties of style). De Quincey (*Historical Essays*, vol. ii.) has valuable essays on rhetoric and style; and Herbert Spencer's essay on style must not be overlooked. Vinet's *Homiletics*, Theremin's *Rhetoric* (admirably translated and edited by Dr. Shedd), Broadus, on the *Preparation and Delivery of Sermons*, Beecher's *Yale Lectures on Preaching*, though specifically devoted to sacred rhetoric, are full of suggestive hints to the general student. J. H. GILMORE.

Rhett (ROBERT BARNWELL), b. at Beaufort, S. C., Dec. 24, 1800; was originally named SMITH; adopted in 1837, with the other members of his family, the name of RHETT, in memory of an ancestor; was liberally educated; studied law; was elected to the State legislature 1826; became attorney-general of South Carolina 1832; was one of the most pronounced advocates of State rights, nullification, and secession; was a member of Congress 1838–49, and U. S. Senator 1850–51; expressed himself openly in favor of a dissolution of the Union, both in Congress and in the columns of the Charleston *Mercury*, the organ of the so-called "fire-eaters," which he owned and conducted; was a leader in the State convention of South Carolina which passed an ordinance of secession Dec. 20, 1860; was chairman of the committee which reported the constitution of the Confederate States to the Montgomery convention Feb., 1861, and subsequently a member of the Confederate congress. D. Sept. 14, 1876.—His son, bearing the same name, now (1876) conducts a newspaper at New Orleans, La.

Rheum. See RHUBARB, by PROF. E. CURTIS, M. D.

Rheu'matism [Gr. ῥευματισμός], a shifting inflammation or neuralgia which attacks fibrous structures in various parts of the body, and most commonly those of the joints. It presents itself under various forms, but they may all be embraced under the following: acute rheumatism and chronic rheumatism.

Acute rheumatism may be defined as an idiopathic inflammation of the synovial capsule of one or more joints, which is accompanied by slight exudation into the joint and œdema of the connective tissue surrounding it. There seems to be an hereditary predisposition to the disease, and the attacks are very liable to recur in the same individual. It occurs in healthy persons between the ages of ten and forty. The exciting cause is generally found to be a "cold" or a residence in damp places; it usually occurs in the winter and spring, and is oftenest met with in the temperate zone. Before the onset of the disease there is at times a feeling of *malaise* lasting for a few days; sometimes the malady is ushered in suddenly by a chill, which is immediately followed by a high fever and pain in one or more of the larger joints. This pain soon becomes unbearable, and the patient cannot allow the slightest motion, nor even the weight of the bed-clothes. The affected joint will be found swollen, and at times red. The joints most commonly affected are the knee, foot, shoulder, elbow, and hand. When a number of joints are affected at one time the patient's condition is indeed pitiable, as it is impossible for him to make the slightest movement without suffering the most intense agony. The complications liable to be encountered are inflammations of the fibrous structures of the heart, lungs, brain, and spinal cord, and the duration of the disease is from two to five or six weeks. It generally ends in recovery, except in those cases which have a severe complication. The treatment should consist of purgatives, diuretics, narcotics, and colchicum; locally, either evaporating lotions or warm applications, the latter best secured by warm water and alcohol (2 parts to 1), and surrounding the limb with flannel.

Chronic rheumatism is a chronic idiopathic inflammation of the fibrous tissues of the body, which produces very little change in the structures of the affected part. The predisposing causes may be congenital or acquired. It may follow the acute variety, or exist from the beginning as a chronic affection; one attack predisposes to another. The exciting causes are those of acute rheumatism and

damp weather and an easterly wind. There are several varieties of chronic rheumatism. In one there is a constant pain, lasting for a long time in certain single joints, which is aggravated by pressure or motion. In another a series of mild attacks of rheumatism, simulating greatly the acute variety, generally occurs at every change of weather or upon the slightest exposure. When once established it is generally hard to get rid of. *Muscular rheumatism* is a chronic rheumatism of the fibrous sheaths of the muscles, and is known as *lumbago* when occurring in the back, where it occasions ludicrous contortions of the body when the patient attempts to move, in order to spare the affected parts; *wry neck* is a similar affection in the neck; and *pleurodynia* is a chronic rheumatism of the muscles of the side and chest. As to the treatment of chronic rheumatism, we have no specific. Probably the nearest to it is the iodide of potassium, which should be given. Sedatives are also useful to relieve pain and procure sleep. Particular attention should be paid to the digestive organs, as derangement always aggravates the trouble. The various mineral springs possess no virtue except from the diuretic action of their waters. EDWARD J. BERMINGHAM.

Rheydt, town of Rhenish Prussia, manufactures yarn, hosiery, shawls, leather, paper, glue, and vinegar. P. 9792.

Rhind (A. C.), b. Oct. 31, 1821, in New York; entered the navy as a midshipman Sept. 3, 1838; became a passed midshipman in 1845, a lieutenant in 1854, a commander in 1863, a captain in 1870; served with heroic gallantry in the waters of Virginia and the Carolinas during our civil war, and was highly commended by Rear-Admirals Du Pont, Porter, and Lee in their official despatches. FOXHALL A. PARKER.

Rhine [Lat. *Rhenus;* Ger. *Rhein*], an important river of Europe, rises in Switzerland in the Alps, where it is formed at Reichenau, in the canton of Grisons, at an elevation of 1922 feet, by the union of two small streams, the Vorder and Hinter Rhein, the former of which, rising on the north-eastern side of the mountain group of St. Gothard, at an elevation of 7600 feet, is generally considered as the principal source of the river. Immediately after its formation the Rhine is navigable for rafts and small craft, but during its whole upper course, from Reichenau to Bâle, through Switzerland, the Lake of Constance, and along the frontier between Switzerland, Bavaria, and Baden, its navigation is difficult, and in many places entirely interrupted by rapids and cataracts, of which that of Schaffhausen, where the water suddenly leaps from a rock 70 feet high, is the most remarkable. During its middle course, from Bâle to Cologne, it winds its way through a broad and fertile valley between the Vosges and the Schwartzwald—the Rheinthal, often called the "garden of Germany;" thence it forces its way, by a narrow gorge, through the plateau of the lower Rhine. In this latter part the Rhine is not only an important route of traffic, but it also presents some of the finest and loveliest scenery in the world, flowing along between vineclad hills, which now and then hem it in between steep, towering rocks crowned with old castles, and then again open into long, beautiful cross-valleys through which smaller streams come rushing. Its lower course, from Cologne to the North Sea, leads through low and level ground, and is uninteresting; it branches off into the Waal, Yssel, Leck, and Vecht, and reaches the ocean as a small stream, almost disappearing among the sandbanks of the shore. The entire length of the Rhine is 960 miles; its breadth at Bâle is 750 feet; at Mentz, 1500 feet; at its entrance into the Netherlands, 2150 feet; its depth varies from 5 to 28 feet; its elevation is 814 feet at Bâle, 121 feet at Cologne. Its principal affluents are the Aar in Switzerland, the Neckar and Main in the Rheinthal, the Lahn and Moselle in the highlands of the lower Rhine. A. GUYOT.

Rhine, p.-v. and tp., Sheboygan co., Wis. P. 6672.

Rhine'beck, p.-v. and tp., Dutchess co., N. Y., on Hudson River and on New York Central and Hudson River R. R., opposite Kingston, has 11 churches, 2 newspapers, a bank, a paper-mill, carriage-factories, and is a shipping-point for the products of the surrounding agricultural region. P. 1322; of tp. 3719.

Rhinehart's, v., Edgefield co., S. C. P. 1438.

Rhine, Province of the. See RHENISH PRUSSIA.

Rhinobat'idæ [from *rhinobatus;* Gr. ῥινόβατος, the ancient name of a fish—ῥίς, ῥινός, "nose," and βάτος, "ray"], a family of selachians intermediate between the sawfishes (Pristidæ) and the typical rays. The body in front is a subcordate disk pointed forward, and ends behind in an elongated caudal portion resembling that of the Pristidæ; the skin is armed with spines, especially in a median dorsal row; the head is produced into a pointed snout; the mouth is rather small and transverse; the teeth small and obtuse; dorsals two, on the middle or posterior portion of the tail; the caudal fin is a heterocercal fold at the extremity of the tail. The family, chiefly distinguished by the form, is composed of species inhabiting the tropical and sub-tropical seas. According to some authors, there are five, and according to others, three genera—viz. *Rhinobatus*, *Rhynchobatus*, and *Trygonorhina*. THEODORE GILL.

Rhinoceros. See RHINOCEROTIDÆ.

Rhinocerot'idæ [from *rhinoceros*, ῥινόκερως, of the Greeks, from ῥίς, ῥινός, "nose," and κέρας, "horn"], a family of ungulate mammals embracing the various species combined under the popular name rhinoceros. They are distinguished by their massive form; short neck; long head; the presence in all the living forms of one or two horns on the middle of the nasal region, and the broad clavate feet, each of which has three toes. The skull has the basioccipital comparatively well developed behind and narrowed forward; the tympanic and periotic bones are ankylosed and wedged between the squamosal, exoccipital, and other adjacent bones; the nasal bones are produced forward and more or less arched, and meet an upward extension of the supramaxillary bones; the teeth are M. $\frac{3}{3}$, P. M. $\frac{4}{4}$, C. $\frac{0}{0}$, I. variable—*i. e.* entirely wanting, $\frac{1}{2}$, or, in extinct forms, $\frac{3}{3}$; the upper molars have a continuous outer wall, are without complete transverse crests, and are excavated by a deep valley extending obliquely inward from the median portion of the inner wall and (in P. M. 4, M. 1–2) a shallow one extending from the posterior wall; the lower molars (P. M. 2, M. 3) have two curved transverse crests. The family embraces but few recent species, which have been variously grouped, but appears to represent but two genera—(1) *Rhinoceros*, including the Asiatic species, which are distinguished by the elongate and free intermaxillary bones, the long upper incisor teeth, the produced nasal bones, and the skin corrugated by well-marked folds; and (2) *Rhinaster*, embracing the African species, in which the intermaxillary bones are very small and free, the upper incisor teeth wanting, the nasal bones broad and rounded, and the skin smooth and not corrugated. In former geological epochs other forms flourished, and one of these (*Cœlodonta*) survived long after the appearance of man on the globe: this form was distinguished by the union of the nasal and intermaxillary bones into one mass, and the ossification of the nasal septum. The existing species of the family are peculiar to Asia and Africa, but formerly the range of the family extended far northward into Europe and Siberia, and at a still earlier period the group was represented in North America. THEODORE GILL.

Rhinodont'idæ [from *rhinodon;* Gr. ῥίνη, "file," and ὀδούς, "tooth"], a family of sharks (order Squali) distinguished by their small teeth, in combination with other characters. The body has the usual shark-like form, the head flat and with a broad, short, and flat snout; spiracles very small; the nostrils have triangular flaps, and are nearly at the front of the snout; the mouth also is nearly terminal; the teeth extremely small, in numerous rows, and with conic recurved points; branchial apertures five, and moderately large, the last situated above the pectoral fin; dorsals two, unarmed, the first in advance of the ventrals, the second opposite the anal; anal rather small; caudal with the lower lobe well developed, with a pit at the root, but with no keels at the sides of the tail. The family has but two known species—(1) *Rhinodon typicus*, found at the Cape of Good Hope and Seychelles; and (2) *Micristodus punctatus*, known from the figure and the teeth of an individual twenty feet long found off the coast of California. Nothing is known of the habits of these fishes, but it is probable that, like the great basking shark (*Cetorhinus* or *Selache*), it is herbivorous. THEODORE GILL.

Rhinoloph'idæ [*rhinolophus;* Gr. ῥίς, ῥινός, "nose," and λόφος, "crest"], a family of insectivorous bats (Chiroptera) provided with nasal appendages. The ears are moderate, separate, and destitute of a tragus; the tail is well developed, and produced to the end of the interfemoral membrane; the intermaxillary bones are but little developed; teeth $\frac{4}{5}$, $\frac{5}{5}$, or $\frac{5}{6}$; canines $\frac{1}{1}$, incisors $\frac{1}{2} \times 2$; the molars have W-shaped ridges and are of large size; the middle finger is composed of two phalanges; the stomach is sac-like, and its extremities incline toward each other. The family is characteristic of the eastern hemisphere, and four species of the genus *Rhinolophus* ascend more or less toward the N. in Europe; two of them reach the British Islands. THEODORE GILL.

Rhinophrin'idæ [*rhinophrynus;* Gr. ῥίς, ῥινός, "nose," and φρῦνος, a "toad"], a family of amphibians of the order Salientia or Anura, distinguished by the imperfect ear and the attachment of the tongue in front. According to Cope, the ethmo-septal walls are ossified to the end of the muzzle and separate the prefrontals; its superior plate is covered by the completely-ossified fronto-parietal; the fronto-

nasals are well developed, entirely in contact with the fronto-parietals, separated by a median point of the latter and by the ethmoid septum; no pterygoid bone nor wing of ectopterygoid is developed; the ectopterygoid itself is straight, with a short maxillary suture; the coracoid and epicoracoid divergent, connected by a narrow single cartilage; the former not dilated, and in contact with or slightly separated from that of the opposite side; the sacral diapophysis dilated. As understood by Cope, it embraces two genera—*Rhinophrynus* and *Hemisus*—the former of which is a Mexican, and the latter an African genus; but by other authors (*e. g.* Mivart) it has been restricted to the American genus, *Rhinophrynus*. THEODORE GILL.

Rhinoplas'tic [Gr. ῥίς, ῥινός, "nose," and πλάσσειν, to "mould"] **Operations** are performed with the view to re-establish a lost nose or a part thereof, or to bring to a normal shape a deformation of this organ. The methods applied are very different. The flap for the new formation in the majority of cases is taken from the forehead, and is cut out so that a pedicle of it remains in connection until it is healed into the new place, thereby allowing the access of blood without interruption. In other cases the flap is taken from the cheeks and from the lip, transplanted in the same manner. Even from more remote parts of the body, especially the arm, the material has been taken successfully to replace a defect of the nose. This last method, as well as the employment of a second individual to supply the wanted flap for new formation, is not much in favor with the surgeons of the day, and is only made use of in very exceptional cases, where the material cannot be obtained otherwise. F. ZINSSER.

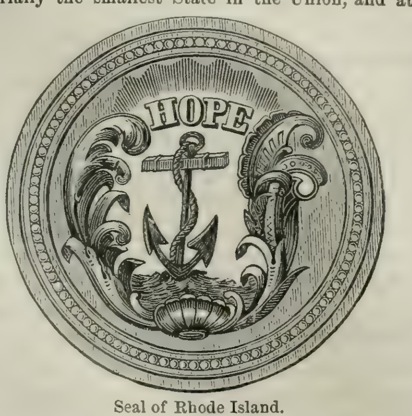
Rhiptoglos'sa [Gr. ῥίπτειν, to "dart," and γλῶσσα, "tongue"], a group or sub-order of saurians or lizards, distinguished by the very elongated worm-like and extensible tongue; the toes are united into two opposing groups; the teeth are on the edge of the jawbones. With these are coincident some osteological characters. The group has been formed for the reception of the family Chameleonidæ. THEODORE GILL.

Rhizogens [Gr. ῥίζα, "root," and γένειν, to "produce"], a proposed class of plants, comprising the Rafflesiaceæ, Balanophosaceæ, and Cytinaceæ, all parasitic, all fungus-like in growth, all phanerogamous, and nearly all having obscure and spore-like seeds. The better opinion seems to be that the two orders first mentioned are exogenous and the last endogenous. They seem to share in the qualities of cryptogamous and phanerogamous plants.

Rhizoph'aga [Gr. ῥίζα, "root," and φαγεῖν, to "eat"], a group or sub-order of marsupial mammals distinguished by the dentition, the incisor teeth being two in number ($\frac{1}{1}\times 2$) in each jaw, and renewable from the roots, as in the placental rodents; in the hind feet the second, third, and fourth toes are connected together. The group has the same position among the marsupials as the rodents among the placental mammals, but the dental characters are not accompanied with modifications of the other parts of the organization equal in value to those which are co-ordinated with the gliriform dentition in the rodents, and consequently the value of the group, even as a sub-order, among the marsupials, is doubtful. It only includes the family of wombats or PHASCOLOMYIDÆ (which see). THEODORE GILL.

Rhizopoda. See COMPARATIVE ANATOMY.

Rhode Island, one of the original thirteen States of the Union, belonging to the New England division; it is territorially the smallest State in the Union, and at the



Seal of Rhode Island.

same time perhaps, in proportion to the number of its inhabitants, the wealthiest. It lies between the parallels of 41° 18′ and 42° 3′ N. lat., and between the meridians of 71° 8′ and 71° 53′ W. lon. from Greenwich. It is bounded on the N. and E. by Massachusetts, on the S. by the Atlantic Ocean, and on the W. by Connecticut. Its extreme length from N. to S. is 47.5 miles, and its extreme breadth from E. to W. 40 miles, though its average breadth does not exceed 35 miles. Its area, if the waters of Narragansett Bay are counted as a part of it, is 1306 sq. m., or 835,840 acres; but its land-surface does not exceed 1054.6 sq. m., or 674,944 acres.

Face of the Country.—The surface of Rhode Island is considerably diversified, portions of it being hilly and broken, while other portions are level and sandy or marshy. There are no mountains in the State, and only a few eminences which are sufficiently elevated to be called hills. Of these the most noteworthy are the Woonsocket Hills in the N., Mount Hope, near Bristol, and Hopkins Hill, near the centre of the State. Narragansett Bay, extending inland about 30 miles from the ocean, divides the State into two unequal parts. Providence River (or estuary) and Bay are merely continuations of Narragansett Bay to the N., as Mount Hope Bay and Taunton River (or estuary) are to the E. The direct shore-line of the State fronting on the ocean is but about 45 miles, but the numerous sinuosities and islands in Narragansett Bay give a coast-line of about 350 miles washed by tide-water in the State. The southern coast of the State has extensive salt marshes and ponds of salt water. There are numerous islands belonging to the State, of which the best known are Rhode Island, with its three towns of Newport, Middletown, and Portsmouth, Canonicut, Prudence, Block Island, Patience, Perry, Hope, Dyer's, Dutch, and Goat islands. The State has three considerable rivers, which, though none of them navigable for any great distance, afford valuable water-power; these are—the Pawtucket, called above the town of that name the Blackstone, the Pawtuxet, which flows S. E. and forms the boundary between Kent and Providence cos., and the Pawcatuck, which flows through the western portion of the State and forms a part of the boundary between Rhode Island and Connecticut.

Geology.—Small as the State is in territorial extent, there is much variety and interest connected with its geology, and the legislature is making arrangements for a very thorough geographical and geological survey, from which valuable results in the way of economic geology may be expected. The western half of the State and a small tract along the eastern shore of Narragansett Bay are Eozoic, belonging to the same formation as that of Eastern Connecticut and Central and part of S. E. Massachusetts; but a tract covering all the islands of Narragansett Bay and part of its western shore, and extending N. E. into Bristol co., Mass., belongs to the Carboniferous era, and forms the easternmost bed of anthracite in the U. S. The coal has not been esteemed as equal to the Pennsylvania anthracite in quality, though perhaps even more extensive in quantity, but it improves in quality as lower strata are reached. About 10,000 to 15,000 tons are annually mined, and as a result of the geological survey it will probably be much more thoroughly explored and used. Excellent iron ore is found in various parts of the State, and lime of the best quality is burned from the limestones at Lime Rock, which belong to the coal-measures and abound in fossil plants. Sandstone, serpentine, and marble abound in several parts of the State, and excellent brick are made from the clay of Providence co. Block Island belongs to the Tertiary era.

Soil and Vegetation.—The soil of the State is for the most part moderately fertile, though the gravelly and pebbly soil of the western part and the sand-dunes and salt marshes of the S. W. are exceptions; but much of it is broken, rocky, and difficult of cultivation. The islands of Narragansett Bay and the region drained by Pawtucket and Pawtuxet rivers is the most arable. The vegetation does not differ materially from that of Massachusetts and Connecticut, though, from the presence of a large body of landlocked water like Narragansett Bay, the temperature is somewhat milder than that of either of the adjacent States. About one-fourth of the surface was in woodland in 1870. The flora and fauna also of the State are almost without exception those of Massachusetts and Connecticut. Narragansett Bay is a favorite resort for the duck, brant, and teal families, and the swamps and marshes adjacent for snipe, woodcock, and grouse.

Climate.—This, though somewhat modified by the influence of the bay, is not materially different from that of the adjacent States. The summer climate of Newport is delightful; the E. winds are tempered by the breadth of land over which they come, and the S. winds become mild by the influence of the Gulf Stream. The mean annual temperature of the State ranges from 47° to 51°. The average mean of Providence for 43 years was 47.94°, and the aver-

age annual range seldom exceeds 100°. The rainfall in the eastern part of the State averages about 40 inches, and in the western part sometimes reaches 44 inches. The average of Providence for 43 years was 44.81 inches.

Agricultural Productions.—Rhode Island is not an agricultural State. Her population is too dense, and her best lands too valuable for town-sites, to make farming, except in the way of market gardening, largely profitable. The area of farming-lands in the State, as in Massachusetts and Connecticut, has been gradually diminishing for the past twenty-five years, and mainly because the lands were becoming too valuable to be cultivated as farms; yet in 1870, 502,308 acres of her nearly 675,000 acres of area were in farms; of these, 289,030 were under cultivation, against 356,487 acres in 1850, while 213,278 acres were in woodland or other unimproved farm-lands. The value of these farms was in 1870, $21,574,968, and of farming implements and machinery, $786,246. The value of all farm productions for the year 1869–70 was $4,761,163; of animals slaughtered or sold for slaughter, $755,552; of market-garden products, $316,133. The crops of cereals are never large enough for home consumption. In 1869–70 the wheat crop was 784 bushels; rye, 20,214; Indian corn, 311,957; oats, 157,010; barley, 33,559; buckwheat, 1444; wool, 77,328 pounds; hay, 89,045 tons; a mere trifle of hops and tobacco; 669,408 bushels of potatoes; 9920 bushels of peas and beans; 498 pounds of beeswax, 6290 pounds of honey, and 765 gallons of domestic wines; clover and grass seed, 2892 bushels. The value of the live-stock the same year was $3,135,132. It consisted of 11,113 horses, 43 mules and asses, 40,105 neat cattle, 23,938 sheep, and 14,607 swine. The agricultural department's report for 1875 gives the following statistics of the produce of some of these items for that year: Indian corn, 281,000 bushels; rye, 21,000; oats, 145,000; barley, 25,500; potatoes, 560,000; hay, 96,100 tons; and an aggregate value for these crops of $3,316,228. The statistics of live-stock were as follows: horses, 14,700; milch cows, 20,400; oxen and other cattle, 16,000; sheep, 25,300; swine, 16,500; total value of live-stock, $3,673,485.

Manufacturing Industry.—Rhode Island ranks tenth among the States in the amount of her manufacturing products, but in proportion to her population and area she has a larger interest in manufactures than any other. In 1870 almost one-fourth of her entire population were employed in manufactories, and the annual product of her mills was about $530 to each inhabitant. Her statistics of manufactures were—1850 establishments, employing 49,417 hands (28,804 men, 14,752 women, and 5861 children); the capital invested was estimated at $66,557,322; the wages paid, at $19,354,256; the raw material used, at $73,154,109; and the annual product, at $111,418,354. Her most prominent industries were connected with the production of cotton, woollen, and worsted goods; the annual product of cotton goods was $22,139,203; of bleaching and dyeing these goods, $15,138,723; of printing cotton and woollen goods, $17,842,480; of the manufacture of woollen goods, $12,558,117; of the production of worsted goods, $2,835,950; and of cotton and woollen machinery, $4,316,376; making 315 establishments employed and nearly $75,000,000 produced, directly or indirectly, in the manufacture of these classes of goods. The other industries which yielded the largest products were—jewelry, $3,043,846; screws, $1,882,318; leather tanned and curried, $1,828,264; india-rubber and elastic goods, $1,804,868; iron and iron manufactures, $2,619,793; clothing, $1,448,066; molasses and sugar refined, $1,600,980; flouring-mill products, $1,281,887; silver and plated ware, $1,212,240. The statistics of the manufactures of the State in 1875 are now (Mar., 1876) tabulating, and if practicable some of them may be given in our article.

Railroads.—There were Jan. 1, 1876, 220.33 miles of railroad-track in the State in operation; the capital stock of these roads was $37,247,313.35; the total indebtedness, $15,427,385.83; the total receipts, $3,743,554.17; the total earnings, $2,131,002.62; the number of passengers, 20,575,973; total tons of merchandise carried, 2,748,267; total number of locomotives, 229, and of cars, 4823. About 57 miles more of railroad were to be completed during 1876. There are some canals for manufacturing purposes in the State, but none for navigation.

Finances.—The bonded debt of the State amounts to $2,563,500, less $181,000 in sinking fund. The habit of making semi-annual reports to the legislature, which sits twice a year, makes it a little difficult to ascertain the exact amount of receipts and expenditures for the entire year. For the year ending Apr. 30, 1875, they were $763,276.07; for the year ending Apr. 30, 1876, it was known on Jan. 11, 1876, that they would exceed $910,000. The payments for the year ending Apr. 30, 1875, were $581,731.92; for the 8 months and 11 days ending Jan. 11, 1876, they were $908,258. The valuation of property by the State board of assessors for 1875 was $328,538,559; that of the town assessors for the same year was $270,415,023.

Commerce.—The following table gives the statistics of the imports, domestic and foreign, exports, entrances, and clearances and tonnage belonging to the three customs districts of Rhode Island, at the dates specified:

Customs Districts.	Imports for year ending June 30, 1875.	Domestic exports, year ending June 30, 1875.	Foreign exports, year ending June 30, 1875.	Imports for year ending Sept. 30, 1875.	Domestic exports, year ending Sept. 30, 1875.	Foreign exports, year ending Sept. 30, 1875.	Entrances of shipping for year ending June 30, 1875, including coastwise trade.			Clearances of shipping for year ending June 30, 1875, including coastwise trade.			Total entrances and clearances, including coastwise trade.			Registered, enrolled, and licensed tonnage for year ending June 30, 1875.	
							Vessels.	Tonnage.	Crews.	Vessels.	Tonnage.	Crews.	Vessels.	Tonnage.	Crews.	Vessels.	Tonnage.
	$	$	$	$	$	$											
Bristol and Warren	....	5,100	....	....	5,100	....	39	5,471	216	62	50,752	843	101	56,223	1,059	19	1,105.35
Newport	1,750	11,632	....	325	11,632	....	336	802,565	28,876	332	[illegible]	29,045	668	1,609,224	57,921	137	6,842.65
Providence	312,950	22,850	238	208,248	30,305	238	992	771,355	23,747	282	[illegible]	3,505	1,274	904,014	27,252	132	34,232.84
Totals	314,700	39,582	238	208,574	47,037	238	1,367	1,579,391	52,839	676	990,070	33,393	2,043	2,569,461	86,232	288	42,180.74

Banks, National, State, and Savings.—There were in Jan., 1875, 62 national banks in the State, having an aggregate capital of $20,504,800 paid in, $14,718,400 in bonds on deposit, and an outstanding circulation of $13,269,820. On Nov. 27, 1875, there were 15 State banks in operation, having an aggregate capital of $5,091,697.20, an outstanding circulation of $20,589.50, and net profits on hand of $252,350.63. There were at the same date 38 savings banks in the State (2 of them in the hands of receivers), having 101,635 depositors and $51,311,330.62 of deposits—an average of about $500 to each depositor.

Insurance Companies.—The statements of the insurance companies are to Jan. 1, 1876. There were at that time 6 joint-stock fire insurance and 18 mutual fire insurance companies organized in the State; the 6 stock companies represent a paid-up cash capital of $1,300,000; gross assets, $2,210,045; liabilities, including reinsurance, $690,816; surplus as regards policy-holders, $1,519,228. Four of these companies also did a moderate marine business. The 18 mutual fire companies show cash assets of $1,226,207; liabilities, including reinsurance, of $712,940; surplus, $513,267. There are no life insurance companies in the State.

Population.—In 1730, the population was 17,935; in 1755, 40,414; in 1770, 59,678; and in subsequent years as follows:

Census year.	Total pop.	Males.	Females.	White.	Free colored.	Slaves.‡	Natives.	Foreigners.	Density.	Ratio of increase.	Illiteracy.	Of school age, 5 to 20.	Of military age, 18–45, males.	Of voting age, 21 and upward, males.	Citizens.	Number of dwellings.	Number of families.	Number of persons in a family.
1790	68,825	33,397	35,428	64,470	4,355	952	......	......	52.70	....	......	......	14,244	[illegible]				
1800	69,122	33,517	35,605	65,438	3,684	381	......	......	52.93	.02	......	......	[illegible]	[illegible]				
1810	76,931	37,610	38,321	73,214	3,717	108	......	......	58.91	11.44	......	......	16,041	[illegible]				
1820	83,059	40,101	42,958	79,413	3,602	48	......	......	63.60	7.83	......	......	[illegible]	[illegible]				
1830	97,199	46,881	50,318	93,621	3,578	17	......	......	74.42	17.02	......	......	[illegible]	[illegible]				
1840	108,830	52,775	56,055	105,587	3,243	5	......	......	84.33	11.97	......	......	[illegible]	[illegible]	15,789			
1850	147,545	72,078	75,467	143,875	3,670	1	124,299	23,246	112.97	†35.57	3,607	45,993	31,775	[illegible]	[illegible]	22,379	28,216	[illegible]
1860	174,620	84,133	90,487	170,649	*3,971	....	137,226	37,394	133.71	†18.35	6,112	[illegible]	35,885	[illegible]	34,472	[illegible]	[illegible]	4.96
1865	184,965	88,263	96,702	180,878	4,087	....	145,262	39,703	141.62	5.92	14,763	57,389	[illegible]	48,071	[illegible]	28,666	[illegible]	4.72
1870	217,353	104,756	112,597	212,219	*5,154	....	161,957	55,396	166.43	17.51	21,921	[illegible]	44,377	58,752	43,996	[illegible]	46,133	4.71
1875	258,239	125,602	132,637	251,968	*6,271	....	186,609	71,630	197.73	18.81	......	......	......	......	......	[illegible]	[illegible]	4.67

* Including 19 Indians in 1860, 154 in 1870, and 79 in 1875. † Increase in ten years.
‡ The slaves, being so few in number, are included with the free colored in making up the totals.

Education.—Public Schools. The report of the commissioners of public schools for the State gives the following particulars in relation to the public schools Jan. 1, 1876: There were 38,554 different pupils entered upon the roll in the day schools and 4600 in the evening schools. The average number of pupils in attendance upon day schools was 30,102, and upon evening schools, 2256; whole number of day schools, 737, of which 436 were graded and 301 ungraded; whole number of evening schools, 39. Average length of schools, 8 months 18 days; number of different teachers who taught during some portion of the year, 1056—viz. males 195, females 861; number of teachers regularly employed, 822; amount paid male teachers, $93,617.70; average monthly wages of male teachers, $85.18; amount paid female teachers, $289,666.44; average wages paid female teachers per month, $46.17. The total receipts from all sources for school purposes were $761,796.92, including State, town, and district appropriations, registry taxes, etc.; the total expenditures for the year 1875 were $764,643.74, which included school buildings, furniture, apparatus, etc., as well as teaching and supervision. The number of school-houses was 426; estimated value of the same, $2,360,017. Number of children between 5 and 15 years of age in the State, June 1, 1875, 53,316. Thirteen cities and towns have high-schools as a part of their graded system. The total expenditure per head of school population is $8.85; for the average number belonging to the schools, per head, $15.68; for the average attendance, $18.04; and for each pupil's instruction per month, $1.92. The permanent school fund is $265,142.51. There is a State normal school at Providence, founded in 1871, which in 1875 had 159 students and 13 teachers and special instructors. Its course of instruction is very thorough and practical. The high schools of the larger cities and towns are admirably conducted, most of them being endowed to a greater or less extent, and their course of instruction extends to the second year of college. There are also 5 or 6 academies and seminaries of excellent reputation, and 5 preparatory schools, having 43 instructors and 607 pupils. The only college in the State is Brown University at Providence, organized in 1765, and having, aside from its undergraduate course, a course of practical science in agriculture, chemical technology, and civil and mechanical engineering. The university has 15 professors, 253 students in the collegiate course, and about 30 in the scientific. Its grounds, buildings, and apparatus are valued at $1,500,000; its productive funds at $687,814 (including $50,000 from the proceeds of the agricultural land-grant); its income from productive funds, $41,470, and from all sources $64,479. Its scholarship funds amount to $55,000, and it has a library of 40,000 volumes.

Charitable and Special Education.—The State has no asylum for deaf mutes, the blind, or the feeble-minded. It had Jan. 1, 1876, 7 State beneficiaries at the American Asylum for the deaf and dumb at Hartford, 10 at the Perkins Institution and Massachusetts Asylum for the blind in Boston, and 2 at the Massachusetts School for idiotic and feeble-minded youths at South Boston.

Charitable and Penal Institutions.—The Butler Hospital for the insane is a private or chartered institution, but receives State patients to a limited extent; 42 such were in that hospital Jan. 1, 1876. The State farm near Providence has an insane hospital, which had Jan. 1, 1876, 173 patients; a workhouse and house of correction, with 279 inmates; and an almshouse, with 164 inmates. There is a reform school at Providence, which had Nov. 1, 1875, 217 children (175 boys, 42 girls), with 4 teachers. The State prison has the reputation of being well conducted, but was very much crowded, and the State is erecting a new one on the State farm. On Jan. 1, 1876, there were 57 prisoners. The Providence county jail is a large and well-managed prison, to which about 2000 prisoners are annually committed, and about the same number discharged. The other 4 county jails are better than the average of such institutions in other States.

Vital Statistics.—The births for the year ending Jan. 1, 1875, were 6466; the marriages 2541, the deaths 4229. Of the births, 3311 were males, 3155 females; 2703 were of American and 2948 of foreign parentage, while 815 were of mixed parentage. The marriages were 1495 of Americans, 695 of foreigners, 351 mixed. The deaths were 2111 males, 2118 females—2282 of American parentage, 1947 of foreign parentage. The age of 2105 males and 2111 females was known; the average age of males was 28.03, of females 31.66, of both sexes 29.86.

Newspapers.—In 1870 there were 32 newspapers of all classes in the State, having an aggregate circulation of 82,050, and annually issuing 9,781,500 copies. Of these, 6 were dailies, with 23,250 circulation; 1 semi-weekly, with 1200 circulation; 19 weeklies, with 43,950; 6 monthlies, with 13,650 circulation. In 1872 only 26 newspapers were reported, of which 6 were dailies, 15 weeklies, and 5 monthlies. We believe subsequent accessions have brought the number up to that of 1870, with a moderate increase of circulation.

Churches.

Denominations.	Number of church organizations, 1870.	Number of church edifices, 1870.	Number of sittings, 1870.	Amount of church property, 1870.	Number of church organizations, 1875.	Number of church edifices, 1875.	Number of ministers, 1875.	Number of church members, 1875.	Adherent population, 1875.	Church property, 1875.
All denominations	295	283	125,183	$4,117,200	336	323	311	40,404	236,060	$5,141,400
Regular Baptists	75	73	23,695	719,400	65	65	69	10,080	51,000	1,007,800
Free-Will, Seventh-Day, and Six-Principle Baptists	34	34	11,191	158,000	46	44	47	5,906	29,500	239,500
Christian Connection	12	12	3,050	33,500	14	13	12	2,040	9,000	57,000
Congregationalists	27	27	18,500	620,000	28	27	32	4,442	22,000	750,000
Protestant Episcopalians	42	39	17,155	735,100	42	40	41	5,481	20,000	760,000
Friends	17	17	5,514	58,600	18	18	.....	3,615	14,000	81,500
Methodists (Episcopal)	33	30	14,605	371,300	45	41	36	5,089	25,400	581,600
Presbyterians	.....	.....	....	....	2	2	2	232	1,160	25,000
Roman Catholics	22	20	19,108	910,100	48	36	43	....	50,000	1,086,000
Second Adventists	17	14	3,370	28,700	17	15	14	1,920	6,800	39,000
Unitarians	4	4	3,450	229,000	4	4	4	750	3,600	256,000
Universalists	4	4	2,770	220,000	4	4	8	549	2,500	250,000
Union churches	.....	4	700	6,500	3	4	3	300	1,500	8,000

There were also in the State in 1870, 1 Jewish synagogue; 1 Lutheran church, with one church edifice, 400 sittings, and $1500 of church property; 1 Reformed Presbyterian or United Presbyterian church, with 1 church edifice, 500 sittings, and $10,000 of church property; 1 Spiritualist assembly; and one local mission, with 1 church edifice, 500 sittings, and $10,000 of church property.

Constitution, Courts, Representatives in Congress, etc.—The State, like the colony, of Rhode Island has always been liberal in its privileges and franchises to its citizens, but eminently conservative in its form of government. By the skill and tact of its founders and leaders, Roger Williams, John Clarke, William Coddington, Benjamin Arnold, and others, there was secured from King Charles II. in 1663 a charter guarantying to the colonists a much larger measure of liberty and self-government than any other granted to an American colony; this charter was suspended from 1686 to 1690 under the Andros administration, but was then revived, and proved so good an organic law that it was continued in force not only throughout the Revolutionary war, but up to the year 1843. A State constitution was, after several efforts and some disturbance, adopted in 1842, ratified by the people, and finally went into operation in May, 1843. This constitution, with three or four not very important amendments, has continued to be the organic law of the State from that time to the present. It provides that voters, in addition to the ordinary qualification of residence and the usual exceptions of disqualification, must either have real estate of the value of $134 or property renting for not less than $7 per annum, or must pay a tax of at least $1, or have done military duty during the year. The legislature consists of a senate, now having 36 members (1 from each town), and a house of representatives, not exceeding 72 members. They hold two sessions annually, the principal one at Newport, and an adjourned one at Providence in October. The executive power is vested in a governor and lieutenant-governor, both annually elected by the people. The secretary of state, attorney-general, and general treasurer, and since 1856 a State auditor, who is also bank and insurance commissioner, are also chosen by the people. The commissioner of public schools was for many years appointed by the governor and senate, but is now chosen by the board of education. The judicial power is vested in a supreme

court, consisting of 1 chief-justice and 4 associate justices, which holds its sessions twice a year in each county, and has both appellate and original jurisdiction; of courts of common pleas, presided over by one of the associate justices of the supreme court, also holding sessions twice a year in each county; of justices' courts, presided over by a trial justice, of whom those for Providence, Newport, Woonsocket, and Pawtucket are elected by the general assembly, and in the other 32 towns by the town councils; and of probate courts for each town, the judges of which in Newport, Providence, Pawtucket, East Providence, and Cranston are elected by the general assembly, and in the remaining cases the town council is the court of probate. The State is entitled under the apportionment of 1872 to two members of Congress.

Counties.

Counties.	Pop. in 1875.	Males in 1875.	Females in 1875.	Pop. in 1870.	Assessed valuation in 1875.	State valuation in 1874.
Bristol........	11,019	5,142	5,877	9,421	$10,774,005	$11,720,253
Kent...........	20,348	9,881	10,467	18,595	16,814,922	17,512,556
Newport.......	21,887	10,612	11,275	20,050	37,501,436	39,044,754
Providence	184,924	89,981	94,943	149,190	189,129,860	242,124,912
Washington ...	20,061	9,986	10,075	20,097	16,194,801	18,136,084
Totals........	258,239	125,602	132,637	217,353	$270,415,023	$328,558,559

Principal Towns.—The two capitals of the State are—Providence, which had a population in 1875 of 100,675, and Newport, which had the same year 14,028 inhabitants. The other principal towns are—Pawtucket, which had in 1875, 18,464; Woonsocket, 13,576; Warwick, 11,614; Lincoln, 11,565; Bristol, Burrillville, Cranston, Cumberland, Johnston, and Westerly, each between 5000 and 6000; Coventry, East Providence, Scituate, South Kingstown, and Warren, each between 4000 and 5000; and North Kingstown and East Greenwich, each between 3000 and 4000.

History.—There seems to be convincing evidence that the Northmen, who visited the North American coast in the tenth and eleventh centuries and planted their colonies there, explored the waters of Narragansett Bay and established one of those colonies on Aquetneck (or Rhode) Island, near the present site of Newport, and that the Vinland, of which they speak so often, was that island. It is the belief of many antiquarians that the round stone tower at Newport, which now forms so picturesque a ruin, was built by these colonists, and the inscriptions on Dighton Rock in Taunton River are also said to be Icelandic or Norse runes. In 1524, Verazzano visited Narragansett Bay, and remained there about two weeks trading with the Indians, who were then very numerous. The founder of the present State of Rhode Island was Roger Williams, an eminent English clergyman and scholar, who emigrated to the Massachusetts Bay Colony and became pastor of the church at Salem. A vigorous and original thinker, of logical mind and great moral courage, he soon startled the leading ministers, who were the ruling spirits of that colony, by the avowal of his doubts (which soon ripened into disbelief) of the propriety of infant baptism, and his conviction that immersion was the only scriptural mode of baptism. He had come to these conclusions by no instruction from others, but solely by his own investigations and logical reasoning. When called to account by the ministers and magistrates for these departures from their faith, he boldly enunciated a doctrine which seemed to them more heretical and pestilential than those he had previously avowed; it was this: that the civil power had no authority to bind men to the belief or maintenance of any religious doctrine—that the human conscience in all these matters was responsible to God alone; and while he admitted the right of the civil magistrates to punish any violation of the moral code, he contended earnestly for "soul-liberty." These doctrines were deemed by the clergymen and civil magistrates subversive of all the purposes for which they had left their native land: they had come to escape persecution and to maintain their own religious views, not to establish a place of refuge for others who differed from them as much as they differed from the dominant party in England; and they would not hear anything in favor of Mr. Williams's views. They labored very earnestly with him to induce him to give up these doctrines, which they regarded as heretical, but finding him fixed in his opinions they notified him in the winter of 1635–36 to leave the colony within six weeks, under penalty of being sent to England by the first vessel. He left Salem, and plunged into the wilderness in what is now Bristol co., Mass., and after six weeks of extreme hardship eventually came in the early spring of 1636, in a canoe, to the present site of Providence, and was greeted on landing by an Indian with the words, "What cheer, Owannux?" the last being the Indian word for "Englishman." He pitched his tent at this point, where he was presently joined by others who, like himself, had been banished for their religious belief. He founded the town of Providence, giving it that name in acknowledgment of "God's good providence in directing him thither;" and when, two years later, his friend, William Coddington, followed him into the wilderness, he advised him to purchase from the Indians the island of Aquetneck or Rhode Island and start another colony there. The towns of Providence, Newport, Portsmouth, and Warwick remained independent of each other, though in most friendly accord, until 1647 (though Newport and Portsmouth were united under the government of Mr. Coddington), when the four towns united under a patent or charter granted by Parliament in 1643. In 1651, for some reason, Providence and Warwick separated from the other two, and had a government of their own for three years, when they reunited, and were from 1654 to 1657 under the presidency of Roger Williams, who was succeeded by Benedict Arnold, subsequently, for ten years in all, governor of the colony. In 1663, John Clarke, aided by Roger Williams, obtained from Charles II. a remarkably liberal charter, under which the colony and State were governed for 179 years. Williams and his friends and coadjutors carried out consistently their principles of religious and civil liberty, and the young colony, notwithstanding the jealousies of its neighbors, grew rapidly. From Massachusetts, Connecticut, and New York numbers came to this colony to find shelter from persecution and intolerance; and it is not greatly to the credit of the Massachusetts Bay colony (Plymouth was more just) that, notwithstanding Williams's great services to that colony in mediating between it and the Indians, and repeatedly preventing Indian raids and massacres, it never reversed or repealed its sentence of banishment. The great Indian war of 1675, from which Rhode Island suffered severely, might have been averted had the counsels of the Rhode Island leaders been heeded. As it was, it cost the colony largely in blood and treasure, and terminated only by the death of Philip of Pokanoket on Rhode Island soil. Rhode Island was not even consulted or informed of the great battle in the "Narragansett country" on her own soil in Dec., 1675, in which 1000 Indians perished or were captured, 300 of them being burned to death by the setting of their camp on fire by the colonial troops. In Jan., 1686–87, Sir Edmund Andros suspended the charter of the colony and made Rhode Island a county of his extensive domain; but in Feb., 1689–90, Andros having been deposed, the colony was reorganized under the charter. For the next 80 or 90 years the colony grew into prominence for its commerce and naval importance. In the wars between Great Britain and France the little colony was particularly active. In 1756 she had 50 privateers at sea, manned by about 1500 men. In the war of the Revolution her citizens were active and prominent both on sea and land. Commodore Hopkins, Paul Jones, the most daring of naval heroes, and Commodores Whipple and Talbot, as well as many of their crews, were Rhode Islanders. Gen. Nathaniel Greene, one of the most conspicuous names among the heroes of the Revolution, was a Rhode Islander and commanded Rhode Island troops during a part of his battles. The little State was in several particulars more prompt in her actions in matters looking to independence of Great Britain than even Massachusetts, which has usually been supposed to have led in these matters. Newport was occupied and held by the British forces from Dec., 1776, to near the close of 1779. In 1780 the count de Rochambeau of our French allies made it his head-quarters. After the war, Newport for some years contended successfully with Boston and New York for the commercial supremacy of the new republic. The State was the last of the thirteen to ratify the Constitution of the U. S., and delayed her admission to the Union till May 29, 1790. In the war of 1812 some of the best naval actions of the war were fought by Rhode Islanders. The naval battle of Lake Erie, under the leadership of Commodore O. H. Perry, was essentially a battle between Rhode Islanders and the British, the commodore, captains, and most of the men being from Rhode Island. The privateers of the State also won many victories. In the period subsequent to that war the only noteworthy event in the State was what was known as the "Dorr rebellion." Repeated efforts had been made for a number of years to replace the charter by a State constitution. One was framed in 1824 and rejected by the people. In 1841 a convention called the "People's convention" met and framed a constitution, which was submitted to the people. Their action was wholly irregular, and the general assembly took no notice of their proceedings. The friends of the new constitution claimed that it was ratified by the people, and proceeded to organize a government under it, electing Thomas Wilson Dorr governor. The general assembly ordered a convention to be held in Nov., 1841, and this convention prepared a constitution which was rejected

by the people in Mar., 1842. The general assembly and the regular State government were, however, elected, and a collision seemed inevitable. Mr. Dorr led his forces, but they were overpowered without bloodshed, and Dorr was compelled to flee. After his flight a new convention was called, and the constitution under which the State is now governed was prepared in Nov., 1842, ratified by the people, and went into operation in May, 1843. Mr. Dorr, who had escaped first into Connecticut and afterward into New Hampshire, voluntarily returned and gave himself up to the authorities. He was tried for the crime of high treason, convicted, and on the 25th of June, 1844, sentenced to imprisonment for life at hard labor. A few years convinced the statesmen of the State of the unwisdom of this action, and in 1851 Mr. Dorr was restored to his civil and political rights. At the commencement of the late civil war the State sent off a body of troops for the defence of Washington, and the governor of the State accompanied and commanded one of her regiments, while another of its citizens, subsequently a governor of the State, was one of the most distinguished of the Union generals, and for a time the commander of the Army of the Potomac.

Governors.—The State originally consisted of four towns. Two of these, Portsmouth and Newport, had at first judges independent of each other, but from 1640 to 1647 united on William Coddington as their governor. Providence and Warwick had no governor or judge until 1647, when the four towns were united under letters patent.

I. COLONIAL.

(1) *Presidents under the Patent.*

John Coggeshall............1647–48
William Coddington......1648–49
John Smith....................1649–50
Nicholas Easton............1650–51

(2) *The Division* (1651–54).

(*a*) *Providence and Warwick.*

President John Smith...1652–53
President Gregory Dexter.............................1653–54

(*b*) *Portsmouth and Newport* (1651–54).

President John Sanford, Sen...........................1652–54

(3) *Reunion of Towns* (1654–63), *Presidents.*

Nicholas Easton............1654–54
Roger Williams.............1654–57
Benedict Arnold............1657–60
William Brenton...........1660–62
Benedict Arnold............1662–63

(4) *Royal Charter Governors.*

Benedict Arnold............1663–66
William Brenton...........1666–69
Benedict Arnold............1669–72
Nicholas Easton............1672–74
William Coddington......1674–76
Walter Clarke...............1676–77
Benedict Arnold *..........1677–78
William Coddington,* Aug., 1678–Nov., '78
John Cranston,* Nov., 1678–Mar., '80
Peleg Sanford................1680–83
William Coddington, 2d..1683–85
Henry Bull....................1685–86
Walter Clarke,† May, 1686–June, '86
Henry Bull..Feb., 1690–May, '90
John Easton..................1690–95
Caleb Carr *..................1695–95
Walter Clarke................1696–98
Samuel Cranston *......1698–1727
Joseph Jencks...............1727–32
William Wanton *.........1732–33
John Wanton *.............1734–40
Richard Ward...............1740–43
William Greene............1743–45
Gideon Wanton............1745–46
William Greene............1746–47
Gideon Wanton............1747–48
William Greene............1748–55
Stephen Hopkins..........1755–57
William Greene *...........1757–58
Stephen Hopkins, 1758–62, 1763–65, and 1767–68
Samuel Ward, 1762–63 and 1765–67
Josias Lyndon...............1768–69
Joseph Wanton ‡...........1769–75

II. STATE ORGANIZATION, BUT UNDER THE CHARTER.

Nicholas Cooke..............1775–78
William Greene, Jr........1778–86
John Collins..................1786–90
Arthur Fenner *.........1790–1805
Paul Mumford (acting)*.1805–05
Henry Smith (acting).....1805–06
Isaac Wilbur (acting).....1806–07
James Fenner................1807–11
William Jones................1811–17
Nehemiah R. Knight.....1817–21
William C. Gibbs...........1821–24
James Fenner................1824–31
Lemuel H. Arnold.........1831–33
John B. Francis............1833–38
William Sprague...........1838–39
Samuel W. King............1839–43

III. GOVERNORS UNDER THE CONSTITUTION OF 1843.

James Fenner................1843–45
Charles Jackson............1845–46
Byron Diman................1846–47
Elisha Harris................1847–49
Henry B. Anthony.........1849–51
Philip Allen..................1851–52
William B. Lawrence (acting)......................1852–52
Philip Allen..................1852–53
Francis M. Dimond (acting)..........................1853–54
William W. Hoppin.......1854–57
Elisha Dyer...................1857–59
Thomas G. Turner.........1859–60
William Sprague...........1860–61
John R. Bartlett (acting).1861–62
William C. Cozzens (acting)..........................1863–63
James Y. Smith.............1863–66
Ambrose E. Burnside.....1866–69
Seth Padelford...............1869–73
Henry Howard..............1873–75
Henry Lippitt................1875–

Electoral and Popular Votes for President and Vice-President.

Year of election.	Candidates for whom the electoral vote of the State was cast.	Electoral vote.
1792	George Washington P.. / John Adams V.-P......	4
1796	John Adams P.......... / Oliver Ellsworth V.-P..	4
1800	John Adams P............	4
	C. C. Pinckney V.-P......	3
	John Jay V.-P............	1
1804	Thomas Jefferson P..... / George Clinton V.-P....	4
1808	C. C. Pinckney P....... / Rufus King V.-P.......	4
1812	De Witt Clinton P...... / Jared Ingersoll V.-P....	4
1816	James Monroe P........ / D. D. Tompkins V.-P...	4
1820	James Monroe P........ / D. D. Tompkins V.-P...	4

Year of election.	Candidates for whom the electoral vote and popular majority were cast.	Electoral vote.	Pop. vote.	Opposition or minority party candidates.	Pop. vote.	Other candidates.	Pop. vote.
1824	John Quincy Adams P......	4	2,145	William H. Crawford P.. / Nathaniel Macon V.-P...	200	Andrew Jackson P.......	No report.
	John C. Calhoun V.-P......	3					
1828	John Quincy Adams P.... / Richard Rush V.-P.......	4	2,754	Andrew Jackson P....... / John C. Calhoun V.-P...	821		
1832	Henry Clay P............ / John Sergeant V.-P.......	4	2,810	Andrew Jackson P........ / Martin Van Buren V.-P..	2,126		
1836	Martin Van Buren P...... / Richard M. Johnson V.-P..	4	2,964	William H. Harrison P.. / Francis Granger V.-P...	2,710		
1840	William H. Harrison P... / John Tyler V.-P..........	4	5,278	Martin Van Buren P..... / Richard M. Johnson V.-P.	3,301	James G. Birney P....... / Thomas Earle V.-P......	42
1844	Henry Clay P............ / T. Frelinghuysen V.-P....	4	7,322	James K. Polk P.......... / George M. Dallas V.-P...	4,867	James G. Birney P....... / Thomas Morris V.-P.....	107
1848	Zachary Taylor P......... / Millard Fillmore V.-P.....	4	6,779	Lewis Cass P.............. / Wm. O. Butler V.-P......	3,646	Martin Van Buren P..... / C. Francis Adams V.-P..	730
1852	Franklin Pierce P........ / William R. King V.-P.....	4	8,735	Winfield Scott P.......... / Wm. A. Graham V.-P...	7,626	John P. Hale P.......... / George W. Julian V.-P..	644
1856	John C. Fremont P....... / William L. Dayton V.-P...	4	11,467	James Buchanan P...... / J. C. Breckenridge V.-P.	6,680	Millard Fillmore P....... / A. J. Donelson V.-P.....	1,675
1860	Abraham Lincoln P...... / Hannibal Hamlin V.-P...	4	12,244	Stephen A. Douglas P.... / H. V. Johnson V.-P......	7,707	John Bell P............. / Edward Everett V.-P.....	No report.
1864	Abraham Lincoln P....... / Andrew Johnson V.-P.....	4	13,692	George B. McClellan P... / George H. Pendleton V.-P.	8,470		
1868	Ulysses S. Grant P....... / Schuyler Colfax V.-P.....	4	12,993	Horatio Seymour P....... / Francis P. Blair, Jr., V.-P.	6,548		
1872	Ulysses S. Grant P....... / Henry Wilson V.-P.......	4	13,665	Horace Greeley P......... / Benj. Gratz Brown V.-P..	5,329		

(For many valuable statistics, documents, and suggestions embodied in this article the writer is indebted to Edwin M. Snow, M. D., superintendent of the State census and health-officer of the city of Providence. Dr. Snow is also author of the article PROVIDENCE in this work.)

L. P. BROCKETT.

Rhodes [Lat. *Rhodus*], an island in the Mediterranean, belonging to Turkey, 10 miles off the coast of Asia Minor, having an area of 420 sq. m., with 35,000 inhabitants, of whom 10,000 are Turks, 3000 Jews, and the rest Greeks. It is mountainous—the highest peak, Atairo, the ancient *Atabyris*, rising 4560 feet—but the soil is fertile and the climate most delicious. Forests of fir cover the mountains; in the valleys figs, oranges, grapes, and olives ripen to perfection. The coral fisheries are an important branch of industry.

Rhodes, the capital of the island of Rhodes, on the north-eastern extremity of the island, rising in terraces around its two fortified harbors, and surrounded with walls and defended by citadels, was founded in 408 B. C., and rose very soon to eminence among the Greek cities, both as a commercial port and as a seat of learning. At the entrance of one of its harbors stood the so-called Colossus of Rhodes, a brazen statue of Helios, one of the seven wonders of the world, and 300 other statues adorned the city. This splendor was to some extent destroyed by Cassius, who defeated the Rhodians in a naval battle in 42 B. C., and sacked their capital; but the island and the city rose once more into importance and prosperity in the period from 1309 to 1522, while in the possession of the Knights of St. John. It was made a very strong fortress and its commerce flourished. After its conquest in 1522 by the Turks, it greatly declined, and having suffered severely in 1851, 1856, and 1863 by earthquakes, and in 1856 by a fearful powder-explosion which destroyed all its principal buildings, large parts of it are now only heaps of ruins. Its commerce is carried on by Greeks, who live in the suburbs outside the walls, but its harbors are nearly spoiled, and the Turkish government is doing nothing to help it. P. about 20,000.

Rhodes (ROBERT E.), b. at Lynchburg, Va., in 1826; graduated at the Virginia Military Institute 1848; was professor there for several years; afterward settled at Mobile, Ala.; entered the Confederate service as colonel 1861; was soon made brigadier-general; fought in most of the great battles in Virginia; was made major-general for good services at Chancellorsville 1863; was at Gettysburg, and afterward commanded a corps under Early in the Valley of Virginia, and was killed at the battle of Winchester, Sept. 19, 1864.

Rhodes, Inner and **Outer.** See APPENZELL.

Rhodes'ville, v., Lincoln co., N. C. P. 872.

Rho'dium [Gr. ῥόδεος, "rose-colored," from the colors of some of its compounds], a metal found in 1804 by Wollaston associated in small quantity with native platinum. The process of obtaining it from the "platinum residues" is complex, and will be found in the chemical textbooks.

* Died in office. † Charter suspended till 1689. ‡ Displaced.

It is whitish-gray and very hard; highest density when fused, 12.1; equivalent, about 104. It is one of the most infusible metals, but may be fused in the oxyhydrogen quicklime furnace of Deville. Pure, it is not acted on by the most powerful acids, but in alloy with some of the other metals may be dissolved in *aqua regia*. Fusion with saltpetre oxidizes it easily, and even fusion with sulphate of potash converts it into a soluble double salt. Chlorine combines with it at a red heat, forming a soluble chloride. It forms four oxides (RdO, Rd_2O_3, RdO_2, and RdO_3). The first two are absolutely insoluble in the strongest acids, and the third almost so. A native alloy of rhodium and gold from Mexico has been reported by Prof. del Rio as containing 34 to 43 per cent. of rhodium. Dana regards this as requiring confirmation. HENRY WURTZ.

Rhodium, Oil of, a balsamic volatile oil obtained from Canary Island rosewood, the woody root of *Rhodoriza scoparia* and *florida*, convolvulaceous plants. The oil is employed as a perfume, and to attract fishes and game to traps of various kinds. Horses are very fond of the odor.

Rhododen'dron [Gr. ῥοδόδενδρον, "rose tree"], a large genus of plants of the natural order Ericaceæ, comprising trees, shrubs, and rootlet-climbing epiphytes, with entire, alternate evergreen, or rarely deciduous leaves, and showy flowers in terminal clusters; these with funnel-form 5-lobed corollas and usually ten declining stamens. Passing S. of the equator only into Java and the neighboring islands, the rhododendron is found throughout the mountainous districts of the northern hemisphere. The greatest number of species occurs in the high mountain-regions extending from Java and Borneo on the S. to the Sikkim Himalaya in the N. Several are found in China and Japan, two reach Kamtchatka, and one of them Alaska. The arctic *R. Lapponicum* of Lapland and Greenland occurs in the alpine region of the White Mountains of New Hampshire. The only two other European species are *R. ferrugineum* and *R. hirsutum*, the *Alpenrosen* of the Swiss Alps. The species peculiar to America are, on the Atlantic side, *R. maximum*, which occurs sparingly as far N. as Canada, and abundantly throughout the whole length of the Alleghany Mountains; *R. Catawbiense*, a lower and earlier-flowered species on the higher mountains from Virginia southward; and *R. punctatum*, a graceful but less showy species of the middle country of the Southern States E. of the mountains. In the higher Northern Rocky Mountains is a peculiar deciduous-leaved species, *R. albiflorum*; in Oregon, *R. macrophyllum*, apparently near our *R. maximum*; in California, *R. Californicum*, nearer *R. Catawbiense*, but taller, and with more showy blossoms. The contrast in the size attained by the different species of this genus is as remarkable as its geographical range is extensive. The arctic *R. Lapponicum* is but a few inches high, while *R. Rollissonii* of Ceylon attains a height of thirty feet, with a stem over a foot in diameter. The useful properties of this genus are few and unimportant; the Siberian *R. chrysanthum*, however, supplies a narcotic sometimes used medicinally. Horticulturally, rhododendrons play a more important part. Several of the South Asiatic species are conspicuous inhabitants of our conservatories, the best suited for such cultivation being *R. arboreum*, *R. Dalhousiæ*, *R. argentium*, *R. Hodgsoni*, *R. Javanicum*, and *R. jasminiflorum*. Of hardy species, the most so at the North is the Siberian *R. Dauricum*, with small deciduous leaves and rose-colored flowers, appearing very early in the spring. But to the patient skill of the hybridizer we owe a race of hardy rhododendrons with showy flowers and foliage, and of greater horticultural value than any of the original types. These hybrids, the result of crossing the Alleghany *R. Catawbiense* with the Eastern *R. Ponticum*, are deservedly more generally planted than any other rhododendrons. A moisture-loving plant and unable to withstand the severe summer droughts so common in many parts of the U. S., and not thriving in soils strongly impregnated with lime, the rhododendron as a garden-plant can only be successfully cultivated in the Atlantic States from Massachusetts to Virginia. To develop its greatest beauty the rhododendron should be planted in well-drained peat or in soil largely composed of decaying leaf-mould, and situations should be selected for it somewhat protected from the winter sun, the greatest enemy, with the summer droughts, to all evergreens in the U. S. The following hybrid varieties, abundantly tested in the Northern Atlantic States, can be confidently recommended as hardy and beautiful garden-plants: viz. *R. Everestianum*, *R. roseum*, *R. album grandiflorum*, *R. purpureum*, *R. grandiflorum*, *R. coriaceum*. C. S. SARGENT.

Rhodora, a genus of plants of the order ERICACEÆ (which see).

Rhomboganoi'dea [from *rhombus*, "a four-sided figure," and *Ganoidea*], an order of fishes belonging to the sub-class Ganoidea and super-order Hyoganoidea. (See FISH.) The skull is in most respects like that of the typical fishes; the pterotic is simple; a symplectic bone is present; the mandible is complex, and in addition to the articular, angular, and dentary bones a coronoid and opercular are developed; the maxillary is broken up into a number of pieces; the vertebræ are opisthocœlian—*i. e.* with a convex articulating surface in front and concave behind; the scapular arch has a simple internal cartilaginous piece (the coracoid) connected with the pectoral fin, representing the three bones of the typical osseous fishes; the pectoral member has, in addition to the actinosts supporting the bones of the pectoral fin, two elements—the metapterygium, bounding it above, and the pro- or mesopterygium, bounding it below. The scales are generally rhomboid and covered with enamel. The order includes a number of ganoid fishes which have survived from the Mesozoic period to the present time, being represented by the living Lepidosteidæ of North America. THEO. GILL.

Rhone, a department of France, bordering E. on the Saone and Rhone, comprises an area of 1066 sq. m., with 670,247 inhabitants. It is mountainous, covered with offshoots of the Cévennes, but with the exception of some very fine valleys the soil is mediocre. Copper, iron, and lead are found; excellent wine is produced, and the manufactures of silk and muslin are of the greatest importance. Of 59,601 children of school age, 3079 received no school instruction in 1857.

Rhone, the ancient *Rhodanus*, a river of France, rises in Switzerland, in the Alps, on the western side of St. Gothard, flows through the Lake of Geneva, crosses the Jura Mountains, turns at Lyons, where it receives the Saone, to the S., and falls, 644 miles distant, into the Mediterranean, through two branches which form the island of Camargue. Its lower course is through swampy and unhealthy districts, but its whole middle one leads through beautiful and fertile regions producing some of the finest wines of France. Throughout it is very rapid and its navigation is often difficult, but it has been made highly available as a route of traffic by a most magnificent system of canals which accompany it and connect it with the Seine, the Loire, and the Rhine.

Rhu'barb [Fr. *rhubarbe*]. A well-known and valuable drug, being the root of some species of *Rheum* growing in China, Chinese Tartary, and Thibet. A good deal of uncertainty still obtains as to the exact species from which different specimens of rhubarb are derived. In the U. S. Pharmacopœia officinal rhubarb is defined as the "root of *R. palmatum* and other species of *Rheum*." A specimen of *Rheum* was obtained through French missionaries in 1867 and sent to France, where it flowered at Montmorenci in 1871. It seemed to correspond in all respects with the descriptions of the true rhubarb-plant, such as they are, and the root was apparently identical with the Asiatic rhubarb of commerce. This species has been described by Baillon under the name of *R. officinale*, and is probably one source, at least, of rhubarb. Rhubarb has been known as a drug from a remote period. It was first brought to Europe by land from China to the Levant ports, whence the name "Turkey" rhubarb, or was shipped directly from China or by way of India, whence the variety called "China," "Canton," or "East India" rhubarb. Later, a direct trade between Russia and China was established, and under supervision of the Russian government rhubarb was transported overland through Central Asia to Russia. With the establishment of this commerce the trade by way of the Levant disappeared, and the name *Turkey rhubarb* came to be applied to that imported direct to Russia. This Russian or Turkey rhubarb was highly esteemed for its unvarying good quality, the Russian officials exercising the utmost strictness in their inspection of the rhubarb brought for exportation. But in 1863, from the depressing influence on trade caused by the opening of a number of ports in the N. of China, the Russian rhubarb office was abolished, and the old fine quality of Turkey rhubarb no longer exists. Chinese rhubarb is now shipped direct from China. Certain species of rhubarb are also cultivated in England and Europe—namely, *R. Rhaponticum*, *R. undulatum*, and *R. compactum*—but the roots are different from those of Asiatic rhubarb, and have not come into general use as a drug. Chinese rhubarb is in variously-shaped pieces, evidently cut and trimmed from a massive root. Many pieces have a hole through them, pierced for the passage of a string by which to hang up the pieces for drying. The color is a rusty brown, and the texture is finely veined and marbled. Rhubarb has a peculiar smell, and a disagreeable, bitter, and astringent taste. A bit of the root if chewed feels gritty, from the presence of crystals of calcium oxalate. The composition of rhubarb is complex, and has not yet been thoroughly worked out; it

contains, among other things, a variety of tannic acid. In small dose rhubarb behaves as a stomachic bitter, but in larger quantities is an active purge, producing liquid mucous evacuations. By reason of the tannin it contains it is also secondarily astringent. It is used in medicine as a stomachic and a laxative or purge, and is especially useful in summer diarrhœas from relaxation of the bowels or improper diet. The pharmaceutical preparations are very numerous. Among the most commonly used is the *spiced* or *aromatic syrup*, which is a tincture of rhubarb, cloves, cinnamon, and nutmeg diluted with six times its measure of syrup. The proportion of rhubarb is small, the preparation being intended as an aromatic astringent stomachic in the bowel complaints of children. *Warner's gout cordial* is a compound tincture of rhubarb, senna, coriander, fennel, liquorice, and raisins. EDWARD CURTIS.

Rhumb [Fr. *rumb*]. In navigation, the track of a ship sailing on a given course is called a *rhumb*. A rhumb-line cuts all the meridians at the same angle, and when this angle is acute the rhumb is a species of spherical spiral, continually approaching the pole, but reaching it only after an infinite number of turns. The angle under which a rhumb-line cuts any meridian is called the *angle of the rhumb*, and the angle that it makes with the prime vertical at any point is called the *complement of the rhumb*. The projection of a rhumb on the plane of the equator is a logarithmic spiral, and the rhumb itself is the same as the LOXODROMIC CURVE (which see). W. G. PECK.

Rhus, the botanic name of the sumach, a genus of the Anacardiaceæ or cashew family, includes not only the common sumach of the U. S. (four species), but the dogwood (*R. venenata*) and the poison-ivy (*R. toxicodendron*).

Rhyme [properly **Rime;** Ang.-Sax. *rîm*, "number"] is a certain agreement in the sound of strong syllables, which, next to accent, is the most important regulator of English verse, and without it it would be difficult to indicate the metre in some of the best specimens of versification, except in an inferior degree by the use of non-metric expedients, such as punctuation and the restriction of an idea to each line. Rhyme enables the audience to distribute rhythmic discourse into lines and stanzas, and it is the chief guide of the listener through examples like Pope's *Ode on St. Cecilia's Day*, Dryden's *Alexander's Feast*, the *Passions* of Collins, or stanzas such as—

> "O Sorrow!
> Why dost borrow
> The lustrous passion from a falcon-eye?—
> To give the glow-worm light?
> Or, on a moonless night,
> To tinge, on siren shores, the salt sea-spray?"—*Keats.*

While the metre of Virgil's hexameter becomes evident before half a dozen lines are heard, the heroics of Milton or of Thomson cannot be thus recognized, and in some passages we may alter successions of a dozen lines without offending the ear of the listener, as in Milton's

> "Man's first disobedience, and the fruit of
> That forbidden tree, whose mortal taste brought
> Death into the world, and all our woe, with
> Loss of Eden," etc.,

or

> "Whose mortal taste brought death into the world,
> And all our woe, with loss of Eden till
> One greater Man restore us and regain
> The blissful seat," . . .

the limping parts of which are not due to the unauthorized division, but to the original, which has three strong syllables ("taste brought death") followed by three weak ones ("into the").

In relation to rhyme, alliteration is a consonant identity with a vowel difference, the latter in a strong syllable, as in "means—veins," "terrible—horrible;" it is also a consonant and vowel identity in weak syllables, as in the lines of Keats—

> "Make not your rosary of yew-berries, . . .
> A partner in your sorrow's mysteries;" . . .

or of a strong ending with a weak one, as in Bryant's association of "spring" with "wel'coming." Assonance is an identity of sound, as in "told—toll'd;" or a vowel agreement in strong syllables, with a consonant difference, as in "drawn—scorn," "voice—noise."

Rhymes are strong syllables which are unlike before the vowel and alike in the vowel, and in any consonants or weak syllables which may follow it, as in "owe—hoe—go," "rose—grows," "hour—power" (both of which are dissyllabic); "lightness—brightness," "pli'ableness—reli'ableness." Pairs like "rough—plough," "privacy—eye" (Keats), are without phonetic resemblance. "Again" may rhyme with "men" and "pain," and "said" with "head" and "paid," but such changes are inadmissible when they suggest a different word, as in saying "wīnd" (a twist) for "wĭnd," which is worse than "hos" for "horse" (as rhymed with "cross" by Bloomfield), because there is no suggestion of a different word, as there is in

> "So with resistless haste the wounded ship
> Scuds from pursuing waves along the deep."—*Falconer.*
>
> "By art, the pilot through the boiling deep,
> And howling tempest, steers the fearless ship."—*Pope.*

A writer in *Scribner's Monthly* (July, 1873, p. 332) uses "wind" correctly—

> "So' too our own nests are toss'd,
> Ruthless, by the wreaking wind,
> When, with stiffening winter's frost,
> Woods we dwelt in, green, are thinn'd." . . .

Barham says truly, in genuine rhyme, that, "A fastidious ear

> Will be more or less always annoy'd with you, when you
> Insert any rhyme that's not perfectly genuine;" . . .

and the present tendency is against such pairs as "howl—soul" (*Wordsworth*), "height—weight" (*Dryden*), "bliss—quits" (*Cowper*), "really—freely" (*Emerson*), "snores—nose" (*Alex. Smith*).

The collected poems of Sir William Jones were published in 1772, and according to Felix Ago (*Rhymes of the Poets*, Philadelphia, 1868) in three of his poems, extending to 588 lines, the rhymes are perfect; his *Seven Fountains*, of 542 lines, has the single exceptional rhyme of "afford—lord;" and the *Palace of Fortune*, of 506 lines, has only "shone—sun," and "stood—blood." Strict rhyming accuracy is not to be expected in translations, and in humorous verse the effect is often heightened by eccentric rhymes. The troubadours and minnesingers brought rhyming to a high degree of excellence, and the modern Persians excel in the art. S. S. HALDEMAN.

Rhy'mer (THOMAS), **The,** the name by which the earliest poet of Scotland is usually mentioned. There is reason to believe that his real name was Thomas Learmount, of Ercildoune, Berwick co., who flourished under the reign of Alexander III. (circa 1283), whose death he is said to have foretold. He was popularly believed to be possessed of magical powers derived from the queen of the fairies, who had carried him away in childhood and kept him in Fairyland seven years, after which he was permitted to come back to earth on condition of returning to his mistress when summoned by the appearance in the village of a hart and doe, which, of course, is related to have occurred. The ballads of Thomas the Rhymer were long preserved by memory, the earliest edition bearing date 1603.

Rhynchocepha'lia [Gr. ῥύγχος, "beak," and κεφαλή, "head"], an order of reptiles, first recognized by Dr. Günther, distinguished, in common with the crocodilians, from the saurians or lizards by the quadrate bone being firmly and immovably united with the cranial bones (opisthotic, proötic, and jugal). The temporal region has two horizontal bars; the ali- and orbito-sphenoid apparatus are in part cartilaginous; the maxillaries are united by suture with the palatine bones; premaxillary is divided; the mandible has its rami united by a fibrous ligament; the vertebræ are amphicœlian—*i. e.* concave or flat before and behind; the sacrum composed of two vertebræ; the limbs are adapted for walking, and typical in structure; the clavicles, episternum, and xiphisternum present and united; no copulatory organs are developed; the anus has a transverse cleft. The typical genus of this order (*Sphenodon*, Gray, *Hatteria*, Gray, and *Rhynchocephalus*, Owen) has a singular external resemblance to certain lizards, especially to those of the family Agamidæ, but its structural characters are eminently different from those of the forms simulated and from all other lizards. The only known existing species (*Sphenodon punctatus*) is found in New Zealand. In former geological epochs, however, the order seems to have been well represented by species in various quarters of the globe. Remains of extinct reptiles found in the Carboniferous and Triassic beds of Europe, as well as of America, have been identified by Prof. Cope as belonging to this order, although by Prof. Huxley some of them had been referred to the order of saurians. THEODORE GILL.

Rhynchops'inæ [from *rynchops;* Gr. ῥύγχος, "beak," and ὤψ, "face"], a sub-family of Laridæ, peculiar in having the lower mandible longer than the upper; both the mandibles are much compressed, and the cutting edges are rapidly contracted toward the nasal region, whence they are parallel to the extremity, presenting trenchant edges; in other respects the form is similar to that exhibited by the terns (Sterninæ), and is naturally associated with that group in contradistinction to the Larinæ and Lestridinæ. The species are known under the English names cutwater and black skimmer; but three species are known, all of which belong to the single genus *Rynchops:* one of these

(*R. nigra*) occurs along the eastern coast of North America; another (*R. albicollis*) in India; and a third (*R. flavirostris*) is based upon specimens found in the Red Sea. The American species is quite abundant along the Southern coast, and is subject to considerable variation. Its note has a characteristic deep guttural intonation. It also differs from its allies, the terns, according to Dr. Coues, in associating in true flocks, as distinguished from the gathering of the terns and gulls. In the daytime it is wont to repose on sandbars. It is supposed to feed by skimming over the surface of the water with the bill open and the lower mandible in the water, but this requires confirmation. THEODORE GILL.

Rhythm, in music [Gr. ῥυθμός, "measure" or "proportion"], such an arrangement or grouping of notes and measures as gives to the ear a sense of relative proportion and conduces to the development of sentiment and beauty. The first or elementary stage of rhythm—viz. the arrangement of notes in measures or bars—has already received attention under the head of MEASURE, to which article the reader is referred. Musical notes when thus grouped into form and measure may possess a certain degree of meaning and connection; but neither melody nor harmony can give adequate expression to musical sentiment and feeling without a further grouping into portions equal to each other and marked by accent. This constitutes a higher kind of rhythm, to which the name of "compound rhythm" is sometimes given. Almost any succession of musical sounds will win attention and interest when the ear recognizes at certain intervals the pulsations of accent and the indications of a regular rhythmical division. A series of sounds without these periodical divisions, with their necessary cadences, would be as difficult to comprehend as a series of words without clauses, sentences, periods, and grammatical connection. In all regular compositions, therefore, we find an orderly succession of periods, formed of groups of two, four, eight, or more measures, as the case may be, with subdivisions into phrases, strains, or clauses. Of these periods, those consisting of four or eight bars are the most simple and agreeable to the ear. Periods of three, six, or nine bars are also in use, but those consisting of five or seven are irregular and less satisfactory. In the use of terms to designate these divisions there is great diversity among musical theorists, and much obscurity in their definitions. In the present article we use the term "period" as denoting one of those larger symmetrical divisions which contains within itself the full expression of some musical sentiment. Such periods may terminate with cadences of various kinds, but the closing period must always end with the perfect final cadence. A period, as already said, is susceptible of division into several parts or members. Thus, a period of eight bars is readily divisible into two "phrases" or "strains," and each of these phrases also admits of division into two "clauses." A period of six bars may be similarly divided either into two or three portions, and each of these portions may be regarded as a phrase or a clause. The chief difference between a phrase and a period lies in the cadence. This should be less conclusive in the phrase than in the period, even though formed of the same chords. The term "section" is applied to those still larger divisions which comprehend several periods. In many cases it is not easy to define the boundaries of these several divisions of section, period, and phrase. Sometimes a shortened or lengthened period occurs which breaks in upon the uniformity of the movement; sometimes also periods overlap each other, as when a new one commences before the former one has terminated; and in numerous cases periods and phrases are broken up into irregular forms for the production of special effects, thereby suspending for a time all regard to rhythmical symmetry. Notwithstanding these irregularities, which occur even in the highest works of art, the study of rhythm is of essential importance as the foundation of all regularity and excellence in musical composition. WILLIAM STAUNTON.

Rhythm [Gr. ῥυθμός, "measured motion or time"], according to Cicero, "is that, in all voices and sounds, which causes impressions, and which we can measure by equal intervals." In prosody rhythm marks out the feet which constitute metre, and the term is equally applicable to verse, music, dancing, and the movements of machinery, whether affecting the ear or the eye; and the term is often used to indicate the more regular kinds of prose. In music and in verse rhythm divides the measures into binary or triple parts, with a recurrence of accent according to this division; but in verse a mixed binary and triple rhythm is more common than in music. When the successive ticks of a clock are not quite alike in sound or in length (that is, when the clock is not in beat) the effect is rhythmic, but when they are alike they produce monotony, which is not rhythm. S. S. HALDEMAN.

Rhytina. See RHYTINIDÆ.

Rhytin'idæ [*Rhytina*, a generic name from ῥυτίς, "wrinkle"], a family of mammals formed for the reception of a species belonging to the order of Sirenia, now extinct, but abundant up to the latter half of the last century. The form was fish-like, with a small head and a horizontal forked tail; the vertebræ, except the terminal, were depressed and provided with transverse processes; in the skull the intermaxillary bones were produced at the apices, and the edge simulated incisive teeth; true teeth were entirely absent, manducation being effected by the very large corneous plate on the palate, and by another opposite it and covering the very large and elongated symphysis of the lower jaw: in this respect this form differed from all other known types of the order. The history of the only known species (*Rhytina borealis*) is peculiar. It was discovered about 1741 by the Russian naturalist Steller on an island in Behring's Strait, on which he and some sailors were shipwrecked, and the castaways depended chiefly upon these animals for food. At that time they were very abundant, and for some time continued to be so, and were killed in large numbers by the adventurers who visited the islands in search especially of sea-otters. In 1768, however, the last known specimen was killed. Steller published quite a detailed account of the animal in 1751, and gave a figure of the external form. It has recently been the subject of a number of elaborate investigations, especially by Dr. J. F. Brandt of St. Petersburg, who has published a number of contributions, two of which are considerable volumes, illustrated by numerous plates. The animal reached a length of about twenty-two to twenty-four feet, being thus much larger than the species of the allied forms Halicoridæ and Trichechidæ or Manatidæ. Like other members of the family, it was herbivorous and fed in great part on algæ. THEODORE GILL.

Riad, or **Riyad,** city of Arabia, capital of the dominion of the Wahabees, in lat. 24° 38′ N., lon. 46° 41′ E., in a large plain, is enclosed by a wall varying from 20 to 30 feet in height, and is surrounded by well-cultivated fields and gardens. The most prominent buildings are the palace of the sultan and the great mosque, forming the two sides of the principal public square, the market-place occupying the centre of the city. After the destruction of Derayeh by Ibrahim Pasha in 1818, Riad became the capital of the Wahabees, and is furthermore important as a station on the route of pilgrims from Persia to Mecca and Medina. P. estimated at 40,000.

Riall (Sir PHINEHAS), b. in England about 1775; entered the British army as ensign 1794; became brevet lieutenant-colonel 1800; commanded a brigade in the West Indies 1808–10; became major-general 1813; commanded on the Niagara frontier at the battles of Chippewa and Lundy's Lane 1814; became governor of Granada in 1816, and was promoted to full general 1841. D. in Paris Nov. 10, 1851.

Riazan′, government of European Russia, bounded N. by the government of Moscow, comprises an area of 16,253 sq. m., with 1,477,433 inhabitants. N. of the Oka the country is low and flat, and the soil generally sandy and little productive; the southern part is higher, more diversified, and fertile. Wheat, rye, hops, hemp, and fruits are produced. Cattle and a fine breed of horses are reared. Iron ore abounds, but mining or any other kind of industry than agriculture is not carried on with energy.

Riazan, town of European Russia, capital of the government of the same name, on the Trubesh, an affluent of the Oka, is the see of an archbishop, has many educational institutions, and carries on an important trade in grain. The city received its present name in 1777 from Catharine II. In its vicinity is the village of Grishina, with a large steel factory in which knives, scissors, surgical instruments, and mechanics' tools are produced in considerable quantity and of good quality. P. 22,279.

Ribaut′ (JEAN), b. probably at Dieppe, France, about 1520; was bred to the sea, and, being a staunch Protestant, was selected by Admiral Coligny as leader of the colony he proposed to establish in North America; sailed from Havre Feb. 18, 1562, in two vessels, with a band of veteran soldiers and several young nobles; landed May 1 at the mouth of St. John's River, Fla., called by him "river of May;" set up a pillar with the arms of France; sailed northward, giving the names of the rivers of France to the streams he discovered; entered Port Royal harbor May 27; built there a block house, which he called Fort Charles; left twenty-six colonists, and returned to France to report progress and send reinforcements, but the distracted state of affairs in France prevented aid being sent, and the survivors of the colony, after nearly perishing by starvation, were picked up at sea by an English vessel. A new expedition under René de Laudonnière having founded a settlement called

Fort Caroline on the river of May in 1564, Ribaut was commissioned governor of the colony, and sailed from Dieppe May 22, 1565, with seven vessels and 300 men; landed at Fort Caroline Aug. 28; had to flee with his vessels Sept. 4 from a Spanish fleet of five vessels under Menendez de Avila, who had established a colony at St. Augustine; sailed to attack the Spaniards, but had his squadron wrecked by a tempest near Cape Cañaveral; set out by land with 500 men to return to the fort, but was intercepted by Menendez, induced to surrender under false pretences, and put to death with most of his companions early in Oct., 1565. The settlement at Fort Caroline had been previously attacked by Menendez, and most of its inhabitants suffered a like fate, though two vessels escaped, one being commanded by a son of Ribaut. The news of this massacre created great excitement in France, and it was partially avenged two years later by Dominique de Gourgues, who in turn surprised the Spanish fort in Florida and massacred the settlers. A curious account of Ribaut's first voyage was published in English May 30, 1563, in a pamphlet of 42 pages, now very rare, entitled *The Whole and True Discoverye of Terra Florida*, etc., translated from the French of Ribaut. (See also French's *Historical Collections of Louisiana and Florida*, and Parkman's *Pioneers of France in the New World* (1868).)

Rib'bon [Fr. *ruban*], a narrow band of woven silk, used chiefly as an ornament of female attire. Though employed in many nations from remote antiquity, the manufacture of ribbons as an important article of commerce dates only from the seventeenth century, and has flourished chiefly in France, the cities of Tours, Lyons, and Avignon being largely engaged therein. At the present time the chief seats of the ribbon manufacture are St. Etienne, France, Bâle, Switzerland, Crefeld in Rhenish Prussia, and Coventry in England. The French articles have an admitted superiority, owing to the employment of hand-looms instead of power-looms.

Ribbon-Fish, a name given to various fishes, chiefly belonging to the family Trachypteridæ. They are so called on account of their much compressed, elongated, and band-like bodies. (See TRACHYPTERIDÆ.)

Ribbon-Worms, an English name sometimes given to the species of the family Nemertidæ, belonging to the order TURBELLARIA (which see).

Ribeauvillé' [Ger. *Rappoltsweiler*], town of the German empire, province of Elsass, manufactures spirits, paper, leather, dyestuffs, and dress articles, and is celebrated for its excellent wines. P. 7181.

Ribe'ra, town of Sicily, province of Girgenti, on an elevated plateau about 4 miles from the sea. The district is extremely fertile, abounding in rice and other grains, in vines and choice fruits, and in rare plants interesting to the botanist, but miasma prevails extensively. The inhabitants are distinguished for their daring character. P. 7200.

Ribera (JOSÉ). See SPAGNOLETTO.

Ribs [Ang.-Sax. *rib*]. The ribs are the curved bones which form the lateral framework of the thorax or chest. They serve as substantial points of attachment for the thoracic muscles, which perform the respiratory motions, and by their resistance and elasticity protect the lungs, heart, and great vessels from external violence and injury. The ribs, in man, are usually twenty-four in number, twelve on each side, but may be one or two more or less in exceptional cases. They are articulated to the spine behind, but in front only the upper seven are connected with the sternum or breast-bone by intervening costal cartilages. Of the remaining five, three connect with the cartilage of the seventh, while the lower two are unattached and termed *free* or *floating* ribs. The ribs are elastic, and being articulated in front and behind move freely upward and outward in inspiration, and reversely downward and inward in expiration. The ribs, like other bones, may be inflamed and thickened from contusion or from blood disease; they are often distorted by collapse of a part or whole of a lung and external atmospheric pressure. The chief injuries to the ribs are separation from their attachments to the spine or sternum, and fracture. The fractured rib is detected by local crepitation of the fragments in respiratory movement, and by the severe local "stitch" or pain it gives the patient. The treatment consists in application of a firm bandage or broad adhesive band around the body to suspend thoracic movement until the rib is united; respiration meanwhile is conducted chiefly by motion of the diaphragm. In advanced age and in rickets the cartilages may be ossified, the ribs become "fixed" or rigid, and lead to secondary lung disease—emphysema.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Ricar'do (DAVID), b. of Jewish parentage in London Apr. 19, 1772. His father, a native of Holland, came to England, and as a member of the stock exchange gained a fortune. The son was a partner with his father till in 1793 he embraced the Christian faith and formed a marriage connection contrary to his father's wishes, which caused the partnership to be dissolved. Through the aid of other members of the stock exchange the younger Ricardo started in business by himself, and succeeded in a few years in securing an independent fortune. He then gave his time to the study of mathematics, chemistry, mineralogy, and geology, and was active in securing the organization of the London Geological Society. In 1809 he published a tract entitled *The High Price of Bullion a Proof of the Depreciation of Bank-notes;* in 1817 published his most important work, on *The Principles of Political Economy and Taxation.* Its leading feature was a theory of rent, which, though embodying ideas before announced by others, was received by the public as a new and important theory, especially in connection with the theory of Malthus on population, then much discussed. (See RENT.) He subsequently became a member of Parliament, where he took a prominent part in the discussion of economic questions. D. at his home in Gatscomb Park, Gloucestershire, Sept. 11, 1823. A collection of his works, edited by J. R. McCulloch, was published in 1846.

A. L. CHAPIN.

Ricarees. See RICKAREES.

Rica'soli (BETTINO), BARON, b. in Florence Mar. 9, 1809, of an old noble Florentine family; promoted liberal reforms in Tuscany in 1847 by signing an address to the grand duke, and founded the journal *La Patria;* was sent as minister to the court of Carlo Alberto, and there urged the union of Piedmont, Tuscany, and the pope against the Austrians; in Dec., 1847, was chosen gonfaloniere of Florence; was then elected to the Tuscan Parliament, and a place in the ministry was offered him, but as the grand duke had turned against the democratic movement, he declined it. Under the dictatorship of Guerrazzi he held himself aloof from public affairs. After the defeat of Novara, hoping to prevent the entrance of the Austrians into Tuscany, he took the initiative in recalling the grand duke, but when the latter withdrew the constitution, Ricasoli retired from the court to his castle of Brolio, where he devoted himself to the improvement of his estates. In 1859 he again put himself at the head of the Tuscan liberal movement, and doubtless aided essentially in the expulsion of the grand duke, and, as head of the provisory government, in the union of Tuscany with Piedmont. This being accomplished, he was appointed governor-general of Tuscany, an office which he held till Mar., 1861. The city of Florence elected him deputy to the Italian Parliament, and after the death of Cavour he became president of the council in the new ministry which was afterward overthrown by the opposition of Rattazzi. In 1866, when General La Marmora was about to take the field, Baron Ricasoli returned to power and resumed the direction of public affairs, in which position he maintained himself until again overthrown by the Rattazzi party. Since then he has taken no active part in politics. The journal *La Nazione*, published in Florence, is the special organ of Ricasoli and of his political friends.

Ricaut (Sir PAUL). See RYCAUT.

Ric'ci (MATTEO), b. at Macerata, Italy, Oct. 6, 1552; studied law at Rome; entered the society of Jesus 1571; went to India as secretary of Father Valignan, inspector-general of the Eastern missions, 1577; was soon afterward appointed to found a Jesuit mission in China; studied Chinese several years at Macao; obtained permission to settle with his companions at Tchao-king-fu 1583; quickly perceived the necessity of adapting his teachings to the condition and tastes of the Chinese; published a *Map of the World* in Chinese, and a small *Catechism* containing only the elementary principles of Christianity; gained a high position among the Chinese *literati*, whose distinctive dress he was at last permitted to assume; set out for Peking in the train of a mandarin; was turned back from Nanking; composed an *Art of Memory* and a *Dialogue of Friendship*, which so pleased the Chinese that he was at last permitted to visit Peking, but, being unable to gain an interview with the emperor, settled at Nanking, the second city of the empire. In 1600 he again went to Peking; was allowed to remain; built a church, and acquired great influence over the emperor in the capacity of teacher of mathematics and other sciences, and caused the establishment of missions in the principal cities of China. D. at Peking May 11, 1610. His *Mémoires* were published by Father Trigault (1615).

Ric'cia, town of Southern Italy, province of Campobasso, on a rocky hill about 25 miles N. N. E. from Ben-

evento. At the foot of the hill, near the torrent Sucida, are the ruins of an old castle, the abode of the feudal lords of Riccia for many centuries. The plague of 1656 reduced this once large town to a few families. Present p. 8200.

Ricciar'di (GIUSEPPE), COUNT, b. in 1808. His father, Francesco, count of Camaldoli, was minister under King Joachim Murat. His mother, a woman of rank, early taught him to hold in horror the despotism at Naples. In 1832, Ricciardi established a review, *Il Progresso*, compromised himself, and was arrested. Through the influence of his father he was liberated, after which he travelled through Italy and the principal countries of Europe. After eighteen months he returned to Naples, where he was again arrested in 1834, and the police, to complete his ruin, threw him into an insane hospital. He was finally released, and went at once to Spain, thence to France, and there he wrote for several reviews, especially for the *Revue Indépendante*, combating the Guelphic ideas of the followers of Gioberti. In 1848 he was elected deputy of the Neapolitan Parliament, and he favored the insurrection in Calabria. In June, 1849, he was again in Paris; in 1860 elected to the Italian Parliament. His literary works are numerous—poems, dramas, political articles, biographies, an autobiography, a *Martirologio Italiano*, a work on ethics, *L'Arte di viver felice*, *Histoire de la Révolution d'Italie*. His works were published at Naples in 10 vols.

Riccio (DAVID). See RIZZIO.

Rice (*Oryza sativa*). Theophrastus (350 years B. C.) gives the origin of the name *oryzon*, *oryssa*, or *oryza*. It is the rice of the markets of the world. It was known to the ancients, as we find it grew most luxuriantly in those regions where man is first known to history. As above, we find it classified and named by the Greek "father of botany," Theophrastus, who was, in turn, the pupil of both Plato and Aristotle, three and a half centuries before the Christian era. From the Arabic we have it *aruz*. In modern Europe, it is *riz*, *reis*, or *rice*. *Oryza sativa*, the common rice, has the culm or stem from one to six feet in length, annual, erect, simple, round, jointed; leaves subulate linear, reflex, embracing, not fleshy; flowers in a terminal panicle, calycine; leaflets lanceolate; valves of the corolla equal in length, the inner valves even and awnless, the outer twice as wide; four grooves, hyspid, awned; style single, two-parted. This is one of the two grand species of rice, and is known as the *lowland* rice. It grows on natural wet lands or is cultivated with excessive irrigation. The *Oryza mutica* is the dry or mountain rice, cultivated in Ceylon and Java, and lately in Hungary. It has the culm or stem three feet high, and more slender than the former; fruits longish; awns longest of all. It is sown on mountains and in dry soil, rots with long inundation, and perishes in sea-water.*

Of each of these two species there are almost numberless varieties, the result, in great part, as in other grains, of the difference in soil and peculiarities of cultivation. The Chinese and inhabitants of the East Indies—in fact, of most tropical and semi-tropical countries—comprising a large majority of mankind, have been from our earliest knowledge of them in great measure subsisted upon rice. The favorite grain of the Orientals seems to be a Bengal rice, called "cargo rice." It is large and sweet, but coarse and red. That preferred in the European markets is known as the "Patna rice," brought from the East. It is small-grained, but very white. But by all accord the large, white, and sweet grain now known as the "Carolina rice," and comprising all the merits of the other kinds, is superior to anything known in the rice-market. The rice now obtaining farther W., in Louisiana and the Mississippi alluvion, is very much like the Carolina rice—as yet hardly equal to it, probably more from unfamiliarity with its cultivation than from any intrinsic difference in its character.

Introduction into America.—We have accounts of it as early as 1694. At that date a vessel from Madagascar which put into the port of Charleston in distress had on board a little sack of the rough rice. It was given to one Landgrave Thomas Smith, who planted it first in a low place in his garden. It yielded admirably, and by him was disseminated as seed among the neighboring planters, and by them to others along the rivers farther in the interior, till it became after a few years of careful culture the staple commodity of the colony.† From this it has extended through all the Southern States of America, and has found quite a successful cultivation far up into the interior and Western States of Tennessee, Illinois, and Missouri. The Carolina is the lowland rice, and the method of culture is by extreme irrigation. At first the swamplands were considered best adapted, but the greater ease of irrigating on tide-lands subsequently gave them the preference, and its cultivation is now chiefly confined to the coast and lands subject to tidal overflow, while the interior swamps have been gradually abandoned.

Louisiana Rice-Culture.—This is also of the lowland character or water-culture, and is mainly the same as the Carolina. The planter seeks a tract of alluvial land, which he divides into sections in proportion to the declination of the land from the river, as these lands always have an inclination from the stream backward. If, as in the case of the Mississippi River, the water during the summer period rises above the fields it irrigates, and is only protected from overflowing by the levees, the planter is allowed to cut openings, called "flumes," through the levee to get water. He does this, however, with every precaution against a possible crevasse. These flumes have valves or gates which are opened or closed at pleasure, regulating the discharge of water. This water is conducted into main ditches with laterals. These laterals separate the various sections of the fields, and convey the water to them as required, being arranged with dams for the purpose. These sections are laid off in drills from eight to ten inches apart; the seed is sown in them, and the water turned on profusely. It lies thus till the plant is seen above the water. It is then drained off, and remains dry until the stalk forms a joint. The water is then again turned on, and allowed to stand until the grain has matured, which is in about six weeks. The business of the cultivator is to see that this water is freshened every other night, or oftener if necessary, and to wade round through the crop and pull up or destroy all weeds, grasses, and such persistent growths as have not been killed by the water. At the proper stage of maturity, which is indicated by its turning yellow, the water having been drained off for a few days, the grain is ready for the sickle or cradle. It is cut and laid on the stubble for another day or two to dry; it is then bound into bundles and shocked, similar to the method with wheat. It then, as may be preferred, is either threshed out in the field or gathered into the stack-yard, there to await convenience and the state of the markets. After threshing it is winnowed and put into sacks for the mill or for market.

Rice has a very long and harsh beard, more so than that of wheat, which is a prolongation of the outer hull or gloom of the rice. The threshing and winnowing therefore become a necessity before carrying to mill. Rice, unlike wheat, is not rid of its inner hull by the simple threshing process; it adheres with a tenacity that requires special treatment. For this purpose machinery is provided which is of necessity elaborate and expensive—too much so to be adapted to the plantations, but becomes the business of large manufactories. To these the producer carries his crop for the hulling. The milling process develops three results — the first, or prime rice, the seconds, or broken rice, and the flour of rice. Of the whole weight, it is a pretty fair estimate, based upon the best authorities, that a little more than half comes out in prime rice. The remainder is between broken rice and flour, after a third allowed for chaff. This completes the process, and the rice is ready for market. It may be added that about 8 per cent. of the crop is usually reserved for seed and home consumption.

Dry-land Culture.—It has been contended by some that the "upland rice," or dry cultivated, is better than the lowland. It is smaller of grain, harder and drier, which is considered an advantage. It grows upon high and dry land, and is cultivated much after the manner of other small grain. The yield is less than that of the former kind, though it is sufficient to reward the planter for his pains and to be considered a valuable crop. It is a noticeable fact that this lowland species of rice, as proved by the identical grain brought to America, is capable of both these kinds of cultivation, showing a most kindly adaptation to the necessities of soil and circumstances; so that the lowland and upland rices of this country are of the same species, the differences being but modifications of the varied cultures, which are almost as various as the soil and localities; while the *Oryza mutica*, as a dry or mountain species of Oriental countries, admits of little or no modification of soil or culture, but, as mentioned above, rots with inundation and perishes in sea-water.

Amount of Production of Louisiana.—After the results of the recent war cut off the supply of rice from the Atlantic States the crop of Louisiana very materially increased. For instance, the product in 1863–64 was but 21,461 sacks; in 1869–70 it reached 100,748 barrels; in 1871–72 it had fallen off to 25,000; then it rose again, and in 1873–74 it was 33,780; and the estimate for 1875 is 104,963 barrels, making a crop of 24,141,490 pounds—second only to South Carolina itself.

*Rees's *Encyclopædia*. † Ramsay's *History of South Carolina*.

Rice Production of the Various States.

	1850, pounds.	1860, pounds.	1870, pounds.	1875, pounds.
South Carolina	159,930,613	119,100,528	32,304,825	28,077,000
North Carolina	5,445,868	7,593,976	2,059,281	
Alabama	2,312,252	493,465	222,945	
Georgia	38,950,691	52,507,852	22,277,380	
Florida	1,095,090	222,704	401,687	
Mississippi	....	809,082	374,627	
Louisiana	4,424,349	6,331,257	15,854,012	24,141,490
Texas	88,203	26,031	63,844	
Virginia	17,154	8,825		
Tennessee	258,854	40,572	3,399	
Missouri	700	9,767	9,706	
Kentucky	5,688			
Arkansas	63,179	16,833	73,021	
Michigan	....	716		
Minnesota	....	3,286		
California	....	2,140		
Totals	212,592,641	187,167,034	73,644,727	52,218,490

Exports of Rice.

Total Export		
In 1850.	In 1865.	In 1870.
76,241,400 lbs.	60,407,756 lbs.	43,125,739 lbs.

Exports from the United States.

Year.	Tierces.	Value.	Per Tierce.
1800	112,056		
1810	131,341	$2,626,000	$20.00
1820	71,663	1,714,923	23.00
1830	130,697	1,986,824	15.00
1840	101,660	1,942,076	19.20
1850	127,069	2,631,557	23.00
1860	84,163	2,567,399	30.00
1870	25,351	454,316	18.00

*Value of the Rice-crop.**—This is derived from examining the net revenue of six different planters for ten years, from 1830 to 1840; it yielded $140 per annum to the hand. The rice for the same time averaged as follows:

In 1830 = $2\frac{5}{8}$	In 1836 = $3\frac{7}{16}$
" 1831 = $2\frac{3}{8}$	" 1837 = $3\frac{11}{16}$
" 1832 = $2\frac{13}{16}$	" 1838 = $4\frac{1}{17}$
" 1833 = $2\frac{5}{8}$	" 1839 = $2\frac{1}{2}$
" 1834 = $3\frac{3}{16}$	" 1875 = $7\frac{1}{2}$
" 1835 = $3\frac{1}{4}$	

The Drill-Plough.†—About the year 1812, Dr. Robert Nesbit introduced a new implement in the economy of rice-planting which excited great interest. Its offices and uses were to open the trenches and deposit the seed. It was found to be a labor-saving machine. The drill-plough was borne by a carriage on two wheels very much resembling in size and height an ordinary dray, and was drawn by one horse between shafts. It consisted of a long box parallel with the axle and above it, in which the given quantity of seed-grain was placed and locked up. From this box the grain was distributed by means of regulators into and through tin tubes descending almost to the earth at the required distance from each other for planting. The tubes or cylinders were guided in their descent and sustained in their respective positions by rods of iron fixed firmly into the frame, but so as to yield to an obstacle when pressed hard against. The rods, on their part, were each furnished at bottom with a sort of shoe protruding a little beyond the tube for the purpose of marking and opening the trench into which the seed was to be conveyed by its corresponding tube. Drawn by a good horse over ground in high tilth, and managed by a judicious hand, the drill-plough would trench seed for from eight to twelve acres of ground in a day, in proportion as it was furnished with a greater or less number of trenching-shoes or tubes. One of these ploughs, used by the inventor, having four tubes, would on long beds trench and sow ten acres in a day; another, furnished with six tubes, could accomplish fifteen acres under like circumstances in the same time.

Threshing-Mill.—The same gentleman, Dr. Nesbit, imported, introduced, and used upon his plantation a Scotch threshing-mill, which was moved by the wind in suitable weather. This machine would thresh and winnow 500 bushels in a day.

Milling.—In the year 1830 a machine was introduced, the beaters of which were shod with sheet iron and serrated with iron wire. This invention is now in very general use, yielding, when worked by animal power, from 200 to 300 bushels per day, and when propelled by steam-power 450 to 700 bushels each day. This is due to the ingenuity and mechanism of Dr. Calvin Emmons.

After having been threshed the rice should be "rayed"—*i. e.* the broken and imperfect grains separated from the full, the small and light from the large, so that a parcel of rice to be milled be made up of grains as nearly equal as practicable.

The grinding is the most important part of the process; it is between the stones that the rice is most apt to break. Each grain revolving probably on its shortest axis, according to a well-tested principle of philosophy, the stones should be set in proportion to the length of the grain. From these stones, with every hull, if possible, broken if not shelled off, the rice passes under the pestle. The proper degree of pounding can only be found by inspection of a practised eye. On being discharged from the mortar the rice must be thoroughly separated by rolling screens and fans from the flour and broken grains. It should then be passed spirally through the brushing-screen, which revolves with great rapidity (the longer the screen the better, provided the velocity be not diminished) until it is delivered into the barrel, clean, bright, and pearly, fully prepared and ready for market.‡

Hygiene.—Rice-culture on the Atlantic coast has proved to be very deleterious to the health of the white man. Malarious fevers are a general consequence, which, however, very rarely affect the negro. The cultivation on the Mississippi River, on the Lafourche, the Terre Bonne, and other interior streams on the Mississippi alluvion, however, has proved no more injurious to his health than the cultivation of any other crop in the same sections. This is a very important feature for consideration in the future rice-cultivation of the Mississippi Valley. Ten years' experience since the manumission of the slaves has shown the labor of the black man to be in rapid decadence; consequently, the agriculture of the South must depend upon the industry of the white man. CALEB G. FORSHEY.

Rice, county of Central Kansas, on Arkansas River, traversed by Atchison Topeka and Santa Fé R. R., consists of fertile rolling prairies. Cap. Atlanta. Area, 900 sq. m. In 1870 it had a population of only 5, but has since been settled.

Rice, county of S. E. Minnesota, on the head-waters of Cannon River, intersected by Milwaukee and St. Paul R. R., has a broken surface and a productive soil, the staples being wheat, Indian corn, oats, hay, wool, and butter. Domestic animals are somewhat numerous, and important manufactures are springing up. Cap. Faribault. Area, 575 sq. m. P. 16,083.

Rice, tp., Jo Daviess co., Ill. P. 570.

Rice, tp., Sandusky co., O., on Sandusky River. P. 927.

Rice (ALEXANDER HAMILTON), LL.D., b. at Newton Lower Falls, Mass., Aug. 13, 1818; graduated at Union College 1844; became partner in a paper-manufacturing firm at Boston, and was active in municipal affairs; president of the common council 1857; mayor of Boston 1857–59; member of Congress 1859–67, filling during the rebellion the post of chairman of the naval committee, and known as an accomplished scholar and orator. Governor of Massachusetts Jan., 1876.

Rice (DAVID), b. in Hanover co., Va., Dec. 20, 1733; graduated at Princeton 1761; was a Presbyterian minister in Virginia 1763–68, and in Oct., 1783, settled in Kentucky, where he was the pioneer preacher. D. in Kentucky June 18, 1816. Author of several religious treatises and of a speech published in 1793 entitled *Slavery inconsistent with Justice and Policy* (2d ed. 1863).

Rice (HARVEY), b. at Conway, Mass., June 11, 1800; graduated at Williams College 1820; settled in 1824 at Cleveland, O., where he was at first a teacher; was admitted to the bar 1826; established the Cleveland *Plain-Dealer* 1829; was an unsuccessful Democratic candidate for Congress in 1834 and 1836; was a State senator 1852–53, and drew up the school legislation then enacted. Author of *Mount Vernon and other Poems* (1859) and of many miscellaneous contributions to magazines and periodicals.

Rice (JAMES CLAY), b. at Worthington, Mass., Dec. 27, 1829; graduated at Yale College 1854; taught school, edited a paper and studied law at Natchez, Miss., 1855–56; settled in New York City 1856; enlisted as a private in a New York regiment 1861; was rapidly promoted for gallantry and intelligence in many battles in Virginia; became colonel of the 44th New York Vols.; commanded a brigade at Gettysburg; was made brigadier-general Aug. 17, 1863. D. from wounds received at the battle of Spottsylvania Court-house, Va., May 11, 1864.

Rice (JOHN HOLT), D. D., b. at New London, Bedford co., Va., Nov. 28, 1777; graduated at Washington College, Va.; was a tutor at Hampden-Sidney College 1796–99; became a Presbyterian clergyman and a pastor in Richmond, Va.; labored much among the slaves; was eminent as a pulpit-orator; founded in 1824 the Union Theological Seminary, and presided over it until his death in Prince Edward co., Va., Sept. 3, 1831. Author of several works.

* De Bow's *Industrial Resources.*
† Condensed from De Bow's *Industrial Resources.*
‡ Col. Allston of South Carolina.

Rice (Luther), b. at Northborough, Mass., Mar. 25, 1783; graduated at Williams College 1810; entered Andover Theological Seminary; was one of the five students who addressed themselves to the general association of Massachusetts announcing their desire to become foreign missionaries; was ordained at Salem Feb. 6, 1812, along with Messrs. Judson, Newell, Hall, and Nott; sailed for Calcutta with the two latter; became a Baptist on the voyage, as did also Mr. Judson, who sailed in another vessel; was baptized at Calcutta according to the Baptist ritual; returned to the U. S., and succeeded in effecting the organization of a Baptist missionary society 1814, for which he successfully undertook the financial agency; was the projector of Columbian College at Washington, D. C., becoming its agent and business-manager. D. in Edgefield district, S. C., Oct. 25, 1836.

Rice-Bird. See Bobolink.

Rice Bunting. See Bobolink.

Rice City, tp., Meeker co., Minn. P. 359.

Rice, Indian, or **Water Rice** [Lat. *Zizania aquatica*], an annual aquatic grass, from five to ten feet high, which abounds in marshy regions of the U. S., especially in Minnesota. Its grain was formerly much employed by the Dakota and Chippewa Indians, and forms an important portion of the food of the game-birds of the North-west. Its stem is now employed as a paper-stock.

Rice Lake, p.-v., Claremont tp., Dodge co., Minn. P. 51.

Rice Lake, tp., St. Louis co., Minn. P. 36.

Rice Lake, p.-v., Barron co., Wis., on Rice Lake, has fine water, manufactories, 1 saw and 1 grist mill, 1 lath and 1 shingle factory, a brewery, 3 hotels, 1 newspaper, and a court-house, etc. It is the centre of a lumbering district. A. Dewey, Ed. "Barron Co. Chronotype."

Rice'land, tp., Freeborn co., Minn. P. 633.

Rice Paper Tree. See Aralia.

Rice'ville, p.-v., cap. of Pearl co., Miss., near Pearl River.

Riceville, p.-b., Bloomfield tp., Crawford co., Pa. P. 301.

Rich, tp., Cook co., Ill. P. 1539.

Rich, tp., Union co., Ill. P. 1432.

Rich, tp., Lapeer co., Mich. P. 499.

Rich, county of N. E. Utah, on Bear River, adjoining Idaho and Wyoming Territories, is mountainous and well timbered. Cap. Randolph. Area, 850 sq. m. P. 1955.

Rich (Claudius James), b. of English parents near Dijon, France, Mar. 28, 1787; educated at Bristol, England; devoted himself from childhood with enthusiasm to Oriental languages; obtained at the age of seventeen years a cadetship in the service of the East India Company; resided for a time at Bombay; became secretary to the British consul-general in Egypt; travelled through Palestine, Syria, and Mesopotamia disguised as a Mameluke; was appointed by the East India Company resident at Bagdad 1808, remaining there six years; explored the site of Babylon 1811, and again 1816; published a *Memoir on the Ruins of Babylon* (1812) and a *Second Memoir on Babylon* (1818); travelled in Koordistan 1820. D. at Sheeraz, Persia, Oct. 5, 1821. His posthumous *Narrative of a Residence in Kurdistan* (1829) was edited by his widow, a daughter of Sir James Mackintosh. He made a valuable collection of Oriental MSS., which was purchased by Parliament for the British Museum.

Rich (Edmund), Saint, b. at Abingdon, Berkshire, England, about 1195; received a bias toward an ascetic life from his mother, Mabel; was sent to school at Oxford, where he made a vow of celibacy, or, in his own language, "wedded the Virgin Mary;" studied theology at Paris, and lectured there on the Scriptures; became an instructor at Oxford, where the university was then developing a revival of scholarship; was the first who taught there the Aristotelian logic and the scholastic philosophy, having among his pupils Roger Bacon; was prebendary and treasurer of Salisbury cathedral 1219–22; distributed its revenues to the poor; acquired fame as a preacher, especially in urging a new crusade, 1227; became rector of Calne; was appointed in 1233 archbishop of Canterbury; exhibited energy as a reformer in the face of opposition from the clergy; presided over two councils 1234, which by threats of excommunication induced King Henry III. to dismiss his foreign favorites; acquired an ascendency over that monarch; negotiated a peace with Llewellyn, prince of Wales, 1234; officiated at the marriage of Henry III. to Eleanor of Provence, and at the coronation of the latter Jan., 1236; had his authority superseded by that of the legate, Cardinal Otho, who held a council Nov., 1237; opposed the marriage of Simon de Montfort with Eleanor, countess-dowager of Pembroke, and excommunicated them 1238, thereby incurring the royal displeasure; went to Rome to negotiate a settlement of the controversy about the appointment of English bishops 1238, but, being unsuccessful, retired to France 1240, where, the fame of his sanctity being general, the queen-mother came to meet him and solicit his blessing; took up his residence in the abbey of Pontigny, and afterward went for his health to the priory of Soissy, where he d. Nov. 16, 1642. His remains were taken back to Pontigny, and having been canonized by Innocent IV. (known in France as *St. Edme*), in 1246, his shrine became a place of pilgrimage. Archbishop Manning and Lord Edmund Howard, with 500 English pilgrims, went thither to invoke his intercession in behalf of the Roman Catholic Church Sept. 3, 1874. He wrote a volume of *Constitutions* in 36 canons (1236), *Speculum Ecclesiæ*, and left MS. treatises, now in the Bodleian Library. There is a MS. biography by his brother Robert in the Cottonian Collection. Another, written by his secretary, Bertrand, was published in Martenne's *Thesaurus Anecdotorum*.

Rich (Obadiah), b. at Boston, Mass., in 1783; went in youth to Spain; was for many years employed in the American consular service at Valencia, Port Mahon, and Madrid; formed valuable collections of Spanish books which were of great use to Washington Irving, Ticknor, and Prescott, and ultimately became a bookseller in London, where he d. Jan. 20, 1850. Author of several valuable catalogues of American books.

Richard' (Gabriel), b. at Saintes, France, Oct. 15, 1764; educated at the College of Angers; became a Roman Catholic priest; came to the U. S. 1792 as teacher of mathematics in the college at Baltimore; soon went as a missionary to Kaskaskia, Ill.; settled at Detroit, Mich., 1798; acted there as vicar-general of the bishop of Ohio; published a periodical and several books in French; was taken prisoner by the English in 1813, and was delegate to Congress 1823. D. at Detroit Sept. 13, 1832.

Rich'ard I. (Plantagenet), surnamed Cœur de Lion ("lion-hearted"), king of England, third son of Henry II. and Eleanor of Aquitaine, b. at Oxford Sept. 13, 1157; was noted from youth for rash valor and a turbulent disposition, qualities which he shared with his elder brother, Henry, and his younger brother, Geoffrey; received the duchy of Aquitaine by the treaty of Montmirail (Jan. 6, 1169), under the feudal supremacy of King Louis VII. of France, to whose youngest daughter, Adelaide, he was at the same time betrothed; went to the court of France, where he was knighted by King Louis; joined his mother and his two brothers in rebellion against his father 1173; was reconciled to him Sept., 1174, relinquishing Aquitaine, but acquiring a territory in Poitou, for which he did homage to the French king; distinguished himself in a campaign against the rebels of Aquitaine; refused to recognize the feudal supremacy of his brother Henry over that duchy, which had at last been given him, and, aided by his father, successfully defended it against an invasion which terminated by the death of Prince Henry, June, 1183; maintained another brief war with his brothers Geoffrey and John, and ravaged Brittany, but was reconciled to them at London Nov. 30, 1184; inherited Geoffrey's titles on his death, Aug., 1186; made war upon the count of Toulouse; aided his father against Philip Augustus 1187; took a vow to go on a crusade 1187; did homage to Philip Augustus, king of France, for all his continental territories Nov. 18, 1188; waged successful war on his father in alliance with the king of France; succeeded to the throne by the death of his father July 6, 1189; immediately liberated his mother from the prison where she had remained several years, and appointed her regent of England; received possession of the duchy of Normandy July 20; arrived in England Aug. 13; was crowned at Westminster Sept. 3; appointed Willim de Longchamp guardian of the realm, and returned to Normandy Dec. 11; joined his forces at Vezelay with those of the king of France for the third crusade, July, 1190; embarked at Marseilles Aug. 7; touched at Naples and at Messina; captured the latter city Oct. 4; remained there six months while he built the castle of Mategriffon; quarrelled there with Philip; formed a close alliance with Tancred, king of Sicily, to whose infant daughter he betrothed his nephew and presumptive heir, Prince Arthur, son of Geoffrey; released himself by treaty from his engagement to the French princess, influenced by a passion for Berengaria, daughter of King Sancho of Navarre, who had arrived in Sicily with her mother; embarked for the East Apr. 7, 1191; touched at Rhodes Apr. 20; landed in Cyprus in May; was ill received, and conquered that island in a few days, dethroning and imprisoning King Isaac Comnenus; married Berengaria at Limesol, Cyprus, May 13; presented the island to Guy of Lusignan; arrived be-

fore Acre June 8; took part in the siege, but soon quarrelled again with the French king; was attacked by the plague; was present at the surrender of Acre July 12, after which Philip returned to France; put his Saracen hostages to death; advanced immediately toward Jerusalem; defeated the Saracens at Arsuf Sept. 6; took and fortified Jaffa; advanced on Askalon, which he took Jan., 1192; set out twice for Jerusalem, but was called back each time by hostilities in his rear; lost and regained Jaffa; performed many brilliant exploits of personal valor, but being obliged by the state of affairs in England to return, made a truce with Sultan Saladin, and sailed from Acre Oct. 9; was shipwrecked at the head of the Adriatic; endeavored to make his way by land through Austria; was seized and imprisoned Dec. 20 by Leopold, duke of Austria, with whom he had quarrelled in the Holy Land; was handed over to the emperor of Germany, by whom he was detained more than a year; was liberated on pledge of a heavy ransom Feb. 4, 1194; landed at Sandwich Mar. 13; found his brother John assuming the functions of king, but speedily forgave him; was crowned at Winchester Apr. 17; sailed for Normandy May 2; engaged in a war with Philip Augustus of France, whom he defeated and forced to sign a disadvantageous truce, and renewed the war three years later with a similar result, but was mortally wounded Mar. 26 by an arrow shot from the petty castle of Chalus-Chabrol, which he was besieging, and d. Apr. 6, 1199, leaving no legitimate children. His fame as a soldier was magnified by tradition, by poetry, and by romance, which attributed to him incredible feats of valor, and he was reputed to be highly accomplished as a troubadour. He was a representative Provençal prince of the age of chivalry, having, beyond the accidents of birth and inheritance, little connection with England. He was ignorant of the English language, and spent almost his whole life in his hereditary provinces of Southern France. Much new light has been cast upon his career by the publication of the *Chronicles and Memorials of Richard I.* (1864), a volume of the Rolls Series, edited by Rev. W. Stubbs from MSS. in the library of Corpus Christi College. PORTER C. BLISS.

Richard II., king of England, son of Edward the "Black Prince" and Joanna of Kent, b. at Bordeaux, France, Apr. 3, 1366; was presented to Parliament as heir-apparent on the death of his father, June 25, 1376; was created prince of Wales Jan. 26, 1377; succeeded to the throne on the death of his grandfather, Edward III., June 22 of the same year; was crowned at Westminster July 16; was under the tutelage of a council of twelve nobles, from which his three uncles were excluded, the government being, however, really controlled by one of them, John of Gaunt, duke of Lancaster, then a claimant of the throne of Castile in right of his wife; maintained a feeble warfare with France; encountered a vigorous opposition from Parliament and from the common people in the imposition and collection of a capitation-tax, which gave rise to the insurrection of Wat Tyler, June, 1381; married Anne of Bohemia, daughter of the emperor Charles IV., Jan. 14, 1382; renewed the war with France; invaded Scotland with slight result beyond the burning of Edinburgh, Aug., 1385; attempted to emancipate himself from the council of regency, which was reorganized under the duke of Gloucester Nov. 19, 1386, but without success, his leading supporters being defeated and put to death with the sanction of Parliament 1387–88; succeeded by a sudden display of vigor in assuming the government May 3, 1389; concluded a truce with France May 27, 1394; lost his queen the same year, and held a Parliament in Ireland; married Isabella of France Oct., 1396; summoned a new Parliament 1397, by whose aid he caused the arrest of Gloucester, who was carried to Calais and died there under suspicious circumstances, and the banishment or execution of his principal adherents; quarrelled with his cousin, Henry of Bolingbroke, duke of Hereford, whom, along with Mowbray, duke of Norfolk, he banished for ten years, 1398; seized the estates of his uncle, John of Gaunt, on the death of that prince Mar. 18, 1399; sailed for Ireland in May, but, being deserted by his troops, returned to Conway, Wales, Aug. 6; found the country in rebellion, Henry of Bolingbroke (now duke of Lancaster) having landed at Ravenspur, Yorkshire, in July and gathered a formidable army; was taken prisoner Aug. 20 by Bolingbroke, and sent to the Tower Sept. 2; was compelled to abdicate Sept. 29; was declared by Parliament Sept. 30 to be deposed in favor of Bolingbroke (who seized the throne under the title of Henry IV., to the exclusion of the legitimate heir, Roger Mortimer, earl of March); was kept a prisoner at Pontefract Castle, but soon disappeared, having been murdered, as was believed, by his keeper, Sir Piers Exton, about 1400. A corpse, alleged to be his, was exhibited at St. Paul's Mar. 4, 1400, and buried in Westminster Abbey. It has been maintained by some writers that he escaped to the Hebrides, lived there many years in concealment, died in 1419, and was buried at Stirling. The reign of Richard is a remarkable period in the constitutional history of England, and still more so in religion and literature, from the eminent names of Wycliffe, Chaucer, and Gower, who were patronized by him. The modern English language is usually dated from this reign.

PORTER C. BLISS.

Richard III., last king of England of the Plantagenet line, b. at Fotheringay Castle Oct. 2, 1452, was the youngest son of Richard, duke of York, and Cecily Neville, daughter of the earl of Westmoreland, his father being the legitimate heir to the throne by descent (in the female line) from Lionel, duke of Clarence, third son of Edward III., and consequently the head of the Yorkist faction in the "war of the Roses," then in abeyance. The duke of York, having renewed the struggle for the crown against the imbecile Henry VI., was defeated, captured, and executed near Wakefield, Yorkshire, Dec. 31, 1460. Richard, then eight years of age, was taken prisoner on this occasion, and shortly afterward sent, with his brother George, by his mother to Utrecht, Holland, where he was under the protection of the duke of Burgundy; returned the following year (his eldest brother having become king under the title of Edward IV.); was created duke of Gloucester, knight of the Garter, and lord high admiral, and endowed with large estates from the spoils of war; resided (as is supposed) for several years at Middleham Castle under the tutelage of his relative, the earl of Warwick, called the "king-maker," against whom, however, he fought in 1470 during the rebellion which for a time restored Henry VI. to the throne; fled with King Edward to Flanders Sept., 1470; was attainted and outlawed by Parliament; accompanied Edward on his return to England early in 1471; was influential in effecting the reconciliation of the latter with his brother, the duke of Clarence; commanded the van of the Yorkist army at the battles of Barnet (Apr. 14) and Tewksbury (May 4); has been accused, without evidence, of having murdered Prince Edward, son of Henry VI., after the latter battle, and King Henry himself in the Tower a few days later; was created lord high chamberlain of England, earl of Dorset and of Somerset, placed in possession of numerous forfeited estates, especially those which had belonged to Warwick, the "king-maker," whose daughter, Anne Neville (his own cousin, previously betrothed to Prince Edward), he married Mar., 1472; quarrelled with his brother, the duke of Clarence (married to Isabel Neville), about the inheritance of Warwick, their common father-in-law, 1473; was made a second time lord high constable Feb., 1472, and soon afterward keeper of the king's forests beyond the Trent, justiciary of North Wales, and seneschal of the duchy of Lancaster, in which capacity he resided some years at Pontefract Castle; accompanied his brother in the invasion of France 1475; inherited the offices and estates of his brother, the duke of Clarence (executed for treason Feb., 1478); was made lieutenant-general of the kingdom upon the breaking out of war with Scotland 1480; took possession of Berwick; penetrated to Edinburgh, and dictated terms of peace July, 1482; was made warden of the W. marches of England and lord of Carlisle early in 1483; learned of the death of Edward IV. while still in Scotland, Apr., 1483; took and imposed upon his generals an oath of allegiance to his nephew, Edward V.; met the duke of Buckingham at Northampton Apr. 29; forcibly assumed the guardianship of the young king the following day, imprisoning Lords Rivers, Grey, and other nobles of the queen's party; proceeded to London; was appointed by the council of state and confirmed by Parliament "protector and defender of the realm" early in May; ordered the seizure and instant execution of Lord Chamberlain Hastings on a charge of conspiracy June 13; asserted his own title to the throne on the ground of illegitimacy of his nephews June 22–24; obtained from Parliament a favorable decision, and assumed the throne June 26; was crowned with his queen at Westminster July 6, and again at York Sept. 8; was soon suspected of having caused the princes to be murdered in the Tower (see EDWARD V.); repressed a conspiracy in behalf of the earl of Richmond as head of the Lancastrian party, putting to death the duke of Buckingham (his own former partisan); convoked a Parliament, which declared him lawful king Jan., 1484; lost his only son, Edward, prince of Wales, Apr. 9; named his nephew, Edward, earl of Warwick (son of Clarence), heir to the throne, but soon substituted for him John de la Pole, earl of Lincoln, son of his sister, the duchess of Suffolk; made a truce with Scotland, and negotiated a marriage between his niece, Anne de la Pole, and the Scottish prince, James, Sept. 21; lost his queen Mar. 16, 1485; became unpopular on account of forced loans; marched with a large army to encounter the earl of Richmond, who had landed at Milford Haven Aug. 7; was defeated at Bos-

worth through the desertion of the Stanleys; killed while gallantly fighting Aug. 22, 1485, and buried by the nuns of Leicester in their chapel, Richmond, the victor, becoming king under the title of Henry VII. Being the last of his line, Richard III. has been loaded with more obloquy than any other king of England, but most of the crimes attributed to him have long since been disproved.
PORTER C. BLISS.

Richard of Cirencester (sis'eter) [Lat. *Ricardus Coronensis*], b. at Cirencester, Gloucestershire, England; entered the Benedictine monastery of St. Peter at Westminster; resided there during the remainder of his life; visited Rome about 1391, and d. about 1402. Author of a Latin history of England to the year 1348. A work entitled *De Situ Britanniæ* was published under his name by Dr. C. J. Bertram of Copenhagen in 1757, and would be of great value if its minute geographical and ethnographical data upon Saxon Britain could be trusted; but no original MS. has been produced, and the work is now generally believed to have been written by Bertram.

Rich'ard of St. Victor, a Scotch mystical schoolman, the date of whose birth is not known. At an early age he appears to have entered the Augustinian abbey of St. Victor in Paris, where he was a pupil of Hugo of St. Victor (d. 1141). In 1159 he became sub-prior, and in 1162 prior, of the abbey, and d. Mar. 10, 1173. As an interpreter of Scripture his method was largely though not exclusively the allegorical. He wrote also doctrinal and practical treatises. He was named *Magnus Contemplator.* The earliest edition of his works was printed at Paris in 1528, but the best appeared at Rouen in 1560. (See monographs by Liebner (1837–39) and Engelhardt (1838).)
R. D. HITCHCOCK.

Rich'ard Plantag'enet, earl of Cornwall and titular emperor of Germany, b. at Winchester, England, Jan. 5, 1209, was a younger son of King John; commanded an expedition to Guienne 1225; took the cross 1236; set out for Palestine 1240; returned to England Jan., 1242; accompanied his brother, Henry III., in his French campaign of that year, but soon lost the province of Guienne and escaped to England; married a princess of Provence 1243; was chosen emperor of Germany by a faction 1256, and crowned king of the Romans at Aix-la-Chapelle May 17, 1257, but was unable to obtain general recognition, and was more than once driven to take refuge in England; was taken prisoner by Simon de Montfort at the battle of Lewes, May 13, 1264; held a diet at Worms 1269; returned to England in that year. D. Apr. 2, 1272.

Rich'ards (JAMES), D. D., b. at New Canaan, Conn., Oct. 29, 1766; studied at Yale College; became pastor of a Presbyterian church at Morristown, N. J., 1794, at Newark 1809, and professor in Auburn Theological Seminary 1823. D. at Auburn Aug. 2, 1843. A selection of his *Lectures,* with a memoir by S. H. Gridley, was published in 1846, and a volume of his sermons, with an essay on his character by Rev. Dr. W. B. Sprague, appeared in 1849.

Richards (JOHN), D. D., b. at Farmington, Conn., May 14, 1797; graduated at Yale College 1821, and at Andover 1824; was for three years agent of the Board of Foreign Missions; was ordained as a Congregational minister at Windsor, Vt., 1827; was one of the editors of the *Vermont Chronicle* 1830–39; was settled at Hanover, N. H., 1841; became agent for the New Hampshire Education Society; was a frequent contributor to periodicals, and began a series of biographical sketches of the graduates of Dartmouth College, which was completed and published by Dr. Chapman. D. at Hanover Mar. 29, 1859.

Richards (WILLIAM), b. at Plainfield, Mass., Aug. 22, 1792; graduated at Williams College 1819; at Andover 1822; went in that year as a missionary to the Sandwich Islands, where he ultimately became interpreter and chaplain to the king; was sent as minister to England and other countries, and was appointed in 1845 minister of public instruction. D. at Honolulu Dec. 7, 1847.

Richards (WILLIAM C.), b. in London, England, in 1817; came to the U. S. in 1831; graduated at Madison University, Hamilton, N. Y., 1848; labored as a Baptist minister in Georgia and South Carolina until 1853, when he settled in New York City; edited in Georgia the *Orion Magazine,* in South Carolina the *Southern Literary Gazette* and the *Schoolfellow;* has contributed to various periodicals, written several juvenile books, and a *Memoir of George N. Briggs* (1866).—His wife, MRS. CORNELIA H. (BRADLEY) RICHARDS, b. at Hudson, N. Y., in 1822, has aided him in his editorial duties, and published several juvenile books under the *nom-de-plume* of "Mrs. Manners." She is a sister of Mrs. Alice B. Haven.

Rich'ardson, county of S. E. Nebraska, on Missouri River, adjoining Kansas, watered by Nemaha River and traversed by Atchison and Nebraska R. R., consists of rolling prairies diversified with timber. Staple products, Indian corn, wheat, hay, wool, and butter. Swine are numerous. Cap. Falls City. Area, 550 sq. m. P. 9780.

Richardson (ALBERT DEANE), b. at Franklin, Mass., in 1833; went to Pittsburg, Pa., 1850; became a schoolteacher, and afterward a reporter for the press; went to Kansas as correspondent of the Boston *Journal* during the Border troubles; became secretary to the Kansas legislature and adjutant-general; was a war-correspondent of the New York *Tribune* during the rebellion, and was for twenty months a prisoner of the Confederates, escaping Dec. 18, 1864; visited California as a correspondent 1865, and published *Field, Dungeon, and Escape* (1866), *Beyond the Mississippi* (1867), and a *Life of Gen. Grant* (1868), all which were very successful. He was shot in the *Tribune* office, New York, Dec. 2, 1869, by Daniel McFarland, on account of jealousy, and was married to Mrs. McFarland on his deathbed by Rev. Henry Ward Beecher.

Richardson (BENJAMIN WARD), M. D., F. R. S., b. at Somerby, Leicestershire, England, Oct. 31, 1828; graduated in medicine at St. Andrew's 1854; became an eminent physician at London; was chosen a member of the Royal College of Physicians and Surgeons 1856; founded and edited the *Journal of Health and Sanitary Review* (1855 *seq.*); gained the Astley Cooper prize of £300 by his treatise *On the Cause of the Coagulation of the Blood* (1856), and the Fothergillian gold medal by a disquisition *On the Diseases of the Fœtus* (1856); originated the use of ether spray for the local abolition of pain in surgical operations (1866); introduced methylene bi-chloride as a general anæsthetic (1867); has been president of the Medical Society of London; has contributed to the *Social Science Review,* published several medical works, and gained a high position by original experiment.

Richardson (CHARLES), LL.D., b. in England in July, 1775; studied but never practised law; devoted himself to literature at London; published *Illustrations of English Philology* (1815); undertook the lexicographical articles in the *Encyclopædia Metropolitana,* for which he also prepared his great work, a Dictionary of the English Language, which (the first part appearing in 1818) was suspended soon afterward by the failure of the proprietors, and completed (as a separate work) in 1837. The complete work appeared in new editions in 1837, 1838, and 1839; was reprinted in the U. S., met with great favor, and still maintains its position as the best work on English etymology, the words being conveniently arranged under the roots. Richardson also published a *Supplement* to his dictionary (1855), a work *On the Study of Languages* (1854), and an *Historical Essay on English Grammar and English Grammarians,* several philological papers in the *Gentleman's Magazine,* and some comments on Shakspeare; was a contributor to *Notes and Queries,* and received a pension from 1852 until his death, at Feltham, Middlesex, Oct. 6, 1865.

Richardson (CHAUNCEY), A. M., b. in Vermont Oct. 10, 1802; licensed to preach in his twenty-first year by Dr. Wilbur Fisk; had charge of a literary institution in Tuscumbia, Ala., and in 1839 became president of Rutersville College, Tex. He was one of the nine ministers who constituted the first Texas conference, in which he rose to eminence, and was an indefatigable worker. D. in Texas Apr. 11, 1852.
T. O. SUMMERS.

Richardson (ISRAEL B.), b. in Vermont 1815; graduated at the U. S. Military Academy, and entered the infantry July, 1841; served in Florida against the Indians and on frontier duty until the threatened hostilities with Mexico, when ordered to Texas with our army of occupation, and in the war served under Gen. Taylor in the battles of Palo Alto, Resaca de la Palma, and Monterey, and under Gen. Scott from the siege of Vera Cruz to the fall of the City of Mexico, receiving the brevets of captain and major for gallantry. Continuing on frontier duty from the close of the war until 1855, at which date he had risen to be captain, he resigned to devote himself to farming pursuits in Michigan. On the outbreak of civil war in 1861 he accepted the colonelcy of the 2d Michigan Vols., which regiment he led to Washington, and May 17, 1861, was commissioned brigadier-general of U. S. volunteers. At the first battle of Bull Run he led his brigade, and in the Virginia peninsular campaign of 1862 commanded a division in Sumner's corps; promoted to be major-general of volunteers July 4, 1862, he commanded with great bravery and distinction at South Mountain and Antietam, where he was fatally wounded Sept. 17. D. at Sharpsburg, Md., Nov. 3, 1862.

Richardson (JAMES), b. at Boston, England, Nov. 3, 1809; became a correspondent of a London journal; visited

Morocco, Algeria, and some portions of the desert of Sahara 1845–46; published his *Travels* in 1848, which led to his appointment as the head of a new expedition into Central Africa, in which he was accompanied by Barth and Overweg. They set out from Tripoli in 1850, visited the stony desert of Hammadah, and penetrated to Bornoo, but Richardson d. at Ungurutua Mar. 4, 1851. Overweg also d. near Lake Tchad Sept. 27, 1852, but Barth successfully accomplished the exploration of vast regions, returning in 1855. He also preserved and sent to England the papers of Richardson, which were edited by Bayle St. John under the title *A Narrative of a Mission to Central Africa* (1853). His earlier *Travels in Morocco* (1859) were edited by his widow.

Richardson (Sir John), M. D., F. R. S., LL.D., b. at Dumfries, Scotland, Nov. 5, 1787; studied medicine at the University of Edinburgh; entered the navy as assistant surgeon 1807; was present at the taking of Copenhagen 1807; was surgeon and naturalist to Sir John Franklin in his Arctic expeditions of 1819–22 and 1825–27; explored on the latter occasion the shore of the Arctic Ocean between the mouths of Mackenzie and Coppermine rivers; published *Geognostical Observations*, etc. as an appendix to the narrative of Franklin's first voyage (1823); edited, along with Swainson and Kirby, the *Fauna Boreali-Americana* (4 vols. 4to, London, 1829–37); was physician to Melville Hospital, Chatham, 1828–38, physician to the fleet 1838–48; was knighted 1846; commanded an expedition in search of Sir John Franklin 1848–49; published *The Arctic Searching Expedition* (2 vols., 1851) and *The Polar Regions* (1861); retired from public service 1855, and devoted his closing years to his favorite studies in philology and ethnology. D. at Lancrigg, near Grasmere, June 5, 1865.

Richardson (Richard), b. near Jamestown, Va., in 1704; was a land-surveyor in Virginia; became a planter in Craven co., S. C.; took part in the border wars with the Indians; was a member of the South Carolina council of safety 1775; suppressed a Tory revolt on the frontier, for which he received the thanks of the provincial congress; was a member of the legislature 1776; aided in forming the constitution of South Carolina; rejected overtures from Lord Cornwallis; was imprisoned at St. Augustine, Fla., after the capture of Charleston, losing his health. D. almost immediately after his release, at Salisbury, S. C., in Sept., 1781.—His son, James B. Richardson, was governor of South Carolina 1802–04; and his grandson, John Peter Richardson, b. at Hickory Hill Apr. 14, 1801, graduated at South Carolina College 1819, was a member of Congress, governor of South Carolina 1840–42, and a leader of the Union party.

Richardson (Samuel), b. in Derbyshire, England, about 1689; learned the printing trade; became a publisher at London, printer of the journals of the House of Commons, master of the Stationers' Company, and purchased in 1760 a half-interest in the office of king's printer. D. in London July 4, 1761. Author of several exceedingly popular novels, which were among the earliest of the modern school, though now considered tedious: *Pamela* (2 vols., 1741), *History of Clarissa Harlowe* (8 vols., 1748–49), and *History of Sir Charles Grandison* (6 vols., 1753–54). His *Correspondence* was edited by Mrs. Barbauld (6 vols., 1804).

Richardson (William A.), b. in Fayette co., Ky., about 1810; graduated at Transylvania University; was admitted to the bar at the age of nineteen; settled soon after in Illinois, where he became State attorney 1835, member of the legislature 1836, 1838, and 1844, being chosen Speaker in the latter year; served in the Mexican war as captain in Hardin's regiment; was promoted to major by vote of the regiment on the battle-field of Buena Vista, Feb., 1847; was member of Congress 1847–55, governor of Nebraska 1858; again elected to Congress 1860, and chosen U. S. Senator on the death of Stephen A. Douglas, 1861. D. at Quincy, Ill., Dec. 27, 1875.

Richardson (William M.), b. at Tyngsborough, Mass., Nov. 2, 1821; graduated at Harvard 1843; was admitted to the bar at Boston 1846; practised law at Lowell; was one of the revisers of the *General Statutes of Massachusetts* (1860) and of the *Supplement* to the same (1863–64); became judge of probate 1856, assistant secretary of the treasury 1872, and was secretary 1873–74.

Richardson (William Merchant), LL.D., b. at Pelham, N. H., Jan. 4, 1774; graduated at Harvard 1797; practised law some years at Groton, Mass.; was member of Congress from that district 1811–14; removed to Portsmouth, N. H., 1814; was chief-justice of the State from 1816 to his death; was author of *The New Hampshire Justice of the Peace* (Concord, 1824) and *The Town Officer;* co-reporter (with L. Woodbury) of vols. i. and ii. of the *New Hampshire Superior Court Cases* (1816 *seq.*), and sole reporter of vols. iii.–v. D. at Chester, N. H., Mar. 23, 1838.

Rich Bar, tp., Plumas co., Cal. P. 200.

Richelieu', county of Quebec, Canada, bounded N. W. by the St. Lawrence and traversed by river Richelieu. Cap. Sorel. P. 20,048.

Richelieu, de (Armand Jean Duplessis), Duke and Cardinal, b. at Paris Sept. 5, 1585; was educated for the military profession in the Collége de Navarre, but having a prospect of succeeding to the bishopric of Luçon, gave up the military career, studied theology, and was consecrated bishop Apr. 16, 1607. Elected a deputy of the clergy to the States General in 1614, he allied himself with the queen-mother and regent, Maria de' Medici; was appointed her almoner, and became a member of the council of state. When, shortly after, dissensions broke out between the king (Louis XIII.) and his mother, Richelieu accompanied the latter to Blois, and retired subsequently to his diocese, but succeeded, nevertheless, in bringing about a reconciliation between mother and son; was rewarded with the cardinal's hat in 1622; re-entered the council of state, and was soon after made prime minister, which office he filled uninterruptedly and with absolute power to his death, exercising a most decisive influence on the history of France, externally and internally. His foreign policy centred in the idea of humiliating Austria. For this purpose he encouraged the rising of the Protestant princes in Germany, the revolution of the provinces in the Netherlands, and even the revolt in Catalonia. He subsidized Gustavus Adolphus, and after his death in 1632 he took the duke of Saxe-Weimar and his army into the French service, and carried on the war against the emperor with great vigor. He also declared war against Spain, and, although his plans in the Netherlands failed, succeeded in separating Portugal from Spain in 1640, and conquered Perpignan in 1642. The final results of these wars he did not live to see, but by the Peace of Westphalia (1648) the progress of the house of Austria was effectually checked and its dream of establishing a world-empire was destroyed. By his internal policy he finished what Louis XI. had begun—the establishment of the absolute authority of the royal power. His government was marked by an almost uninterrupted series of conspiracies among the feudal nobility of the realm, headed by the queen-mother (whose favor had turned into a deadly hatred), by the queen herself, Anne of Austria, by Gaston of Orleans, the brother of the king, and by the royal princes. But, a master in intrigue and the very genius of detective police superintendence, he was always well informed and fully prepared, and punished the conspirators with merciless severity. The king felt a deep antipathy toward him, and on this circumstance the first conspiracies based their hope of overthrowing him. But with the king this almost physical aversion was wholly overawed by a mixture of admiration and fear of the towering spirit of his minister, and on Nov. 11, 1630 (*la Journée des Dupes*), when the king had consented to his dismissal and the whole court exulted, Richelieu forced himself into the presence of Louis, turned him around in a moment, and reappeared with great dramatic effect among his enemies, stronger than ever. Afterward the conspirators sought and found support in foreign countries, especially in Spain, and Richelieu needed armies to maintain himself. But he proved unconquerable. Maria de' Medici fled from place to place in foreign countries; Gaston of Orleans was made utterly contemptible by his cowardly and treasonous submission; Montmorency, Marillac, Cinq-Mars, and a hundred others were beheaded. The scaffold, the dungeon, and exile were the end of all resistance to him who wielded the royal power. Besides the feudal nobility, there was another political power in France at the time when Richelieu took the reins—namely, the Huguenots—and to crush this young but steadily increasing influence was one of his first undertakings. He laid siege to their principal stronghold, La Rochelle, and this siege is one of the most memorable events in the history of France, both with respect to the besieged and to the besieging parties. On Oct. 28, 1628, the city surrendered, four-fifths of its inhabitants having perished by the sword and by famine. By the fall of La Rochelle the political power of the Huguenots was wholly broken, but Richelieu's further measures concerning them were moderate and even magnanimous. In his personal appearance the cardinal loved magnificence; he built the Palais Cardinal, afterward the Palais Royal, which entirely outshone the royal residence. He showed great interest in literature and art. He founded the Jardin des Plants, enlarged the Sorbonne and the royal library, and gave substantial encouragement to many scholars, poets, and artists. His interest in literature, however, was not only a merit, but also a foible with him. He wrote *Mirame* and *La Grande Pasto-*

rale. He was jealous of Corneille, and the foundation of the French Academy was, as far as he was concerned, simply a miserable literary intrigue. His *Lettres, Instructions diplomatiques, etc.* were edited by Avenel (6 vols., Paris, 1853–68). Of the *Mémoires du Cardinal de Richelieu, Testament politique du Cardinal de Richelieu,* and *Journal du Cardinal de Richelieu,* the last is spurious, and the two former of doubtful authenticity. D. in his palace in Paris Dec. 4, 1642.—From his brother descended the MARSHAL RICHELIEU (b. Mar. 13, 1696; d. Aug. 8, 1788), the protégé of Madame de Pompadour, commander in the Seven Years' war, and equally notorious for his scandalous robberies in Hanover and for his matchless debaucheries; and the DUKE OF RICHELIEU (b. Sept. 25, 1766; d. May 17, 1822), who in Sept., 1815, succeeded Talleyrand as minister of foreign affairs under Louis XVIII., in which office, as well as at the Congress of Aix-la-Chapelle in 1818, he rendered great services to his country. In Feb., 1820, he once more took charge of the ministry, but, although a noble and disinterested character, of great moderation and considerable political skill, he was unable to sustain himself between the radicals and the ultras, and resigned in Dec., 1821. CLEMENS PETERSEN.

Richerand' (ANTHELME), b. at Belley, department of Ain, Feb. 4, 1779; studied medicine at Paris, and was appointed professor of surgical pathology at the School of Medicine in 1807. D. Jan. 25, 1840. Wrote *Nouveaux Éléments de Physiologie* (1802), *Leçons sur les Maladies des Os* (1805), *De l'Enseignement actuel de la Médicine et de la Chirurgie* (1816), *Des Officiers de Santé et des Jurys Médicaux* (1834), and *De la Population dans ses Rapports avec la Nature des Gouvernements* (1837).

Rich'field, p.-v. and tp., Adams co., Ill. P. 1496.

Richfield, p.-v. and tp., Genesee co., Mich., on N. branch of Flint River. P. 1421.

Richfield, p.-v. and tp., Hennepin co., Minn., on Mississippi River. P. 930.

Richfield, p.-v. and tp., Otsego co., N. Y. P. 1831.

Richfield, tp., Henry co., O. P. 396.

Richfield, tp., Lucas co., O. P. 822.

Richfield, p.-v. and tp., Summit co., O. P. 1018.

Richfield, p.-v., Fayette tp., Juniata co., Pa. P. 131.

Richfield, p.-v., cap. Sevier co., Ut., on Sevier River.

Richfield, tp., Adams co., Wis. P. 266.

Richfield, p.-v. and tp., Washington co., Wis., on Northern division Milwaukee and St. Paul R. R. P. 1654.

Richfield Springs, p.-v., Richfield tp., Otsego co., N. Y., near the head of Schuyler Lake, on a branch of Utica Chenango and Susquehanna R. R., has 1 newspaper, 4 churches, a sulphur spring celebrated for the cure of cutaneous disorders, and has lately become a fashionable summer resort. P. 696.

Rich'ford, p.-v. and tp., Tioga co., N. Y., on Southern Central R. R. P. 1434.

Richford, p.-v. and tp., Franklin co., Vt., at the confluence of Missisquoi and Clyde rivers and N. E. terminus of eastern division of Vermont Central R. R., has 1 newspaper, good water-power, and several manufactories. P. 1481.

Richford, p.-v. and tp., Waushara co., Wis. P. 428.

Rich Grove, tp., Pulaski co., Ind. P. 315.

Rich Hill, tp., Muskingum co., O. P. 1404.

Rich Hill, tp., Greene co., Pa. P. 2470.

Richibuc'to (formerly LIVERPOOL), a port of entry, cap. of Kent co., N. B., at the mouth of Richibucto River, which is navigable for 15 miles. Lat. of entrance, 46° 43′ N., lon. 64° 50′ W. Lumber and fish are largely exported, and shipbuilding is a leading pursuit. P. about 800.

Rich'land, new county of E. Dakota, on Red River of the North, adjoining Minnesota, consists of rolling prairies and fertile river-bottoms. Area, 1400 sq. m.

Richland, county of S. E. Illinois, watered by affluents of Wabash River and intersected by Ohio and Mississippi R. R., has a level surface and a fertile soil, and raises sheep and swine. Staples, Indian corn, wheat, oats, hay, tobacco, sorghum-molasses, wool, and butter, and has several saw-mills and furniture manufactories. Cap. Olney. Area, 375 sq. m. P. 12,803.

Richland, parish of N. E. Louisiana, watered by Bayou Bœuf and other streams, and intersected by North Louisiana and Texas R. R., produces sweet potatoes and cotton and raises cattle and swine. Cap. Rayville. Area, 550 sq. m. P. 5110.

Richland, county of N. Ohio, on the head-waters of Walhonding River, traversed by several railroads, has a hilly surface. Staples, wheat, Indian corn, oats, hay, maple-sugar, wool, and butter; raises large numbers of cattle, sheep, and swine; has many flouring and saw mills, several tanneries, iron-foundries, and brick-kilns, and numerous flourishing manufactories of agricultural implements, woollen goods, carriages and wagons, iron ware, machinery, and furniture. Cap. Mansfield. Area, 450 sq. m. P. 32,516.

Richland, county of Central South Carolina, lying between Congaree and Wateree rivers, has a hilly surface largely covered with pine forests, and is traversed by several railroads. Chief staples, cotton, rice, Indian corn, and sweet potatoes; has several flouring and saw mills and manufactures of machinery and iron ware. Cap. Columbia, which is also the State capital. Area, 465 sq. m. P. 23,025.

Richland, county of S. W. Wisconsin, on Wisconsin River, drained by Pine River and other streams, and traversed by Chicago Milwaukee and St. Paul R. R. Staple products, Indian corn, wheat, oats, hay, potatoes, hops, wool, butter, and cheese, and raises considerable numbers of cattle, sheep, and swine. It is in the centre of the most important hop-growing region of the U. S.; has several mills and manufactories. Cap. Richland Centre. Area, 576 sq. m. P. 15,731.

Richland, tp., Crawford co., Ark. P. 927.

Richland, tp., Desha co., Ark. P. 445.

Richland, tp., Jefferson co., Ark. P. 933.

Richland, tp., Madison co., Ark. P. 1362.

Richland, tp., Monroe co., Ark. P. 899.

Richland, tp., Newton co., Ark. P. 161.

Richland, tp., Phillips co., Ark. P. 1929.

Richland, tp., Searcy co., Ark. P. 471.

Richland, tp., Washington co., Ark. P. 1156.

Richland, tp., La Salle co., Ill. P. 730.

Richland, tp., Marshall co., Ill. P. 920.

Richland, tp., Shelby co., Ill. P. 1053.

Richland, tp., Benton co., Ind. P. 546.

Richland, tp., De Kalb co., Ind. P. 1825.

Richland, tp., Fountain co., Ind. P. 1759.

Richland, tp., Fulton co., Ind. P. 1314.

Richland, tp., Grant co., Ind. P. 1065.

Richland, tp., Greene co., Ind. P. 2143.

Richland, tp., Jay co., Ind. P. 1342.

Richland, tp., Madison co., Ind. P. 1065.

Richland, tp., Miami co., Ind. P. 1600.

Richland, tp., Monroe co., Ind. P. 1486.

Richland, p.-v. and tp., Rush co., Ind. P. 917.

Richland, tp., Steuben co., Ind. P. 653.

Richland, tp., Whitley co., Ind. P. 1723.

Richland, tp., Adair co., Ia. P. 292.

Richland, tp., Chickasaw co., Ia. P. 566.

Richland, tp., Decatur co., Ia. P. 849.

Richland, tp., Delaware co., Ia. P. 874.

Richland, tp., Fayette co., Ia. P. 405.

Richland, tp., Guthrie co., Ia. P. 218.

Richland, tp., Jackson co., Ia. P. 1141.

Richland, tp., Jasper co., Ia. P. 749.

Richland, tp., Jones co., Ia. P. 794.

Richland, p.-v. and tp., Keokuk co., Ia., on Skunk River. P. 1585.

Richland, tp., Mahaska co., Ia. P. 1561.

Richland, tp., Tama co., Ia. P. 888.

Richland, tp., Wapello co., Ia. P. 1451.

Richland, tp., Warren co., Ia., on Des Moines River. P. 1381.

Richland, tp., Labette co., Kan. P. 1744.

Richland, tp., Miami co., Kan. P. 844.

Richland, p.-v. and tp., Kalamazoo co., Mich. P. 1381.

Richland, tp., Montcalm co., Mich. P. 88.

Richland, tp., Saginaw co., Mich. P. 466.

Richland, tp., Rice co., Minn. P. 773.

Richland, tp., Gasconade co., Mo. P. 1099.

Richland, tp., Macon co., Mo. P. 1180.

Richland, tp., Morgan co., Mo. P. 1785.

Richland, tp., Ozark co., Mo. P. 635.

Richland, p.-v., Pulaski co., Mo., on Atlantic and Pacific R. R., 164 miles S. W. of St. Louis, has an academy and a newspaper. Business, stock-raising and farming. P. about 500. D. FRAZER TOMSON, ED. "PULASKIAN."

Richland, tp., Putnam co., Mo. P. 720.

Richland, tp., Scott co., Mo. P. 1080.

Richland, tp., Stoddard co., Mo. P. 438.

Richland, tp., Vernon co., Mo. P. 547.

Richland, tp., Washington co., Neb. P. 221.

Richland, p.-v. and tp., Oswego co., N. Y., on Oswego and Rome and Rome Watertown and Ogdensburg R. R. P. 3975.

Richland, tp., Beaufort co., N. C. P. 2097.

Richland, tp., Onslow co., N. C. P. 2133.

Richland, tp., Randolph co., N. C. P. 713.

Richland, tp., Allen co., O. P. 2139.

Richland, tp., Belmont co., O. P. 4170.

Richland, tp., Clinton co., O. P. 1854.

Richland, tp., Darke co., O. P. 1105.

Richland, tp., Defiance co., O. P. 1194.

Richland, tp., Fairfield co., O. P. 1517.

Richland, tp., Guernsey co., O. P. 1404.

Richland, tp., Holmes co., O. P. 1242.

Richland, tp., Logan co., O. P. 1401.

Richland, tp., Marion co., O. P. 1146.

Richland, p.-v. and tp., Vinton co., O. P. 1814.

Richland, tp., Wyandot co., O. P. 1271.

Richland, tp., Allegheny co., Pa. P. 707.

Richland, tp., Bucks co., Pa. P. 2111.

Richland, tp., Cambria co., Pa. P. 868.

Richland, tp., Clarion co., Pa. P. 1015.

Richland, tp., Venango co., Pa. P. 1023.

Richland, v., Barnwell co., S. C. P. 987.

Richland, tp., Ohio co., W. Va. P. 1389.

Richland, tp., Richland co., Wis. P. 1572.

Richland Centre, p.-v., Richland tp., Bucks co., Pa.

Richland Centre, p.-v., cap. of Richland co., Wis., on Pine River, 13 miles from Milwaukee and St. Paul R. R., has 3 churches, good schools, 1 bank, several flouring-mills, and a bedstead and stove factory. P. about 1500. Fogo & Laws, Eds. "Republican."

Richland Grove, p.-v. and tp., Mercer co., Ill. P. 1444.

Rich'man, tp., Wayne co., Ia. P. 374.

Richman, tp., Raleigh co., W. Va. P. 389.

Rich'mond, town of England, county of Surrey, on a hill on the right bank of the Thames, among beautiful surroundings, 10 miles S. W. of St. Paul's, London. Its original name was Sheen, and under Edward I. and Edward II. it was a royal residence. In 1498 the palace was burnt down, but was rebuilt by Henry VII., who changed the name to Richmond. Elizabeth was imprisoned here for a short time by Mary; she afterward often resided here, and d. here in 1603. Under the Commonwealth the palace was partially destroyed, and in the next century was pulled down. P. 15,113.

Richmond, the southernmost county of the island of Cape Breton, including also Arichat and other islands. It has an extensive and much-broken coast-line, and the county is intersected by St. Peter's Canal, half a mile long, which leads from the Bras d'Or to St. Peter's Bay. Maritime pursuits are extensively followed. Cap. Arichat. P. 14,268.

Rich'mond, county of Quebec, Canada, traversed by the river St. Francis and by Grand Trunk Railway. Copper ores, slate, and building-stone abound. There are important and varied manufactures, and water-power is abundant. Cap. Richmond. P. 11,213.

Richmond, county of Georgia, on Savannah River, adjoining South Carolina, has a broken surface intersected by many small streams, and is traversed by several railroads. Staples, cotton, Indian corn, sweet potatoes, and rice; has several flouring and saw mills and some manufactures of cotton goods, iron castings, and machinery. Cap. Augusta. Area, 350 sq. m. P. 25,724.

Richmond, county of New York, comprising Staten Island, Shooter's Island at the entrance of Newark Bay, and several small islands in Staten Island Sound; is traversed by a railroad, abounds in villa residences of citizens of New York City, and has a number of manufactories and shipyards. (See Staten Island.) Cap. Richmond. Area, 59 sq. m. P. 33,029.

Richmond, county of North Carolina, adjoining South Carolina, between Lumber and Yadkin rivers, traversed by the Carolina Central R. R.; has a rolling surface and a productive soil; raises cotton, sweet potatoes, and Indian corn, and swine in considerable numbers. Cap. Rockingham. Area, 730 sq. m. P. 12,882.

Richmond, county of Virginia, on Rappahannock River, has a level surface abounding in pine timber, a fertile soil, and abundant oyster-beds in the Rappahannock. Staples, Indian corn, cotton, and wheat. Cap. Warsaw. Area, 175 sq. m. P. 6503.

Richmond, p.-v., cap. of Richmond co., Quebec, Canada, on St. Francis River, at the junction of Grand Trunk Railway with its Quebec and western branches, 221 miles N. W. of Portland, Me. It has important copper-mines, is the seat of St. Francis College (Scottish Kirk), has a grammar school, a mechanics' institute, and a weekly newspaper, and is connected by a bridge with Melbourne. P. 715.

Richmond, tp., Cass co., Ill. P. 1115.

Richmond, p.-v. and tp., McHenry co., Ill. P. 1404.

Richmond, city, cap. of Wayne co., Ind., lat. 39° 47′ N., lon. 84° 47′ W., 700 feet above tide-water, 4 miles from the eastern border of the State, 68 miles E. of Indianapolis and the same distance N. W. of Cincinnati, O. The country is undulating, and the E. branch of Whitewater River has cut for itself a channel through the soil and limestone rock about 200 feet deep, with abrupt and in many places almost perpendicular sides. The ground is rolling, and all its descents tend ultimately toward the deep valley of the river. A soil mostly loam, resting on a subsoil of gravel, and this on the horizontal limestone rock, affords superb drainage, which, with other things, has given to Richmond, and maintained for it, a sanitary condition rarely if ever equalled by that of any other city. It is situated in the midst of a rich and well-cultivated agricultural country, and enjoys the healthy trade naturally pertaining to such a situation. Whole number of mercantile and industrial establishments in 1875, other than manufactories, was 248, with a capital of $2,001,444, employing 941 hands, paying wages $257,302, and making gross sales amounting to $5,262,457. Its manufactures are important and flourishing; number in 1875, 127, with an aggregate capital of $1,807,785, consuming raw material to the value of $795,684, employed 1507 hands, paid wages $654,459, and sold goods amounting to $2,729,346. The principal articles manufactured are caskets and burial-cases, threshing-machines, engines, saw-mills, mill-machinery, school and church furniture, cigars, galvanized iron-work, ploughs, woollen goods, etc. It has 3 national banks, with an aggregate capital of $1,000,000, and 1 savings bank. Its common schools in 1875 occupied 37 rooms and employed 37 teachers, whose salaries aggregated $16,574. Earlham College, under the control of the Society of Friends of Indiana Yearly Meeting (Orthodox), had 14 professors and 221 students. Denominational schools of Friends (Hicksite), Lutherans, and Catholics had 906 pupils and employed 16 teachers. It has also 1 business college. It has 19 churches, and 2 congregations without edifices, 23 Sabbath schools, an orphans' home, a home for friendless women, and 2 organizations of women to look after the poor and distribute alms. It has 43 mutual benevolent associations under various names, 3 daily and 5 weekly newspapers, and 1 monthly magazine, a public library and a scientific association with a museum, 2 theatres, and a number of halls and lecture-rooms. It has street railroads, and a steam fire department, and is equipped in every quarter with the wires and apparatus of the national fire-alarm company. Richmond is one of the Indiana railroad centres, 3 principal lines E. and S. ramifying to all important cities in these quarters, and 3 principal lines to the W. and N. ramifying to all important cities in those quarters. It has a large, commodious union dépôt which receives and despatches 40 passenger-trains daily. Aggregate value of railroad tickets sold in 1875, $82,991; total number of freight-cars handled in 1875 in the freight-yard, 255,235; total amount of freight, 1,452,144,070 pounds P. 9445.
John O. Hardesty, Ed. "Daily Independent."

Richmond, p.-v. and tp., Washington co., Ia.

Richmond, tp., Nemaha co., Kan. P. 2153.

Richmond, p.-v., cap. of Madison co., Ky., at the terminus of Richmond and Louisville R. R., 20 miles W. of Lexington, contains 7 churches, the Central University, and the Madison Female Academy, 3 national and 1 savings bank, 1 large steam flouring-mill, 1 newspaper, and 2 hotels. The village is lighted with gas. P. 1629.
T. M. Green, Ed. "Kentucky Register."

Richmond, p.-v. and tp., Sagadahoc co., Me., on Kennebec River and on Portland and Kennebec R. R. P. 2442.

Richmond, p.-v. and tp., Berkshire co., Mass., on Boston and Albany R. R. P. 1091.

Richmond, p.-v. and tp., Macomb co., Mich. P. 2181.

Richmond, tp., Osceola co., Mich. P. 653.

Richmond, p.-v. and tp., Winona co., Minn. P. 219.

Richmond, tp., Howard co., Mo. P. 2988.

Richmond, p.-v. and tp., cap. of Ray co., Mo., on St. Joseph line of St. Louis Kansas City and Northern R. R., has 2 newspapers, a foundry, some flouring-mills, and a considerable trade. P. 1218; of tp. 5581.

Richmond, p.-v. and tp., Cheshire co., N. H. P. 868.

Richmond, tp., Ontario co., N. Y. P. 1622.

Richmond, p.-v. and tp., cap. of Richmond co., N. Y., beautifully situated and contains many fine villa residences.

Richmond, tp., Ashtabula co., O. P. 883.

Richmond, tp., Huron co., O. P. 880.

Richmond, p.-v., Salem tp., Jefferson co., O. P. 405.

Richmond, v. (Hale P. O.), Jefferson tp., Ross co., O., on Scioto River. P. 227.

Richmond, tp., Berks co., Pa. P. 2874.

Richmond, tp., Crawford co., Pa. P. 1399.

Richmond, tp., Tioga co., Pa. P. 1558.

Richmond, tp., Washington co., R. I. P. 2064.

Richmond, tp., cap. of Fort Bend co., Tex., on Brazos River and Galveston Harrisburg and San Antonio R. R., has 1 newspaper. P. 816.

Richmond, p.-v. and tp., Chittenden co., Vt., on Vermont Central R. R. P. 1309.

Richmond, city, capital of Virginia, and seat of justice of Henrico co., on the N. side of James River and 151 miles from its mouth, in lat. 37° 32′ 17″ N., lon. 77° 27′ 28″ W., at the Great or Lower Falls, the head of tidewater. The site is a cluster of picturesque hills, of which the principal are Church and Shockoe. A settlement was made on what is now the lower portion of the city as early as 1609. "Fforte Charles" was erected there as a protection against the Indians in 1644–45, and in 1679, Col. Wm. Byrd built a mill there, and afterward a warehouse. The place was known as "Byrd's Warehouse" till May, 1742, when it was made a town by act of assembly. It was not until 1779 that it was created the capital of the State, being then but a small town. The population in 1800 was only 5737; by the census of 1870 it was 51,038; and by a census taken in 1874 by the city board of health it was 60,705, of which 33,492 were whites and 27,163 negroes. At the beginning of the year 1875, Richmond contained 7779 houses, of which 3846 were brick and 3933 wooden; assessed value of taxable real estate, $29,142,655; personal property, $11,315,838; city taxes, $668,338.17; State taxes (in city), $333,925.40; city debt, $4,323,591, of which $1,030,700 are 8 per cent. bonds, and the remainder 6 per cent. The city has an excellent police, and its efficient fire department has 5 steam-engines. The city owns and operates its own gas and water works, the former lighting over 1125 street lamps, and supplying annually for private and public consumption 90,000,000 feet of gas; and the latter supplying an average of over 350,000,000 gallons of water a day from capacious reservoirs, into which it is pumped by steam from the river above the city. The waterworks are enlarging by the addition of another reservoir and the further extension of mains and pipes. In 1874 there occurred 529 marriages in the city, of which 255 were white and 274 colored; total deaths, 1583—whites 727, colored 856; still-births, 191—whites 64, colored 127. In 1874 the manufactured products of the city were estimated at $17,746,720, of which the flouring-mills produced $2,214,683 (with the Columbian mills destroyed by fire during the year), ironworks $2,946,760, and tobacco-factories $8,327,581, a great variety of manufactories producing the remainder. The tobacco-factories were 57, cigar-factories 36, producing 23,803,189 pounds manufactured tobacco and 4,072,200 cigars, the U. S. internal revenue for the year in the city, paid almost exclusively on tobacco, being $3,801,761.56. Value of direct importations (chiefly coffee and salt), $296,036; exports, $3,031,686, of which over $1,500,000 was flour, and nearly the same amount tobacco, principally leaf and stems. Vessels entered from foreign countries, 10 American, tonnage 2477; 24 foreign, tonnage 7705; clearances, 39 American, tonnage 12,178; 51 foreign, tonnage 13,866. There are a chamber of commerce, corn and flour exchange, tobacco exchange, and stock exchange. A street railway traverses the city from its eastern to its western extremity. The railroads centring at Richmond are Richmond and Petersburg, Richmond Fredericksburg and Potomac, Richmond and Danville, Chesapeake and Ohio, and Richmond York River and Chesapeake. The Chesapeake and Ohio has a tunnel under Church Hill to its own wharves on the river. The James River and Kanawha Canal, connecting by dock with the navigable river below the falls, extends up the James to Buchanan, 196 miles from Richmond. The vast coal and iron veins of the State are within easy reach of the city, with both rail and water transportation. The James River Improvement, in which the city is assisted by the Federal government, has greatly increased the navigability of the river, removing obstructions and deepening the channel, so that now, at mean high tide, there is 14 feet depth to the wharves at Rocketts (as the lower portion of the city is called), with a promise of 18 feet at an early day. The water-power afforded by the falls is immense and easily utilized, but comparatively little of it has yet been taken advantage of. There are 2 bridges for vehicles and pedestrians across the river to the little city of Manchester on the S. side, 1 of them being free. Near the city are inexhaustible quantities of fine granite, and several large quarries are actively worked. Opposite Rocketts is a U. S. government granite-works, where much of this stone is prepared for public buildings at Washington City. Richmond has a fine system of public free schools, including a high school. There are 93 of these schools, of which 60 are for white pupils and 33 for colored. Some of the public school-houses are very handsome and well equipped. Private schools for both sexes are also numerous, including Richmond College for males and Richmond Female Institute for girls and young ladies. Richmond Medical College, with an able faculty, is taught in a fine structure remarkable as a specimen of the Egyptian style of architecture. The Roman Catholics have several excellent schools under their control, and for the higher education of the colored people there are the Richmond Normal School and the Colver Theological Institute. Not far from the city, at Ashland, is now located Randolph-Macon College. The city has 51 churches—16 Baptist (8 colored and 8 white), 12 Methodist (2 colored), 8 Episcopal (1 colored), 4 Presbyterian, 2 Lutheran, 3 Roman Catholic, 3 Jewish, 1 Disciples, 1 Friends, and 1 Universalist. Some of the churches are very elegant in appearance. Besides the State Central Lunatic Asylum (for colored insane), and the city almshouse, there are a number of orphan asylums, homes, etc. sustained by the various denominations and private charity, including a refuge for abandoned women. Societies of all orders are numerous among both white and colored, and Masonic Hall, on lower Franklin street, was dedicated in 1783, and is one of the earliest edifices in America thus set apart for Masonry, if not the earliest. There are several fine cemeteries, of which the principal are Hollywood, Shockoe, and Oakwood. In Oakwood over 16,000 Confederate soldiers are buried who died in the city hospitals during the war; and nearly as great a number is interred in Hollywood, where a high pyramidal monument of rough granite stones is erected to their memory. Hollywood is noted for its picturesque beauty and the distinguished dead whose dust is garnered there. There are 12 banks, of which 4 are national, and 12 home insurance companies. The State penitentiary is here, and on Shockoe Hill, visible from all quarters of the city, is the capitol, a handsome structure, with a noble pillared portico toward the river. It is surrounded by a square of 12 acres, finely shaded and adorned by trees, and beautified by shrubbery and flowers. In it are three fountains, Hart's marble statue of Henry Clay, Foley's bronze statue of Gen. Thomas J. (Stonewall) Jackson (a gift from English gentlemen to Virginia), and Crawford's equestrian statue of Washington. The last is the finest statue in America, and was inaugurated Feb. 22, 1858. The main pedestal is 42 feet high, and the equestrian statue (of bronze) 25 feet high. On sub-pedestals around and below the principal statue are statues in bronze of Henry, Jefferson, Lewis, Mason, Marshall, and Nelson—all illustrious Virginians. The first three of these statues are by Crawford and the others by Rogers. On an outer and still lower circle of pedestals are six symbolical figures in bronze, representing War, Peace, Justice, etc. The total cost of this monument was $260,000, of which $47,000 was from private donations. In the capitol itself are Houdon's statue of Washington, a bust of La Fayette, and a great many portraits of eminent Virginians. The State library contains many valuable books and records, together with a variety of curious and interesting relics, etc. The office of the governor and the halls and offices of the executive and legislative branches of the State government are in the capitol, where also the Southern Historical Society has its chief office and keeps its archives. The governor's mansion is located in the north-eastern corner of Capitol Square. Richmond and vicinity possess many interesting things and scenes for the visitor. Among these may be mentioned Bacon's Quarter Branch, reviving recollections of Bacon's rebellion in early colonial times; Bloody Run, said to have been so called in commemoration of a bloody defeat of the Indians by Bacon; the old Stonehouse, credited with being the oldest house in the city, and with having entertained Washington, Madison, Jefferson, and other Revolutionary heroes and worthies beneath its roof; St. John's church, of the colonial period, in which Patrick Henry is said to have made his famous speech,

State Capitol at Richmond, Va.

wherein he said, "Give me liberty or give me death!" St. John's ancient graveyard; the waterworks; the falls and isles of the river, including Belle Isle, where many Federal prisoners were kept; the Libby prison; the Tredegar ironworks, etc.; the flouring-mills, the largest in the world; the State fair-grounds ("Camp Lee" of the Confederacy); the Jefferson Davis mansion (now a public school-house); the U. S. custom-house and post-office, etc.

Richmond has been noted for its calamities. Among the principal of these are the following: 1781, taken and burned by the traitor Arnold; Dec. 26, 1811, Richmond Theatre burned, over 70 persons perishing in the flames, including Gov. G. W. Smith and many other distinguished citizens (Monumental Episcopal church now commemorating the disaster and its site); the burning of the city in Apr., 1865, at the evacuation by the Confederate government; the capitol disaster, in which, on Apr. 27, 1870, over 60 persons were killed or mortally wounded by the yielding of the floor of the court-room of the court of appeals beneath the weight of the multitude gathered to hear the decision of the court in the contested election for mayor of the city between Chahoon and Ellyson; the great flood in James River, in Sept., 1870, which inundated a great portion of the city; the Spottswood Hotel fire, in which a number of persons perished, etc.

In June, 1861, Richmond was made the capital of the Confederate States, and there the Confederate congress met on the 20th of July following. All the departments of the Confederate government were established in the city, and it became not only the heart and head of the effort to establish separate Southern independence, but the principal point of Federal invasion and attack. Owing to these facts, the city became prominent and important to the people of both sections of the Union, and the name and fame of Richmond familiar to the civilized world. The historical associations of both the Revolutionary and Confederate eras thus clustering about Richmond will always lend it a peculiar interest, and the beauty and advantages of its location will yet enable it to overcome adverse fortune and take a high rank among the foremost cities of the country. Richmond has now 5 daily newspapers, 3 morning and 2 evening, a number of religious and secular weeklies, and a medical, an agricultural, and an educational monthly, etc. M. P. Handy, Ed. "Enquirer."

Richmond, tp., Wise co., Va. P. 743.

Richmond, tp., St. Croix co., Wis. P. 875.

Richmond, tp., Shawano co., Wis. P. 539.

Richmond, p.-v. and tp., Walworth co., Wis. P. 1017.

Richmond (Dean), b. at Barnard, Vt., Mar. 31, 1804; removed in childhood to Salina, N. Y.; had few educational advantages, but became well informed by private studies; was first a manufacturer of salt, afterward a provision-dealer at Buffalo; became wealthy and an active Democratic manager, wielding a vast influence in the counsels of his party, but would never accept any office. He was a director of several railroads; became vice-president of the consolidated New York Central R. R. 1853, and president 1864. D. in New York City Aug. 27, 1866.

Richmond (Legh), b. at Liverpool, England, Jan. 29, 1772; graduated at Trinity College, Cambridge, 1794; took orders in the Church of England 1797; became curate of Brading and Yaverland in the Isle of Wight 1798, chaplain to the Lock Hospital, London, 1805, and was presented in the same year to the rectory of Turvey, Bedfordshire, which he held until his death, May 8, 1827. Author of several popular tracts, which have been circulated by millions in many languages, especially *The Dairyman's Daughter*, *The Negro Servant*, and *The Young Cottager.* He also edited *The Fathers of the English Church, or a Selection from the Writings of the Reformers and Early Protestant Divines of the Church of England* (8 vols., 1807–11).

Richmond (Margaret Beaufort), Countess of, daughter of Edmund Beaufort, duke of Somerset, and granddaughter of John of Gaunt, duke of Lancaster, b. at Bletsoe, Bedfordshire, England, about 1438; married Edmund Tudor, earl of Richmond (son of Owen Tudor by his wife, the queen-dowager Catharine of Valois, widow of King Henry V.), in 1455; lost her husband the following year shortly after the birth of her son, Henry Tudor (afterward King Henry VII.); resided some years at Pembroke

Castle under the protection of her brother-in-law, Jasper Tudor; married Sir Henry Stafford 1459; was again left a widow 1481; married Thomas, Lord Stanley, 1482, and assisted at the coronation of Richard III. July, 1483; was attainted with her son, in consequence of the conspiracy of Buckingham in favor of the latter, Oct., 1483; was known as countess of Derby during the reign of her son, her husband having been created earl of Derby as a reward for his defection from Richard III. on Bosworth Field; had no children by her later marriages; was noted for charity and devotion, and also for her patronage of letters and her own literary taste; translated *The Mirroure of Gold for the Sinfull Soule*, from a French version of the *Speculum Aureum Peccatorum* (printed by Pynson), and the fourth book of the *Imitation of Christ* (1504), and endowed Christ's College 1505, and St. John's College by bequest 1511, founding in each a "Lady Margaret professorship of divinity," still maintained. D. June 29, 1509. The principal title of the Tudor, Stuart, and Brunswick dynasties to the English throne was derived through this lady's descent from Edward III. through John of Gaunt, which was by no means free from objection from a heraldic point of view.

Richmond College, Richmond, Va., began its existence in 1830 as a seminary organized by the Baptist general association for the education of candidates for the ministry. In 1844 the seminary expanded into a college with a regular faculty of instruction and the power to confer degrees. Robert Ryland, D. D., was made president. The college steadily grew in favor and influence until the war shut its doors and destroyed its endowment. In 1866 the college was reorganized on a new basis, with T. G. Jones, D. D., as president. The university system is adopted, and studies are elective. There are now 7 independent academic schools, a school of law, and a commercial department, with 197 students. In 1869 a president was dispensed with as unnecessary under the new system. The faculty of instruction and government consists of coequal professors, one of whom is annually chosen to be chairman and chief executive officer. Each professor is responsible for the efficient conduct of his own school, and graduation in that school is determined by the professor after rigid written examinations. The degree of bachelor of arts is conferred upon such students as have graduated in a prescribed number of schools—the degree of master of arts upon such as have graduated in all the schools. Attendance on religious exercises is voluntary. A course of weekly lectures on the Bible, free of cost, is given every session. New and enlarged buildings, an ornament to the city, are in process of construction, and a vigorous effort is making to raise an endowment of $300,000, and with every prospect of success.

Richmond, Dukes of (1675), dukes of Lennox (Scotland, 1675) and of D'Aubigny (France, 1683), earls of March and of Darnley (1675), barons of Settrington and of Methuen (1675), a family of the English nobility descended from CHARLES LENNOX, natural son of King Charles II. by a French woman, Louise Querouaille, made duchess of Portsmouth, b. May 29, 1672; received the Lennox estates in Scotland and assumed that surname Aug. 20, 1680; resided several years in France, returned to England and supported the revolution of 1688; served in the army in Flanders under William III.; sold the Lennox estates 1702. D. at Goodwood May 27, 1723.—His son, CHARLES LENNOX, second duke, b. in London May 29, 1701; entered Parliament 1722; was lord high constable of England at the coronation of George II. 1727; made master of the horse and privy councillor Jan., 1735; brigadier-general July, 1739, major-general June, 1742; attended George II. at the battle of Dettingen, June, 1743; made lieutenant-general, and served against the rebels in Scotland 1745, and became colonel of the horse guards Feb., 1750. D. Aug. 8, 1750.—CHARLES LENNOX, third duke, b. Feb. 22, 1735, a man of talent and of liberal principles; entered the army; served with credit as general at the battle of Minden, 1759; was ambassador to France 1765; was principal secretary of state May, 1766; was dismissed from office in July of the same year; favored the recognition of American independence 1778; headed the Reform party in the House of Lords 1781, and was master-general of the ordnance 1782–95. D. Dec. 29, 1806.—His sister, SARAH LENNOX, married Col. George Napier, and was mother of the Napiers of Peninsular fame.—His nephew, CHARLES LENNOX, fourth duke, b. in 1764, served in the army; inherited the title 1806; was appointed lord lieutenant of Ireland 1808 and governor-general of British North America July 29, 1819. D. in Canada of hydrophobia Aug. 28, 1820. —His son, CHARLES GORDON LENNOX, b. in London in 1791; became a member of the privy council and of the Reform ministry of Earl Grey 1831. D. Oct. 21, 1860.—His son, CHARLES HENRY GORDON LENNOX, b. Feb. 27, 1818; educated at Christ Church, Oxford; sat in Parliament for West Sussex 1841–60; was aide-de-camp to the duke of Wellington 1842–52, and to Viscount Hardinge 1852–54; became president of the Poor Law board and member of the privy council 1858; succeeded to the dukedom 1860; was president of the board of trade in the Disraeli cabinet 1867–68; became the leader of the Conservative party in the House of Peers Feb. 26, 1870, and lord president of the council on the accession to power of the second Disraeli ministry in Feb., 1874. The dukedom of Gordon was conferred upon him in 1876.

Richmond Hill, p.-v., York co., Ont., Canada, near Northern Railway, 16 miles N. of Toronto, has 1 weekly newspaper. P. about 80.

Rich'mondville, p.-v., Forester tp., Sanilac co., Mich., on Lake Huron. P. 83.

Richmondville, p.-v. and tp., Schoharie co., N. Y., on Albany and Susquehanna R. R., has 1 newspaper and some trade and manufactures. P. of v. 630; of tp. 2307.

Rich Moun'tain, v., Cleveland co., N. C. P. 751.

Rich'ter (JEAN PAUL FRIEDRICH), generally called JEAN PAUL, b. at Wunsiedel, in Bavaria, Mar. 21, 1763. His father was a country minister, but very poor, and when he died, in 1779, he left to his family nothing but debt. The son, nevertheless, went to Leipsic in 1781 to study at the university, and he contrived to stay there four years, though he lived in the most pinching poverty, often having nothing to eat for two or three days. In 1784 he fled from Leipsic in order to escape imprisonment for debt, and for three years lived, together with his poor mother, at Hof. But from 1787 to 1789 he was private tutor in a family at Töpen, and from 1790 to 1794 a schoolmaster at Schwarzenbach. Compared with his life in Leipsic and at Hof, these positions offered him affluence, and in the mean time he had become a celebrated author. He had originally gone to Leipsic to study theology, and had read much of this science, as of everything else; but he was incapable of systematic and exhaustive study. There was something roving and diffuse in his intellect, as in his talent. He could concentrate his powers for one moment on one point, and a brilliant spark would be the result, but he could not keep them collected and lead them in a steady direction for any length of time. Thus, by his studies at Leipsic he had only prepared himself for a miscellaneous literary activity, and his first attempts were not successful. His *Grönländische Processe* ("Lawsuits in Greenland," 2 vols., 1784) and *Auswahl aus des Teufels Papieren* ("Selections from the Papers of the Devil," 1788) were not read; their satire is narrow, their humor forced, their form unripe. But in 1793 his romance, *Die Unsichtbare Loge* ("The Invisible Lodge," 2 vols.), turned the scales of fortune, and now followed in rapid succession, and with decided success, *Hesperus* (4 vols., 1794), *Biographische Belustigungen unter der Gehirnschale einer Riesin* ("Biographical Recreations under the Cranium of a Giantess," 1796), *Leben des Quintus Fixlein* (1796), *Blumen-, Frucht- und Dornenstücke, oder Ehestand, Tod und Hochzeit des Armenadvocaten Siebenkäs* ("Flower, Fruit, and Thorn Pieces, or Marriage, Death, and Wedding of Lawyer Siebenkäs," 4 vols., 1797), *Der Jubelsenior* (1797), *Das Kampaner Thal* (1797). These writings made Jean Paul the literary fashion of Germany. In 1794 he gave up his position as a schoolmaster, and began a life of visits to the different literary centres—Leipsic, Weimar, Dresden, and Berlin. He was everywhere well received, and made many intimate friends, among whom, however, Goethe and Schiller were not. It was especially the fair sex which was enthusiastic for him. In Berlin the most distinguished ladies sent their footmen when he had his poodle trimmed in order to get a lock of its hair. Many of them fell in love with him, some proposed to him, and one committed suicide when rejected. In 1801 he married in Berlin the beautiful and spirited Caroline Mayer, and removed first to Meiningen, then to Bayreuth. The king of Bavaria gave him an annual pension of 1000 florins, and the University of Heidelberg made him a doctor. In 1803 he published his *Titan*, and in 1804 *Die Flegeljahre* ("Wild Oats," 4 vols.), which two romances, together with his first philosophical attempt, *Vorschule der Æsthetik* ("Introduction to Æsthetics," 3 vols., 1805), may be considered as indicating the culmination of his talent. In 1807 he wrote another philosophical book on education, *Levana oder Erziehungslehre*, and in the following years he published a great number of political and satirical pamphlets, sermons, humorous sketches, etc. D. in Bayreuth Nov. 14, 1825. His collected works (Berlin, 1826–38) comprise 65 vols., and the general character of these is that of a collection of "gems." No writer has made such brilliant remarks, and no ten have made so many. He wrote in

"gems." And this is the reason why a book of Jean Paul's is the most captivating reading for the first half hour and the most provokingly tiresome for the next. It has been said that when he read a book he noted down on small slips of paper every striking fact or idea he met with, and that when he wrote a book he had these slips arranged before him as prompters of his imagination. The miserable style in which his books are written proves the tale to be true. But beneath this utterly inartistic manner of composition there are genuine poetical inspirations, and although these inspirations are not very elevating, as they are not of any high order, they are very charming on account of the originality and peculiarity of their character. Jean Paul is alternately sentimental, grotesque, and gloomy. But his sentimentality is generally airy and graceful, like "woven wind;" his grotesqueness is often witty and sportful; and his gloom sometimes rises into true pathos.

CLEMENS PETERSEN.

Rich Square, p.-v., Northampton co., N. C. P. 3133.

Rich Valley, tp., McLeod co., Minn. P. 527.

Rich Valley, p.-v. and tp., Smyth co., Va. P. 3572.

Rich View, p.-v. and tp., Washington co., Ill., on Illinois Central R. R., has 1 newspaper. P. 1080.

Rich'ville, p.-v., De Kalb tp., St. Lawrence co., N. Y., on Rome Watertown and Ogdensburg R. R.

Rich'wood, tp., Izard co., Ark. P. 280.

Richwood, tp., Sharpe co., Ark. P. 722.

Richwood, tp., Calhoun co., Ill. P. 1111.

Richwood, tp., Peoria co., Ill. P. 1239.

Richwood, tp., McDonald co., Mo. P. 833.

Richwood, tp., Miller co., Mo. P. 1361.

Richwood, tp., Washington co., Mo. P. 760.

Richwood, p.-v., Union co., O., on Atlantic and Great Western R. R., 100 miles N. W. of Cincinnati, has 3 churches, a public library and reading-room, 2 banks, 1 newspaper, 2 large grain-elevators, a flax-mill, 1 steam chair-factory, and 2 hotels. Principal business, farming. P. 436. J. H. VAUGHAN, ED. "GAZETTE."

Richwood, tp., Richland co., Wis. P. 1378.

Rich Woods, tp., Jackson co., Ark. P. 261.

Richwoods, tp., Prairie co., Ark. P. 280.

Richwoods, tp., Pulaski co., Ark. P. 409.

Ric'imer, a general of the Western Roman empire, of barbarian descent, noted as much for his cynical unscrupulousness as for his political craft and military talent; ruled the Western Roman empire for about twenty years through puppet emperors, whom he set up and put down entirely at will—first Avitus, whom he dethroned in 456 and made a bishop; next Majorianus, whom he caused to be assassinated in 461; then Vibius Severus, who died in 465; next Anthemius, who was murdered in 472; and finally Olybrius, who died in the same year as Ricimer (472).

Ricinus. See CASTOR OIL.

Rickarees', Arickarees, or **Rees,** a tribe of Indians of the Pawnee stock living on the upper Missouri River, separated from the Pawnees in the Platte Valley toward the close of the eighteenth century; suffered severely from smallpox 1791; were further reduced in numbers by wars with the Dakota tribes; were for many years hostile to the whites; were defeated and dispersed by U. S. troops 1823; made a treaty 1825; were driven up the Platte Valley 1831; returned to the Missouri some years later, and united with the Mandans and Minnetarees, with whom they located at Fort Berthold 1862; and were assigned to a vast joint reservation in N. W. Dakota and E. Montana by executive order of Apr. 12, 1870. No Protestant mission or school has yet been established among them, but the American Board of Commissioners for Foreign Missions has recently accepted the care of their religious education. They number somewhat less than 1000.

Rick'ets, a term applied to a distortion of the bones, especially those of the extremities, which is the result of a diseased condition arising from mal-assimilation of the ingredients which properly form the bone-substance, and by which they are deprived of the proper supply of earthy materials. It is a disease of early life, occurring as a rule in infants from twelve to eighteen months of age. The predisposing causes are the influence of an impure or poisonous atmosphere, improper food and clothing, and poorly ventilated, damp apartments, especially if they be deprived of sunlight. The symptoms are not well marked and characteristic in the early stages; they develop gradually and almost imperceptibly. The little patient seems to lose his spirits, and his general health fails; indigestion sets in, and is accompanied by swelling of the abdomen and colic. As a consequence, we have emaciation taking place to a marked degree, the muscles becoming soft and flabby, the face sallow, and the skin dry, and there is scanty and turbid urine and thin fœtid evacuations. The fontanelles and sutures remain open until a late period, and there is often noticed a profuse sweating of the scalp, and a rolling of the head upon the pillow which results in a baldness of the back of the head. The teeth are very late in making their appearance, and decay rapidly after doing so. As the disease advances the bones grow softer and softer, and become distorted by the superincumbent weight and muscular contraction. The bones of the extremities are bent, shortened, and twisted, and the ends enlarged. The ribs become flattened by atmospheric pressure, and drawn inward by the contraction of the diaphragm, and as a consequence we have the sternum pushed forward in front, and the deformity known as pigeon or chicken breast. As a disease of the bones, rickets is never dangerous. It is from the deformities resulting, and their interference with the action of the lungs and other viscera, that the danger arises. The treatment can be summed up in a few words —fresh air, sunlight, good food, bathing, and *cod-liver oil.* The deformities may be remedied to a certain extent by the use of splints. In after life, when the bones have become hardened, a wedge-shaped piece may be taken from the convex side and splints applied.

EDWARD J. BERMINGHAM. REVISED BY WILLARD PARKER.

Ricketts (JAMES B.), b. in New York 1816; graduated at the U. S. Military Academy, and entered the artillery July, 1839; served in the Mexican war and on frontier duty up to 1861; commanded a battery in the capture of Alexandria May 24, as in the battle of Bull Run July 21, 1861, from which date he was made brigadier-general of volunteers; was engaged in the battle of Cedar Mountain, at the second battle of Bull Run, and at Chantilly commanded a division, as at South Mountain and Antietam; participated in the final Richmond campaign in command of a division from the battles of the Wilderness to the investment of Petersburg; recalled to Washington July, 1864, to aid in the defence against Early's threatened attack, and engaged in the subsequent pursuit of Early's army, participating in the battles of Monocacy, Opequan, Fisher's Hill, and Cedar Creek; brevetted from lieutenant-colonel to major-general for gallantry. In Jan., 1867, was retired on the full rank of major-general.

Ricks, tp., Christian co., Ill. P. 414.

Ricord' (PHILIPPE), M. D., b. at Baltimore, Md., of French parentage Dec. 10, 1800; went to Paris 1820; received his medical degree 1826; was surgeon-in-chief of the Hôpital du Midi at Paris; acquired a wide reputation by his treatment of venereal diseases; obtained the Monthyon prize 1842, and was appointed consulting surgeon to the emperor Napoleon III. Oct., 1869. Author of numerous surgical works in his special department.

Ricot'ti (ERCOLE), b. at Voghera in 1816; took his degree in the University of Turin, and at the age of twenty-one presented to the Academy of Sciences of that city his *chef-d'œuvre, Storia delle Compagnie di Ventura.* For this he was honored with a prize, although the work only appeared completed in 1843–44, when it was published in Turin in 4 vols. This was followed by other works—*Corso di Lezioni sopra la Storia d'Italia dal Basso Impero ai Comuni* (Turin, 1848), *Breve Storia d'Europa e specialmente d'Italia* (2 vols., Turin, 1850–51), *Storia della Monarchia Piemontese* (6 vols., Florence), *Della Vita e degli Scritti di Cesare Balbo* (Florence), *Storia della Costituzione Inglese* (Turin). At first a civil engineer, then a lieutenant in the army, he was in 1846 appointed professor of modern history in the University of Turin; was a deputy of the Subalpine Parliament 1848–53; rector of the University of Turin, etc., and is senator of Italy. A recent work of his is *Della Rivoluzione Protestante.*

Rid'dell (JOHN LEONARD), M. D., b. at Leyden, Mass., Feb. 20, 1807; graduated at the Rensselaer Institute at Troy, N. Y., and received the degree of M. D. from the Cincinnati Medical College in 1835, where he became professor of botany and adjunct professor of chemistry; subsequently held the professorship of chemistry in the medical department of the University of Louisiana from 1836 to 1865. Author of a *Flora of the Western States* (1836) and of many contributions to botany; discovered the microscopical characteristics of the blood and black vomit in yellow fever; first brought to notice the botanical genus named from him *Riddellia;* was melter and refiner of the U. S. mint at New Orleans, and inventor of the binocular microscope and magnifying glass. D. at New Orleans, La., Oct. 7, 1867. PAUL F. EVE.

Riddle. See ENIGMA.

Rid'dle (ALBERT GALLATIN), b. at Monson, Mass., May 28, 1816; was taken in infancy to Northern Ohio; educated at Painesville Academy and at Western Reserve

College; studied law; was prosecuting attorney for his county 1840–46, and again 1854–56; served in the Ohio legislature 1848–50, and in Congress 1861–63; was for some time consul at Matanzas, and afterward settled as a lawyer at Washington, D. C. Author of *Students and Lawyers*, *Bart. Ridgley*, *The Portrait*, and *Alice Brand*.

Riddle (George Reade), b. at Newcastle, Del., in 1817; graduated at Delaware College; became a contractor for the construction of railroads and canals; admitted to the bar 1848; member of Congress 1851–55; commissioner of Delaware to verify Mason and Dixon's line 1849; U. S. Senator 1864–67. D. at Washington Mar. 30, 1867.

Riddle (Joseph Esmond), b. in England about 1804; educated at St. Edmund Hall, Oxford; took orders in the Church of England 1832; was for some years curate of Harrow; became incumbent of a church at Leckhampton, near Cheltenham, 1840, and was Bampton lecturer 1852. D. at Cheltenham Aug. 27, 1859. Author of a valuable *Latin-English Dictionary* (1836), an *English-Latin Dictionary* (1838), a *Manual of Christian Antiquities* (1839), *Natural History of Infidelity* (Bampton lectures, 1852), and many other works, theological and educational; was a contributor to the *Encyclopædia Metropolitana*, and published (with Rev. T. K. Arnold) *A Copious and Critical Latin-English Lexicon, founded on the German and Latin Dictionaries of Dr. W. Freund* (1849), and *English-Latin Lexicon* (1849), based on that of Dr. C. E. Georges; also labored with Rev. John T. White in the preparation of another *Latin-English Dictionary*, which appeared in 1862, and upon a new edition of Passow's *Greek Lexicon*.

Ridenhouse, v., Stanley co., N. C. P. 656.

Ridge, tp., Monro co., Ala. P. 1190.

Ridge, tp., Jackson co., Ill. P. 1056.

Ridge, tp., Shelby co., Ill. P. 1139.

Ridge, tp., Union co., Ill. P. 940.

Ridge, tp., Van Wert co., O. P. 1406.

Ridge, tp., Wyandot co., O. P. 584.

Ridge, tp., Williamsburg co., S. C. P. 1426.

Ridge'bury, p.-v. and tp., Bradford co., Pa. P. 1476.

Ridge'field, p.-v. and tp., Fairfield co., Conn., on Ridgefield branch of Danbury and Norwalk R. R. P. 1919.

Ridgefield, tp., Huron co., O. P. 2533.

Ridge'ley, tp., Bullock co., Ala. P. 2080.

Ridgeley, p.-v., Platte co., Mo. P. 121.

Ridge'ly (James Lot), b. at Baltimore, Md., Jan. 27, 1807; educated at St. Mary's College, Baltimore, and at Mount St. Mary's College, Emmittsburg; studied law; was admitted to the Baltimore bar June, 1828; member of the city council of Baltimore 1834–35; of the house of delegates 1838, and of the constitutional conventions of 1849 and 1864; was 12 years register of wills for Baltimore county, several years president of the board of education, and inaugurated the present public school system 1848; was appointed by Pres. Lincoln collector of internal revenue, and has been since 1855 president of the Mutual Fire Insurance Company; was initiated into Odd Fellowship in 1829; became a member of the grand lodge of Maryland in 1830, and of the grand lodge of the U. S. 1831; in the latter was elected in 1836 grand sire, and since 1842 has been grand corresponding and recording secretary; is the chief author of the various rituals now in use; edited the *Covenant*, the official magazine of the order; wrote *Odd Fellowship—What is it?* and numerous other publications, including *The Odd Fellow's Pocket Companion* (Philadelphia, 1853). Theodore A. Ross.

Ridge'ville, tp., McIntosh co., Ga. P. 413.

Ridgeville, p.-v., Franklin tp., Randolph co., Ind., on Pittsburg Cincinnati and St. Louis R. R. P. 716.

Ridgeville, tp., Henry co., O. P. 764.

Ridgeville, tp., Lorain co., O. P. 1477.

Ridgeville, p.-v. and tp., Monroe co., Wis. P. 829.

Ridge'way, p.-v., Lincoln tp., Winneshiek co., Ia., on Milwaukee and St. Paul R. R.

Ridgeway, p.-v. and tp., Osage co., Kan. P. 1141.

Ridgeway, p.-v. and tp., Lenawee co., Mich. P. 992.

Ridgeway, p.-v. and tp., Orleans co., N. Y., on Erie Canal and on New York Central R. R. P. of v. 118; of tp. 5096.

Ridgeway, p.-v., Warren co., N. C., on Raleigh and Gaston R. R., has 1 newspaper.

Ridgeway, p.-v., Hale tp., Hardin co., O., on Cleveland Columbus Cincinnati and Indianapolis R. R. P. 177.

Ridgeway, p.-v., Fairfield co., S. C., on Charlotte Columbia and Augusta R. R.

Ridgeway, p.-v. and tp., Henry co., Va. P. 3171.

Ridgeway, p.-v. and tp., Iowa co., Wis. P. 2489.

Ridge'wood, p.-v., Franklin tp., Bergen co., N. J., on Erie R. R.

Ridg'way, p.-v. and tp., cap. of Elk co., Pa., on Philadelphia and Erie R. R., 118 miles from Erie and about 120 miles from Williamsport, has 4 churches, 2 banks, 2 newspapers, 2 tanneries, 4 hotels, 1 grist and 3 saw mills, and a foundry and machine-shop. Principal business, lumbering and tanning. P. 800.

Rid'ley, tp., Delaware co., Pa. P. 1142.

Rid'ley (Nicholas), D. D., b. at Unthank, Northumberland, England, about 1500; educated at the grammar school at Newcastle-upon-Tyne; graduated at Pembroke Hall, Cambridge, 1522; obtained a fellowship and was ordained priest 1524; studied theology at the Sorbonne, Paris, and at the University of Louvain, 1527–29; became on his return to Cambridge under-treasurer to the university, and soon afterward senior proctor (1533) and public orator, in which capacities he protested against the usurpations of ecclesiastical jurisdiction by the papacy, procuring a decree of the university to the same effect; was appointed domestic chaplain to Archbishop Cranmer 1537, vicar of Herne, Kent, 1538, master of Pembroke Hall and chaplain to the king 1540; was accused of heresy at the instigation of Bishop Gardiner, on account of having preached against the "Six Articles," but acquitted by Cranmer 1541; became prebendary of Westminster 1545, bishop of Rochester Aug. 14, 1547; bore an important part in all the ecclesiastical measures of the reign of Edward VI.; assisted Cranmer in compiling the Liturgy (1548) and framing the forty-one "Articles of Religion;" induced the king to change Greyfriars and St. Bartholomew's priories into charitable institutions; converted his own house of Bridewell into a workhouse; was instrumental in founding Christ's, St. Thomas's, and Bethlehem hospitals; was a member of the commission which deposed Bonner, and was his successor as bishop of London Apr., 1550; aided in the deposition of Gardiner, bishop of Winchester; visited the princess Mary at Hunsdon, desiring to gain her acquiescence in his views of Church reform, but was unsuccessful, 1552; concurred in the proclamation of Lady Jane Grey as queen, and was induced by the duke of Northumberland to preach a sermon at Paul's Cross in defence of her title July 16, 1553; was committed to the Tower on the accession of Mary a few days later; was taken to Oxford Apr., 1554, to participate in a discussion with the court theologians on the Real Presence; was formally tried for heresy with Cranmer and Latimer by a commission named by Cardinal Pole, and condemned to death as an obstinate heretic Oct. 1, 1555, and, after several efforts to induce him to recant, was burnt at the stake with Latimer in front of Baliol College, Oxford, Oct. 16, 1555. His *Life* was published by his descendant, Dr. Gloucester Ridley (1763), and his *Works*, chiefly tracts in favor of the Reformation, were edited by Rev. Henry Christmas for the Parker Society (1841).

Ridol'fi (Cosimo), Marquis, b. in Florence in 1794; was brought up in the country, and became particularly skilled in agricultural and physical science. He founded on his estate of Melato an agricultural institute and created a model farm; took an active part in the *Giornale Agrario* and in the labors of the Accademia de' Georgofili, of which he was named president. The grand duke Leopold confided to him the education of his two sons. In 1847 he presided over the ministry which bore his name, he himself taking the portfolio of the interior; was afterward sent by the grand duke as minister plenipotentiary to Paris, London, and Brussels. After the flight of the grand duke he retired from public affairs, but returned to political life again in 1859 with Baron Ricasoli. He was appointed senator of the kingdom in 1861. His principal work is *Lezioni Orali di Agricoltura* (2 vols. 8vo; 2d ed., Florence, 1866). D. in Florence in 1864.

Ri'dott, p.-v. and tp., Stephenson co., Ill., on Chicago and North-western R. R. P. 1915.

Rie'desel, von (Friedrich Adolph), Baron, b. at Lauterbach, Hesse, June 3, 1738; studied at the College of Marburg; was an officer of a Hessian regiment in the British service during the Seven Years' war, distinguishing himself at the battle of Minden; became adjutant-general of the Brunswick army 1767, colonel of carbineers 1772, and major-general 1776, in which capacity he was sent to America in command of the division of 4000 Brunswickers hired to Great Britain; arrived at Quebec June 1; spent a year in Canada exercising his troops in the Indian methods of warfare; joined Burgoyne in his campaign against Albany 1777; was at Ticonderoga and Hubbardton July 6–7, and at the first battle of Saratoga, Sept. 19; advised a retreat after the second battle,

Oct. 7; surrendered with Burgoyne Oct. 17; was taken to Albany with his wife and children, who were entertained with great courtesy by Gen. Schuyler; was sent to Cambridge, Mass., Nov., 1777; transferred to Virginia 1778; was exchanged in the autumn of 1780; was placed by Sir Henry Clinton in command of Long Island; was transferred to Canada Sept., 1781; returned to Germany Aug., 1783; became lieutenant-general Mar., 1787; commanded the Brunswick contingent in Holland (1788–93), and became commandant of the city of Brunswick 1794. D. at Brunswick Jan. 6, 1800. His *Memoirs, Letters, and Journals during his Residence in America*, edited by Max von Eelking, were translated by William L. Stone, and published by Joel Munsell (2 vols., Albany, 1868).—His wife, FRIEDRIKE CHARLOTTE LUISE, daughter of the Prussian minister Masson, b. in Brandenburg in 1746; married about 1763; d. at Berlin Mar. 29, 1808. She wrote to her mother an interesting series of letters descriptive of life in Canada, of the incidents of Burgoyne's campaign, and of her residence as a prisoner at Cambridge and elsewhere. They were edited by her son-in-law, Count Reuss. *Voyage de Mission en Amérique, ou Lettres de Madame de Riedesel* (Berlin, 1799), were published in an incomplete English version at New York in 1827, and in a complete translation by William L. Stone: *Letters and Journals, etc.* (Albany, 1867).

Rie′gelsville, p.-v., Durham tp., Bucks co., Pa., on Delaware River.

Rie′go y Nuñ′ez, del (RAFAEL), b. at Oviedo, Spain, Oct. 24, 1785; was a volunteer in the national uprising against the French invasion of 1808; taken prisoner and detained in France 1808–14; visited Germany and England; became an officer in the Spanish army; headed the triumphant movement for the restoration of the constitution of 1812, which was commenced by a single battalion in the Isla de Leon Jan. 1, 1820; was chosen president of the new Cortes at their first session, Feb., 1823; was taken prisoner after the French intervention of that year, which he had strenuously opposed; conveyed to Madrid Oct. 2; condemned to death as a traitor and executed at Madrid Nov. 7, 1823. His limbs were sent to different parts of the Peninsula, and his head was kept at Las Cabezas (Isla de Leon), where he had proclaimed the constitution. Under subsequent liberal administrations his memory has been highly honored, and the so-called *Hymn of Riego* was the national hymn of Spain under the republic.

Rien′zi, p.-v., Alcorn co., Miss., on Mobile and Ohio R. R.

Rienzi, di (COLA), b. about 1312 at Rome, where his father was a tavern-keeper and his mother a water-carrier, although he himself claimed to descend, illegitimately, from the imperial house of Luxemburg. The first twenty years of his life he spent among the peasants of Anagni, but on his return to Rome he began to prepare himself for the office of a notary by studying grammar and rhetoric and reading the old Latin poets and historians. He was by nature a man of great eloquence and of a vivid imagination, and the study of ancient literature highly developed his natural power of speech, while at the same time it filled his imagination with a dazzling vision—that of the greatness of Rome. The state of the city was miserable. The pope resided at Avignon, and with him the last means of order and justice were lost. The noble families had their fortified castles in the streets, and feuds among the lords and violence and cruelties against the people were the general features of life in Rome. One of the nobles assassinated Rienzi's brother, and the impossibility of bringing the murderer to punishment gave his visions at once a practical bearing; from a dreamer he became a reformer. In 1343 he was chosen a member of the deputation which was sent to Avignon to congratulate Pope Clement VI. on his accession to the papal throne, and to urge him to return to Rome and protect the people against the oppression of the nobles. Rienzi is said to have made a great impression on the pope, and he received many favors from him; but as he failed to induce him to take any action, he returned to Rome in 1344 and began the work of reform himself, well knowing that he could not carry it through without a revolution. On May 20, 1347, the revolution was accomplished. It was preceded by no conspiracy; it was accompanied by no violence; it looked more like a pageant. From the church of St. Angelo, Rienzi and his twenty-five confederates issued forth in grand attire, and, accompanied by the bishop of Orvieto, they walked in a solemn procession to the capitol, when Rienzi read to the assembled people the constitution which purposed to usher in the new era—*il buono stato*. The constitution was accepted with enthusiasm, and Rienzi was invested with dictatorial power under the title of "tribune of liberty, peace, and justice." The nobles, who had paid no attention to his public harangues, because they considered him mad, were taken completely by surprise, and were compelled to surrender their strongholds and take oaths to support the constitution; and in a very short time such a change took place in Rome and in the dominions belonging to her that not only other Italian cities, but foreign monarchs, sent deputations and embassies to congratulate the tribune. Unfortunately, however, for Rienzi, although he had become a reformer, he had not ceased to be a dreamer. He had restored order and peace to Rome; he next attempted to restore her old supremacy over the world, and summoned Ludwig of Bavaria and Karl of Bohemia, who contended for the imperial crown, to repair before him. The attempt failed utterly. The foreign princes were disgusted and offended at his arrogance. The Roman populace grew tired of his magnificent processions and of his taxes. And in such a moment of general distemper the nobles attacked him and compelled him to flee in disguise from the city Dec. 15, 1347, seven months after his accession to power. Once more he returned to Rome. After living concealed among the Franciscan monks in Southern Italy for two years, he went to Prague, to the emperor Karl IV. A monk had prophesied that he should deliver Rome and inaugurate a new era in the history of the world, the era of the Holy Ghost, by the aid of the emperor. Rienzi believed in the prophecy, but the emperor did not. He sent him to Avignon, and the pope kept him in prison. Innocent VI., however, the successor of Clement IV., thought that Rienzi could still be used with advantage as a means of restoring peace and order in Rome, where, during the rule of the nobles, things were worse than ever. He sent him with Cardinal Albornoz to Rome in the quality of a senator, and in Aug., 1354, Rienzi made a sort of triumphal entry into the city. He was received with enthusiasm. But very soon it became apparent that the man's character had changed sorely under his misfortunes. His fantastic arrogance was the same, but now it was accompanied by caprice, suspicion, and cruelty. The nobles never acknowledged his government, and he had to besiege them in their castles; and the populace became so infuriated by his arbitrary measures that a wild crowd surrounded him on the stairs of the capitol and killed him, Oct. 8, 1354. CLEMENS PETERSEN.

Rie′sengebirge ("Giant Mountains"), a mountain-range which for a distance of about 50 miles forms the boundary between Bohemia and Prussian Silesia, is congruous to the Erzgebirge in the W., and is continued eastward by the Sudeten. The highest peak is Schneekoppe, 5253 feet.

Rie′si, town of Sicily, province of Caltanisetta, about 17 miles N. W. of Terranuova, in one of the richest and most healthy districts of the island. Besides grain, oil, fruits, nuts, etc., valuable minerals abound here. There is an active trade in agricultural products, and the chemical manufactures of Riesi are much esteemed. The inhabitants enjoy an enviable reputation, according to the Sicilian standard, for industry, honesty, and intelligence. P. in 1874, 11,500.

Rie′ti [anc. *Reate*], town of Italy, province of Perugia, on the Velino, about 50 miles N. E. of Rome. A large part of the adjoining plain was once a lake, the draining of which was begun nearly 300 years before our era, and only fully completed in the seventeenth century. The walls which still surround the town, now divided into the old and the new city, were reconstructed on earlier foundations in 1250. The streets and squares are not inconvenient, and of the 15 churches, some are very old, and not so entirely remodelled as to destroy their interest. The cathedral and Santa Scolastica are particularly noteworthy. The communal buildings and private palaces are very respectable. Fifteen monastic edifices became public property on the recent partial suppression of convents in Italy. Rieti is enumerated by Roman writers as among the first of the Sabine cities, and after its submission to Rome it continued to prosper even through the barbarian invasions, which it had the rare fortune to escape, coming at last peaceably under the Lombard rule. In the ninth century, however, it suffered greatly from the Saracens, and from this time calamity after calamity succeeded—sieges, sacks, fires, and plagues. Nevertheless, it managed, for the most part, to preserve its independence, even against the arms of the popes, until 1500, when it lost its autonomy and became a portion of the papal territory. In 1785 it was greatly damaged by an earthquake, and in 1799 it endured the horrors of fourteen days' sack at the hands of the troops of the Santa Fede. The first bishop of Rieti is said to have been Prosdocimus, a disciple of St. Peter. Some traces of the magnificent Roman villas mentioned by Varro as in this neighborhood may still be seen. The fruits and other

agricultural products of this plain are of a very superior quality, and it furnishes seed on a large scale for other parts of Italy. P. 14,500.

Riet'schel (Ernst Friedrich August), b. at Pulsnitz, Saxony, Dec. 5, 1804; studied at the Academy of Art in Dresden, under Rauch in Berlin, and in Italy; was appointed professor in Dresden in 1832, and d. there Feb. 21, 1861. His principal works are—*Mary weeping over the Body of Christ*, a group in natural size, in Potsdam; the statue of Thaer in Leipsic; of Lessing in Brunswick; the Goethe-Schiller group in Weimar; the Luther monument in Worms; the busts of Luther and Augustus II. of Saxony for the Valhalla.

Ri'fle, a firearm (large and small) having the barrel grooved to give a rotatory movement to the projectile. (See Cannon and Small-Arms.) P. V. Hagner.

Ri'fling of Ord'nance. Rifling is the device by which a cannon is made to give its projectile a movement of rotation about an axis coinciding with the axis of the gun. It is in consequence of this rotation that the elongated projectile moves in the direction of its longer axis, and hence is far less resisted by the atmosphere than a spherical shot of equal weight. The rifling is, in fact, making the gun a nut or female screw, while the projectile has upon it, or is made by force of the explosion to take, projections which cause it to turn in the gun according to the pitch of the screw cut therein.

Mechanically, the rifling of a gun consists in cutting grooves in the bore, and is generally effected by a tool fastened to the end of a bar and forced down the bore. By giving to the gun or to the bar a movement of rotation the groove cut by the tool will take a screw-like form, according to the degree of rotation, or what is termed the "twist" of the rifling. We do not propose to follow out any particular method of effecting the rifling; any desired peculiarity can be readily obtained. Rifling of cannon may be divided, first, into rifling for muzzle-loading guns; and, second, rifling for breech-loading guns.

The rifling for muzzle-loaders consists of a certain number of grooves, usually varied according to the calibre. In the case of "studded" projectiles the grooves must admit the studs to go down freely in the gun; and if more than one row of studs is placed on the shot, the non-bearing side of the studs in the front row must be partially removed in case of the increasing twist which is now used in the heavy Woolwich gun of England. The expanding projectiles adopted in the U. S. service are loaded without regard to the grooves, and only take the impression of them from the force of the powder at the time of firing. The yielding qualities of the expanding material permit its accommodating itself to the increasing twist if used in the gun. In each gun the grooves are of equal width and depth. The "lands" or portions between two grooves are consequently equal. For expanding projectiles the grooves should be of an unequal number, so that a land should always be opposite a groove. In regard to the number of grooves for muzzle-loading guns, the Woolwich practice is from three to nine, increasing with the calibre. The 81-ton gun is stated to have eleven grooves, each 1.5 inches wide and .2 inch deep. The rifling of the Parrott guns is made on the following plan: The circumference of the bore is divided into an even number of equal parts, each as near an inch as practicable; one is made a groove, and the adjacent one a land; each groove is .1 inch deep. The twist is increasing from 0 at the seat of the shot to a final twist at the muzzle, as given below:

Rifling of Parrott Guns.

Size of gun.	Diameter of bore, inches.	Number of grooves.	Number of lands.	Depth of grooves, inches.	Width of grooves and lands in parts of circumference.
3-inch............	3.00	3	3	0.1	$\frac{1}{6}$
20-pounder......	3.67	5	5	0.1	$\frac{1}{10}$
30 "	4.2	5	5	0.1	$\frac{1}{10}$
60 "	5.3	7	7	0.1	$\frac{1}{14}$
100 "	6.4	9	9	0.1	$\frac{1}{18}$
200 "	8.00	11	11	0.1	$\frac{1}{22}$
300 "	10.00	15	15	0.1	$\frac{1}{30}$

In regard to the twist, it may be assumed that it must be greater in proportion to the length of the projectile, but opinions as to the degree of twist are not precise. The converted 8-inch rifle lately subjected to a very successful trial in our service has a twist of 1 turn in 40 feet, and uniform. The heavy Woolwich guns have been rifled as follows:

7-inch gun, uniform twist, 1 turn in 35 calibres.
8 " increasing 0 to 1 turn in 40 "
9 " " 0 1 " 45 "
10 " " from 1 turn in 100 to 1 turn in 40 calibres.
12-inch gun, increasing from 1 turn in 100 to 1 turn in 50 calibres.
35-ton gun, " " 0 to 1 turn in 40 calibres.
81 " " said to be from 0 to 1 turn in 35 calibres.

The increasing twist is supposed to be attended with certain advantages, which are—that the projectile is not compelled to turn at the moment of starting from its place, but takes up its rotation gradually in its passage through the bore, and thus the strain upon the gun near the seat of the charge is diminished; also, that expanding projectiles, which must take the grooves, if at all, at the first movement of the shot, will do it more readily when the rifling is without twist in the lower portion of the bore. It is also probable that the increasing twist is favorable to the communication of a rapid rotation to the projectile.

There are also peculiar modes of rifling, some of which have been found practicable, but it is doubtful whether any of them will supersede the more familiar plans to which we have adverted. Among these peculiarities are the Whitworth guns, which have bores hexagonal in section, but so turned round as to give the desired twist to the bore itself. The shot, being so formed as to conform to the bore with a slight windage, is of course projected from the gun with the desired rotation. The Lancaster gun was constructed at first in a way somewhat similar to the Whitworth. The bore was oval in cross-section, but the longer axis of the oval changes in position so as to give a twist to the bore, by which the projectile acquires its rotation. Rifling by means of ridges left in the bore running through its length, but with a twist, has also been tried. In this case the projectile has grooves to suit the ridges left in the gun, and on being fired takes up the rotation due to the guiding ridges.

Rifling of Breech-loading Cannon.—In this case the grooves extend from the muzzle to the chamber which receives the projectile. This chamber is made by removing the grooves, and the projectile, thus filling the chamber, is actually larger than the bore of the gun, is forced through it on firing, and so made to take the grooves. The grooves of breech-loading guns are usually quite numerous, and made to narrow slightly in width toward the muzzle of the gun. The Sutcliffe breech-loading 9-inch gun, for example, has 32 grooves and 32 lands. Each groove is .09 inch deep, and is made to narrow 0.1 inch from the chamber to the muzzle of the gun. The twist is uniform—1 turn in 45 feet. R. P. Parrott.

Ri'ga, the capital of Livonia, next to St. Petersburg and Odessa the most important port of Russia, on the right bank of the Düna, about 8 miles from its mouth in the Gulf of Riga, where is situated the fort of Dünamünde, erected for the protection of the harbor. The fortifications of the city have been razed and the walls converted into promenades which surround the old city, separating it from its three suburbs—those of St. Petersburg, Moscow, and Mictan. Among the public buildings the most notable are St. Peter's church, built in 1406, with a tower 470 feet high; the palace of the governor-general, built 1494–1515 by Walter von Plettenberg; the city hall, the new exchange, etc. The city has a polytechnic institute, a school of navigation, several other schools for special purposes, and numerous charitable institutions. It contains about 100 manufactories of cotton, woollen, linen, and iron goods, and its shipbuilding industry is very flourishing; it owns over 100 vessels, of which one-fourth are steamers. But it derives its greatest importance from its commerce: 3177 vessels entered the harbor in 1873, and 3181 cleared it. The value of the imports, comprising coal, salt, iron, and colonial produce, amounted to 19,611,660 rubles; that of the exports, consisting of flax, hemp, timber, and grain, to 20,153,453 rubles. The city was founded in the beginning of the thirteenth century, and belonged to the knights of the Teutonic order. Its prosperity began when it became a member of the Hanseatic League under the protectorate of Poland. It was conquered by the Swedes in 1621, and incorporated with Russia in 1710. P. 102,043, of which 47,000 are Germans, 25,000 Russians; the rest Letts, Jews, etc.

Riga, p.-v. and tp., Lenawee co., Mich., on Lake Shore and Michigan Southern R. R. P. 1540.

Riga, p.-v. and tp., Monroe co., N. Y. P. 2171.

Riga, Gulf of, an inlet of the Baltic, 100 miles long, 80 miles broad, and bounded by the Russian governments of Curland, Livonia, and Esthonia. It receives the Düna. Oesel is a large island at its entrance.

Rigault' de Genouilly' (Charles), Admiral, b. Apr. 12, 1807, at Rochefort, Lower Charente, France; educated at the Polytechnic School, and entered the navy 1827; captain of a corvette 1841, and in command of La Victorieuse when she was lost in the China seas, but his conduct was vindicated; in 1848 captain of a frigate; rear-admiral 1854, and sent to the Crimea, where he commanded a de-

tachment of marines. Commanded a squadron which bombarded and occupied Canton, China (1857), in conjunction with an English naval force; promoted vice-admiral 1858 and admiral 1864; senator 1860, he voted in favor of maintaining the temporal power of the pope; succeeded M. Chasseloup-Laubat as minister of marine 1867, and remained on the formation of a new cabinet 1870. In 1864 he received the grand cross of the Legion of Honor. D. at Paris 1874.

Rig′don (Sidney), b. in St. Clair tp., Allegheny co., Pa., Feb. 19, 1793; received a fair English education, and was working as a printer at Pittsburg when about 1812 a manuscript was offered for publication by an eccentric preacher named Solomon Spaulding. It was entitled *The Manuscript Found, or The Book of Mormon*, and pleased Rigdon so much that he made a copy before it was returned to Spaulding, who died soon after. About 1817, Rigdon became a preacher; and though at first professing orthodoxy, soon began to propagate singular doctrines connected with the "manuscript" in question. In 1829 he became acquainted with Joseph Smith, and with him devised the publication of the *Book of Mormon* as the basis of a new sect. He accompanied Smith to Kirtland, O., to Missouri, and to Nauvoo, where he was one of the presidents of the Church; was one of the originators of the "new revelation" permitting polygamy; was twice tarred and feathered, several times imprisoned, and was a candidate for the succession to the leadership on the death of Smith. On the election of Brigham Young, Rigdon refused to acknowledge his authority, was excommunicated, returned to Pittsburg, Pa., and lived in obscurity. D. at Friendship, N. Y., July 14, 1876.

Riggs (Adam), b. in Tennessee June 6, 1816; joined the Tennessee conference of the Methodist Episcopal Church in 1839; filled important stations, and several times represented the conference in the highest court of the Church. D. in Tennessee Oct. 29, 1871. T. O. Summers.

Riggs (Elias), D. D., LL.D., b. in New Providence, N. J., Nov. 10, 1810; graduated at Amherst College 1829, at Andover Theological Seminary 1832, and went immediately to his work abroad. He was in Athens, Greece, 1832–34, in Argos 1834–38, in Smyrna 1838–53, and since 1853 has been in Constantinople, except in 1857–58, when he taught Hebrew and the cognate languages in Union Theological Seminary, New York City, while he superintended the electrotyping of his own Armenian translation of the Bible. He has also translated the Bible into Bulgarian, and is now (1876) engaged, with others, in revising the translation into Turkish. Most of his work has been done in the modern Greek, Armenian, Bulgarian, and Turkish languages, but he is acquainted with upward of twenty more. He received the title of D. D. from Dartmouth College in 1853, and of LL.D. from his alma mater in 1871. He has published—*A Manual of the Chaldee Language* (1832; 2d ed. 1858), *Brief Grammar of the Modern Armenian Language* (1847), *Vocabulary of Words used in Modern Armenian, but not found in the Ancient Armenian Lexicons* (1847), *Notes on the Grammar of the Bulgarian Language* (1847), *Outline of a Grammar of the Turkish Language as written in the Armenian Character* (1856), *Suggested Emendations of the Authorized English Version* (1873).

R. D. Hitchcock.

Riggs (Stephen R.), D. D., many years a missionary of the American Board to the Dakota Indians; author of several elementary books for his Indian pupils, and of a *Grammar and Dictionary of the Dakota Language* (1852), published by the Smithsonian Institution, which has the reputation of being one of the most valuable contributions to American philology ever made. Aided by Dr. Williamson, he has given the Dakotas a translation of almost the entire Bible. He received the degree of D. D. from Beloit College in 1873.

Right, in law. See Rights, by Pres. T. D. Woolsey, S. T. D., LL.D.

Rights [Ang.-Sax. *riht*]. In law and political science this word denotes powers of free action rightfully, or by right reason, belonging to an individual, with which, therefore, others are bound not to interfere. The word presupposes that there is something *objectively* right and objectively wrong in feeling, purpose, or act; and this we here assume. Rights may be said to be such *subjectively*—that is, an individual is the *subject* of rights; he is one to whom powers of action belong. And these powers of action belong to him as being necessary for the development of his nature, for fulfilling the ends which are pointed at by his bodily, mental, and moral powers, by his position, needs, and relations in a community or world of like beings. Thus, the general nature and destination of man in the world is the foundation of rights. And yet we deny the full exercise of rights to immature children, because they are as yet *undeveloped* human beings; and for this reason, in order to protect them against fraud and childish folly, if they have property bequeathed to them, law prevents them from having the control of it, that it may be preserved for their use when they can use it in the exercise of manly reason. Law also, for the time or altogether, takes away, as a mode of inflicting punishment, one or more of a man's rights—his liberty, or property, or even his life. The grounds for such limitations or deprivations of rights cannot here be unfolded; we only remark in this place that for the security of moral order certain wrongdoers must suffer evil; that this is felt by men of ordinary moral sensibilities to be deserved; and that there is no punishment possible, unless in the act former rights are taken away.

So intimately are rights connected with the destination and needs of human beings on earth that they would be changed or cease with an alteration of our nature. Thus, suppose men grew up out of the ground without the intervention of others, full-grown and mature in their powers: there would then be no family rights. Or suppose the earth so contrived as to supply them with all the food and shelter they needed, and that the seasons were such that no clothing were wanted: in this case all labor, property, protection of property, contract, and, to a great extent, association, would disappear. Thus, rights would be but a very small fraction of what they now are.

The use and the end of the conception of rights point toward society. It is for the reason that men may develop their nature and exercise the powers pointed out by their nature and destination, that they are driven toward the recognition of the rights of others as well as their own, so that they may not in society invade each other. Social instincts thus, and obligation, the necessary concomitant of rights, are the two poles of human life in communities. The one draws men into fellowship, the other secures and preserves that fellowship against force. The desires of property and of other things, if not balanced by the feeling that the thing coveted belonged to a particular individual—or, in other words, by the moral feeling or obligation—would be the scourges of society, and in fact would render its existence, at least the existence of industrial communities or of anything above barbarism, impossible. Obligation, then, is the moral element in the theory of rights. Rights themselves, or free powers of acting in certain ways, involve nothing but power and desire; but men recognize the fact that others like them have the same power and desire; and thus a common, equal rule is acknowledged for all beings on account of their common nature. Here we advance to the observation that rights are equal and obligations reciprocal. There is no reason why I should have rights, and my fellow-man not be admitted to have them. And, as before said, obligations are correlative. Thus, every man, being a subject of rights, has cords running from him to every other member of his society, to every fellow-man.

But rights and correlative obligations, after all, are but the underpinning of the social fabric. They deal simply with *acts* and with *intention as embodied in acts*. When a man labors in order to acquire property, they do not ask him whether he is covetous or benevolent; and when he spends property, they do not ask him whether it was best for him so to use his property. He may get the best in a bargain, but he is not obligated—however right and proper for him it may be—to see to it that the other party should have an equal benefit. He may marry for love or for money, but the marriage is lawful in either case. Thus, there is a wide difference between the province of morals (which pertains chiefly to the conscience, and only in a subordinate sense to social order and law) and that of rights and obligations. The principal discriminations between the two are the following: (1) The moral comprehends the other, which we shall call, with the Germans and some English writers, as Lieber, Whewell, Wildman, *the jural*. Granting that an individual has rights, it does not follow that this fact of his freedom to act in one way discharges him from the duty of acting in another. Duty is universal, absolute, all-comprehensive. I have a right to acquire property, but it may be wrong for me to do so; I may have duties which prevent it—for instance, the duty of watching by the side of a sick parent. But no one save him who has the right determines in the particular case how he shall act. The duty goes with him, and the sin, but others have no right to keep him from the sin. Of course we do not mean to deny that some sins *in act*, when they seriously harm society or prevent the fulfilment *of obligations*, may sometimes be noticed by organized society—that is, by the state. (2) Rights and obligations *pertain only to the act;* the department of morals has to do as much with the disposition, the state of the will, the feelings, as with the act. It is true that an important discrimination is made in law between mere injury and intended wrong—between injury caused

by *culpa levis* or *lata* and that caused by malice prepense. But this applies to criminal law, and the obligation to repair an injury may exist where there is neither malice nor negligence, as when a scared horse overturns another man's wagon loaded with crockery. (3) Rights may be *waived* by the subject of them. He is free to say, for instance, whether money due on contract shall be collected or a debt be forgiven. If it were not so, the performance of many humane or benevolent acts would be impossible, which consist in self-renunciation. But when we say that rights may be waived, we mean that this may be done in *particular cases*, not that there may be a free waiver of the exercise of them *in all future cases.* Rousseau was entirely right in maintaining, against Grotius, that a man had no right to surrender all his rights—that is, to make a slave of himself, slavery being the negation of rights. For if he could do this, he could abridge his power of doing good, which is greatly dependent on his power of exercising his rights. That is, he could sink himself freely below the condition where his nature puts him, and renounce the place given him by God in the world; which would be flagitious. All, however, that Grotius meant was, we believe, that a nation could submit to superior power and lose its liberties, or, in other words, could come *jurally* under the absolute power of a conqueror. (4) The *negative side* in the sphere of rights and obligations is the most important, but it is not necessarily thus in the moral sphere. Most laws are prohibitions of acts affecting the rights of others or general social order. There may be some pretext for saying that a laborer shall not be compelled to work for more than ten hours, but when did law force a free man to work any given number of hours, even if he had bargained to do so, or when did it forbid him to bargain to work more than a certain amount of time *per diem?* As it respects duties, some are positive, as the duty of helping the poor; others are negative, as the duty of not wounding the feelings of others without cause; others may be put either into the positive or the negative form. The commandments of the Decalogue—all of them which relate to men—are statements of obligation in the negative form, except that which requires obedience to parents. And the reason why this commandment is positive lies in the nature of the family life, where rights and obligations are wonderfully blended with moral claims and duties. (5) Rights, and therefore obligations, can be sharply defined, while moral claims and duties as a class cannot be. Thus, the former can be made the subject-matter of law, while the latter lie beyond the reach, in a great measure, of human legislation. This is, indeed, not true of those *acts* of outward morality, and especially those immoral acts, which can be seen and heard, and which are detrimental to the community. Thus, not going to church on Sunday was long finable in England and other countries, and even *neglect* implying ingratitude toward parents (which, however, may in its outward manifestations be held perhaps to be a violation of obligation), has been punished. But the vast majority of duties hide beyond the eyesight of human law, and the attempt to measure and weigh them is impossible. In the end, when classified by moralists, they must be left to the individual conscience; and even these general rules of duty, without a purification of the internal moral sense, cannot be applied to the government of the conduct with much success.

It results from all this that rights and obligations are the principal subject-matters of which private law takes cognizance; immoral acts may be regarded as injuries to the state, but the same act which violates obligation to a fellow-man may be taken notice of by law as an injury to society also. It is shown by the above discussion that there ought to be as many forms or heads of rights as there are natural divisions growing out of our destination in society. It is not our province here to mention them in detail. They may be classified as derived from our bodily, social, moral, and religious nature. They may be enumerated rudely as the rights of life and limb, property, contract, association, free speech, worship, and the family rights. The rights are called *natural* rights, as deducible from our nature, and not as derived from an imagined state of nature and carried down into a state of society. As such, again, they are called primitive or *original* rights, as distinguished from acquired rights—that is, from those which have come to us by gift or political privilege. Whether political rights can be properly called rights may be questioned, but this is not the place to give the due answer to that question. We observe, in closing, that certain somewhat vague yet most real relations of man to man may be called duties, and yet have some analogies to rights. Thus, the treatment of our fellow-men, which is prescribed by a sense of propriety, by the feeling of the gentleman, by honorable sentiments, may be arranged with rights and obligations under the head of justice. The proprieties of life are due to and owed by fellow-men in society; gentlemanly conduct is dictated by both kindness and the rights of others not to have their feelings wounded; and honor or honorable feeling is a nice sense of justice, as the poet Wordsworth calls it. And thus the apostle Paul beautifully stretches the line of rights and obligations when he says, "Owe no man anything, but to love one another."

THEODORE D. WOOLSEY.

Rights, Bill of. See BILL OF RIGHTS.

Rights of Man. See RIGHTS, by PRES. T. D. WOOLSEY, S. T. D., LL.D.

Ri'gi, a mountain of Switzerland, in the canton of Schwytz, is isolated between the lakes of Zug and Lucerne, and rises 5902 feet above the sea, 4500 feet above the lake. Several carriage-roads and a railway lead from the base of the mountain to the top, which offers a very extensive view.

Ri'gor Mor'tis [Lat.], the condition of muscular rigidity developing shortly after the death of the body. The muscular fibres are found to be firm and shortened, as if in a state of chronic contraction. It is due to suspended nutrition of the tissues, and begins when their response to artificial irritation and electricity ceases. Rigor mortis develops at a variable period after death, and when established lasts a variable time. In persons who die suddenly, as by accident or by heart disease, and in whom the muscles are well developed and nourished, rigor mortis may be postponed for many hours—twelve or twenty-four—and may then persist for two or three days. Reversely, when death is the result of exhaustive disease, the blood is impoverished and the muscles are wasted and flabby, rigor mortis develops speedily—within an hour, or even a few minutes—and is incomplete and of brief duration. As soon as rigor mortis passes off, the relaxed body begins to decompose. Rigor mortis was formerly explained as a state of contraction, the death-act of the muscular fibre. It is now believed to be due to the separation and coagulation of the albuminoid substance in the fluid of the muscle, following the cessation of nutrition.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Rig Veda. See SANSKRIT LANGUAGE AND LITERATURE, by PORTER C. BLISS, A. M.; and VEDA.

Ri'ley, county of N. E. Kansas, between the Big Blue and the Kansas and Republican rivers, skirted on its S. border by Kansas Pacific R. R., has a broken surface and a fertile soil. Staples, Indian corn, hay, wheat, and butter. Cap. Manhattan. Area, 654 sq. m. P. 5105.

Ri'ley, tp., Yell co., Ark. P. 545.

Riley, p.-v. and tp., McHenry co., Ill. P. 882.

Riley, p.-v. and tp., Vigo co., Ind., on Wabash and Erie Canal. P. 1492.

Riley, p.-v. and tp., Clinton co., Mich. P. 1139.

Riley, p.-v. and tp., St. Clair co., Mich. (RILEY CENTRE P. O.), on Belle River. P. 1664.

Riley, tp., Butler co., O. P. 1612.

Riley, tp., Putnam co., O. P. 1084.

Riley, tp., Sandusky co., O. P. 1461.

Riley (BENNET), b. at Baltimore, Md., in 1786; entered the U. S. army in youth; served against the Indians on the Plains and in Florida; commanded a brigade in Mexico under Twiggs; was brevetted brigadier-general for gallantry at Cerro Gordo and major-general for Contreras, and in 1849–50 commanded the military department of Upper California. D. at Buffalo, N. Y., June 9, 1852.

Riley (CHARLES VALENTINE), b. in London, England, Sept. 12, 1843; came to the U. S. 1860; worked on a farm several years; became editor of the entomological department of the *Prairie Farmer* at Chicago 1863–68; became State entomologist of Missouri 1868, in which year he began, with Benjamin D. Walsh, State entomologist of Illinois, the publication of a monthly magazine, *The American Entomologist.* He has published annual reports on the entomology of Missouri, and has rendered valuable services to science and to agriculture by tracing the history of the Colorado potato-beetle (1863), the discovery of a thirteen-year brood of the "seventeen-year locust" or periodical cicada (1868), of the phylloxera insects on American grape-vines, and establishing their identity with the French species; by his recommendation to use diluted Paris green against the Colorado potato-beetle (1871) and the cotton-worm (1873), and the discovery of the yucca-moth (*Pronuba yuccasella*) by which the yuccas are fertilized. The French government presented him in 1873 a gold medal "for services rendered to French grape-culture."

Riley (JAMES), b. at Middletown, Conn., in 1775; became a sea-captain; commanded the brig Commerce when she was wrecked on the W. coast of Morocco Aug., 1815, and kept for some time a prisoner by the Moors,

from whom he was ransomed by the British consul at Mogadore, Mr. W. Wiltshire, as was set forth in an *Authentic Narrative* drawn up from his rough notes by Anthony Bleecker, which was published in 1816, and obtained a wide circulation. Capt. Riley subsequently traded for many years to the port of Mogadore, resided in Van Wert co., O., 1821–28, and was a member of the Ohio legislature 1823. D. at sea Mar. 15, 1840. His later history was written by his son, W. Wiltshire Riley, under the title *A Sequel to Riley's Narrative* (Columbus, O., 1851).

Riley (Joshua), M. D., b. in 1800; was a practitioner of medicine for half a century in Georgetown, D. C., where he d. Feb. 11, 1875. From 1844 to 1859 he occupied the chair of materia medica in the medical department of Columbian College. Paul F. Eve.

Riley Plantation, tp., Oxford co., Me. P. 32.

Ri'ma-Szom'bath, town of Hungary, on the Rima, manufactures wooden articles and linen fabrics, and trades in hides. P. 8300.

Ri'mersburg, p.-b., Toby tp., Clarion co., Pa. P. 324.

Ri'mini [anc. *Ariminum*], town of Italy, province of Forli, lying very near the Adriatic, in lat. 42° 4′ N., 12° 34′ E. It is a walled and well-built town, and the streets and squares are fine and regular, but there is everywhere an air of decay. The Corso, the main street, passes through the centre of the town, and the two principal squares, Piazza Cavour and Piazza Giulio Cesare, open upon it. The latter is named from the tradition that Julius Cæsar here harangued his troops after the passage of the Rubicon. The structures of interest still remaining from the Roman period are—the remarkable bridge of Augustus over the Marecchia, begun by that emperor, finished by Tiberius, and still in good preservation; the arch of Augustus, now the Porta Romana, one of the most striking monuments of Roman architecture still to be seen in Eastern Italy; the Fontana Publica, which has undergone endless changes. The great mediæval attraction is the cathedral, founded in the fourteenth century, but restored in the fifteenth by Sigismund, the most renowned of the celebrated Malatestas. It is one of the finest existing specimens of Italian Gothic, and is extremely interesting to the student of architecture and of the sepulchral monuments of the Middle Ages. Several other churches and the Palazzo Communale contain admirable pictures. The house of Francesca da Rimini, the lady so pathetically immortalized by Dante, is still pointed out. The Gambalunga Library (seventeenth century) consists of about 25,000 vols. The site of Rimini has been successively occupied by an Umbrian, Etruscan, and Roman city, the latter being improved and adorned by Julius Cæsar, Augustus, and other Roman emperors. It was Christianized very early, and here in 359 A. D. was assembled the celebrated Council of Rimini, consisting of more than 400 Western bishops, who wellnigh substituted Arianism for orthodoxy as the creed of the Latin Church. Though Rimini escaped the sword of Attila, it suffered cruelly from succeeding invasions. Narses made it the chief city of the maritime Pentapolis, the other four towns being Pesaro, Fano, Sinigallia, and Ancona, and the whole territory was governed by an exarch from Constantinople. In 1200 the first of the great Ghibelline family Malatesta was made military governor of the Marches, and his descendants assumed the lordship of Rimini, which they retained (except during Rimini's brief union with the Venetian republic) until it became a portion of the papal territory in 1509, when it was included in the so-called legation of Ravenna. In 1860 it was united to the kingdom of Italy. The chief industry of Rimini is connected with the fisheries, which are abundant, and the old harbor, now nearly filled up by sand brought in by the torrent Marecchia, serves for little else than a shelter for fishing-smacks. The Porto Canale, however, receives vessels of 120 tons. Rimini is a favorite resort for sea-bathing, the arrangements being excellent and the climate favorable. P. about 16,000; of commune, 34,000.

Rimous'ki, an extensive county of Quebec, Canada, bounded N. by the estuary of the St. Lawrence and S. partly by New Brunswick. It is to a very large extent a wilderness. It is traversed by Grand Trunk Railway. Cap. Rimouski. P. 27,418.

Rimouski, p.-v., cap. of Rimouski co., Quebec, Canada, on the S. E. shore of the St. Lawrence, 180 miles below Quebec. It is the seat of the Roman Catholic bishop of St. Germain de Rimouski, has several large buildings, including the cathedral church, a college, 2 convents of nuns, a bishop's palace, and a court-house. There is a costly government wharf, a good trade in lumber, and 1 semi-weekly newspaper. Rimouski is a favorite summer resort, having fine scenery and good trout-fishing. P. 1186.

Rin'derpest [Ger.], or **Steppe Murrain,** a contagious eruptive fever among cattle, endemic or nearly so in Russia, and occasionally sweeping as a most destructive epizoötic throughout Europe. It considerably resembles smallpox in its symptoms and progress. It is not confined to neat cattle, but attacks nearly all other ruminant mammals, and even some others. Man, the horse, swine, and fowls are quite exempt from it, so far as is known. It has thus far not been known in North America. The best treatment is the "stamping-out" process—that is, the prompt destruction of all diseased animals. The only other treatment advised is the use of strong disinfectants and occasional stimulation; but it is found very difficult by any system of isolation and treatment to prevent the spread of the disease. From 30 to 90 per cent. of the diseased animals die under any treatment.

Rindge, p.-v. and tp., Cheshire co., N. H., on Monadnock R. R. P. 1107.

Rine'hart (William H.), b. Sept. 25, 1825, in Frederick co., Md., where he spent his childhood and youth (receiving a simple education) in ordinary rustic sports, and in labor on his father's farm. Prior to his manhood he seems to have given no promise of his subsequent career. In his maturity he used to say that the most impressive hours of his youth were when, as a teamster on a lonely mountain-road, he would check his horses (with their jangling bells) while he paid silent homage to the beauty and mystery of forest, stream, and firmament. A simple accident guided this spiritual quality into a permanently happy path. A quarry opened on his father's farm led to a shop for rustic gravestones. Shortly afterward, Rinehart, then twenty-one years old, came to Baltimore, where he apprenticed himself to a marble-worker. Determined to excel, he rapidly acquired skill of hand and eye, and within two years was made chief of the ornamental work. His nights were now devoted to self-directed study. In 1850, with no instruction, and having seen no sculpture except a few public monuments, he began modelling in clay the human figure or parts of it from such subjects as chance enabled him to use. In 1855, then thirty years old, he sailed for Italy, determined to be an artist, and rarely has determination been so resolutely kept or its aim so firmly won. He remained in Florence two years, with means so narrow as to verge on absolute privation, but with such success in artistic growth that he brought back to Baltimore in 1857 two bas-reliefs (*Night* and *Morning*) of such sentiment and execution as won attention to him as unquestionably a real artist. For a year thereafter he occupied a studio in Baltimore, modelled several busts, a fountain figure for the U. S. general post-office, two supporting figures (*Indian* and *Backwoodsman*) for the clock in the new House of Representatives, Washington. In 1858, then thirty-three years old, he went to Rome, which from that time became the settled habitation of his heart. His success now was immediate and continuous till his death. At the instance of Crawford's widow, Rinehart completed the modelling of the bronze doors of the U. S. Capitol, which Crawford had left unfinished at his death. Rinehart now produced his life-size *Angel of the Resurrection* and *Jesus* ("I am the resurrection and the life"), also his *Woman of Samaria* (a noble figure) listening to Jesus; a lovely group of two *Sleeping Children*. Of this there are replicas in Greenmount Cemetery, Baltimore, in a drawing-room of that city, and in the palace of an Italian duchess at Palermo. One of Rinehart's very highest works was of this period—*Love Reconciled with Death*—bronze, life-size, for the tomb in Greenmount of his early and ever-helpful friend, Mrs. Walters. For pure womanly beauty, unconscious grace of limb and vesture, and a subtle blending of sorrow, love, and spiritual peace, this figure is a masterpiece. In 1866, Rinehart paid a brief visit to America. Returning to Rome, he did not leave there until 1872, except for brief vacation. His portrait-busts had now become so widely recognized, not only as admirable likenesses, but for their distinction and repose, that commissions came to him so liberally that he had usually two or three years of such work ahead. He made upward of 100 of them. Some of our loveliest countrywomen and some of the strongest of our men were thus perpetuated by him in a style that may challenge the best work of any period. The State of Maryland having commissioned him to make an heroic statue in bronze of the late U. S. Chief-Justice Taney, Rinehart unveiled this work in the State-house grounds, Annapolis, Dec. 10, 1872, amid a distinguished company. It was regarded at once as not only a living likeness, but in manner and expression as the ideal of a lawgiver upright, wise, and calm. On this visit to America, Rinehart brought with him what he considered the *chef d'œuvre* of his life—the work on which he said he was content to rest his fame—his statue of *Clytie,* sweetheart of the sun, when just for-

saken by Apollo. The figure is entirely nude, but unconscious of anything save the bitter-sweet of a just-vanished joy. For pathetic loveliness in body, limbs, and countenance, and for spontaneous union of all the figure in showing a woman's soul in the shadow of love's eclipse, this work has won the highest praise. While it charms all beholders with its beauty and its spiritual power, it may safely await the world's recognition as a work of the highest order. *Clytie* was bought by a gentleman of Baltimore, who gave it to the Peabody Institute of that city in perpetual trust as a free exhibition to all citizens and strangers. A replica is owned by an American lady resident in Rome. Besides the works already named, Rinehart's early years in Rome produced *Leander, Hero, Indian Girl*, and *St. Cecilia;* his later years, a monumental figure for a lady's grave at Troy, N. Y.; the group of *Latona and her Children* (the infants Diana and Apollo), *Antigone, Atalanta*, and *Endymion.* Widely different in treatment, these latter works all show a signal union of loveliness and power. The style of Rinehart was original, deeply imaginative, and profoundly infused with the old Greek feeling; his invention striking, yet full of truth; his modelling tender, strong, and patient; but the crowning excellence of his work lay in a dramatic singleness of conception and expression, which, hiding design, is the highest art, and which gives to each of Rinehart's mature works a true poetic life. A man of strong affections, he had a notable power of winning friends and holding them. His manner was conspicuously open, hearty, and cheerful; his figure, of medium height, compact and sinewy; his head remarkably fine, and he wore a full tawny beard. With a press of orders he remained in Rome at work so far into the summer of 1874 that he was attacked with disease, which in a trip too late to Switzerland and Germany ran rapidly into pulmonary consumption, of which he died in full consciousness and peace, surrounded by devoted friends, Oct. 28, 1874, ten days after his return to Rome. Rinehart was never married. By will (after providing properly for his kinsmen) he left the whole remainder of the savings of his art-career ($45,000) in trust in Baltimore for the help of struggling art-students and to found a lectureship on sculpture. His remains were buried in the Protestant cemetery, Rome; afterward disinterred and, Jan. 4, 1875, laid at rest in Greenmount Cemetery, Baltimore. JOHN W. MCCOY.

Ring [Ang.-Sax. *hring*], an ornament worn on the finger, frequently invested with symbolical meaning. From the remotest antiquity the finger-ring (usually connected with a seal) was an emblem of an authority which could be delegated by the simple process of delivering it to an agent. The cases of Pharaoh and Ahasuerus are instances in point. Precious stones of great value were employed in rings by the Hebrews and Persians, and later by the Greeks and Romans. They have long been in almost universal use in Christendom as tokens of marriage or betrothal, and are often engraved with mottoes. The "fisherman's ring" is an indispensable article of the papal chancery, and the custom has been imitated by the bishops of some Christian churches. Magical virtues have often been ascribed to rings both by pagan and Christian nations, and traditions of poison concealed in rings have played a large part in the criminal annals of the Middle Ages.

Ring (BERNARD JACQUES JOSEPH MAXIMILIEN DE), b. at Bonn in Rhenish Prussia May 27, 1799, of Alsatian parents; received a completely French education; devoted himself from his sixteenth year to the study of archæology; resided from 1815 to 1848 in various places of Germany, investigating German antiquities, and wrote: *Vues pittoresques des Vieux Châteaux du Grand-duché de Bade* (folio, 1829), *Description du Château du Tubingue* (1835), *Établissements celtiques dans le Sud-ouest de l'Allemagne* (1842), *Histoire des Germains depuis les temps les plus reculés jusqu'à Charlemagne* (1850), *Établissements romains du Rhin et du Danube* (2 vols., 1852–53, crowned by the Academy), *Essais sur la Rigsmaal-Saga et sur les trois Classes de la Société germanique* (1854), and *Histoire des Peuples opiques, de leur Législation, de leur Mœurs, de leur Langue, etc.* (1859).

Ring (MELCHIOR), was school-master in Hersfeld, Hesse; removed in 1523 to Eckardtshausen in Saxony; met here with Thomas Münzer, and became immediately one of his most ardent disciples. In 1524 he went with Knipperdolling, Melchior Hoffmann, and other Anabaptist leaders to Stockholm, where he caused a great commotion and violent riots, but returned in the same year to Saxony to take part in the Peasants' War. After the battle of Frankenhausen, he fled to Switzerland, where he preached with great success, especially at St. Gallen, but in 1527 he was obliged to leave the country because one of his most intimate friends and disciples, Thomas Schugger, committed wilful murder at an Anabaptist meeting, and declared the deed to be a divine inspiration. Returning to Hersfeld, he preached partly in Hesse, partly in Saxony, explaining that by baptism infants were sacrificed to Satan; that Luther, although originally a God-awakened man, had now become the very Antichrist, etc. Persecuted by the civil authorities, he repaired in 1528 to East Friesland, and made a great impression both in Emden and Bremen, but was finally expelled in 1530, and returned to Hesse. Here he was imprisoned, but escaped to Münster, where he probably found his death during the Anabaptist war. All his writings have perished.

Ringat, the principal town of Indragiri, a state of Sumatra, dependent on the Netherlands, stands in lat. 0° 21′ S., on the river Indragiri, 60 miles from its mouth, and has between 2000 and 3000 inhabitants. In 1838 the Dutch took possession of the country, and added it, under an assistant resident, to Riom; but in 1843 England objecting to this arrangement, the relations between the country and the Dutch government became somewhat looser.

Ring'bone, an exostosis or bony tumor on the coronet of the horse, most common on overworked horses, but sometimes seen on colts, or even newly-dropped foals. Ringbone may stiffen and spoil a horse for the road, although not unfrequently there is no practical trouble from it; but it injures a horse's market-value, and is practically incurable.

Ring'genberg, village of Switzerland in the canton of Berne, on the south-western shore of Lake Brienz, contains some interesting ruins of the castle of Ringgenberg, which was destroyed in 1352 in a war between the feudal lords and the inhabitants of the village.

Ring'gold, county of S. Iowa, on Platte and Grand rivers, adjoining Missouri, has a rolling surface and a fertile soil. Staples, Indian corn, hay, wool, and butter. Sheep and swine are numerous. Cap. Mount Ayr. Area, 576 sq. m. P. 5691.

Ring'gold, p.-v., cap. of Catoosa co., Ga., on Western and Atlantic R. R., 115 miles N. W. of Atlanta, has a Masonic educational institute, several churches, a handsome court-house, with offices for the county officials, 1 newspaper, dry-goods, grocery, and drug stores, abundant water-power, rich deposits of iron ore, and grist and flouring mills. The famous Catoosa and Cherokee Springs are located in the county. P. of v. 316.

W. H. WALKER, ED. "CATOOSA COURIER."

Ringgold, p.-v. and tp., Washington co., Md. P. 763.

Ringgold, p.-v., Union tp., Morgan co., O. P. 79.

Ringgold, v., Walnut tp., Pickaway co., O. (EAST RINGGOLD P. O.). P. 121.

Ringgold, p.-v. and tp., Jefferson co., Pa. P. 1006.

Ringgold (CADWALADER), b. in Maryland in 1802, son of Gen. Samuel Cadwalader; entered the U. S. navy as a midshipman 1819; became captain 1856, commodore 1862, and rear-admiral 1867; was for a time in command of a surveying and exploring expedition in the North Pacific and China seas; was employed upon the blockade of Southern ports during the civil war, and retired Dec., 1864. D. in New York City Apr. 29, 1867.

Ring'kjöbing-fjord, lagoon of Denmark, on the west coast of Jutland, 28 miles long from N. to S., and 9 miles broad from E. to W., is separated from the North Sea by a narrow strip of land hardly one mile across and covered with sand-banks, and contains the fertile island of Holmsland, with 1920 inhabitants. On its north-eastern shore stands Ringkjöbing, a well-built little town with about 2000 inhabitants, and a harbor at Haurvig, 10 miles distant, among the sand-banks.

Ring'-Money. In rude and low stages of civilization the use of rings of the precious and other metals for personal adornment is, as is well known, very much more prevalent than in enlightened society. The great value attached to such rings gave them an early value for purposes of exchange. This use of rings, even of iron and copper, both for decoration of the person and for money, is still prevalent in Africa. In ancient Egypt ring-money of silver and gold prevailed. From the old Gauls and Norsemen its use descended to mediæval Europe. Curious pre-historic ring-money may be seen in the large museums, some designed to be worn as bracelets and bangles, others fit for wearing on the fingers. In mediæval times the weight and value of ring-money were fixed by statutes.

Ring'sted, town of Denmark, in the island of Sealand, on the railway from Copenhagen to Korsör, was a place of considerable importance in the twelfth and thirteenth centuries, and has an interesting old church containing several royal tombs and other monuments. P. about 2000.

Ring'worm, a parasitic cutaneous disease occurring most frequently among children and upon the face and neck. It was formerly described as *herpes circinatus*, and

regarded as a vesicular disease. It is more properly *tinea circinatus*, being analogous to *tinea sycosis*, or barber's itch, and *tinea decalvans*, or bald spots of the head. These diseases are due to a parasitic growth, consisting of innumerable sporules which find a nidus in the hair-follicles and excite secondary inflammation of the skin. Ringworm is contagious, not only from person to person by close contact, but in the uncleanly is transplanted from spot to spot on the head and hands or wrists. The treatment is by "parasiticides," or remedies destructive to parasitic life. Local application of tincture of iodine, iodine and ammonia, sulphurous acid, sulphur dry or in ointment, carbolic acid, creosote, oil of cade, mercurial ointment, oleate of mercury, solution of corrosive sublimate, and cantharidal collodion.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Rin'mann's Green, Cobalt Green, or **Zinc Green,** a beautiful green pigment, consisting of the oxides of cobalt and zinc, prepared by (1) precipitating a mixture of the sulphates of cobalt and zinc with carbonate of soda, washing, and igniting; (2) evaporating and igniting a mixture of the nitrates of the two metals; (3) mixing moist carbonate of cobalt with oxide of zinc in the proportion of 1 to 1.5 CoO to 9 or 10 ZnO, drying and igniting; (4) the finest color is obtained by mixing moist phosphate, arsenite, or arseniate of cobalt with oxide of zinc, drying, and igniting. C. F. Chandler.

Ri'o, p.-v. and tp., Knox co., Ill., on Rockford Rock Island and St. Louis R. R. P. 1133.

Rio, p.-v., Otsego tp., Columbia co., Wis., on La Crosse division of Milwaukee and St. Paul R. R. P. 300.

Ri'o Arri'ba, county of N. W. New Mexico, on the Arizona frontier, traversed by the Rio Grande and San Juan River, is crossed by several mountain-ranges. Sheep-raising is the chief industry. Cap. Los Luceros. Area, about 5500 sq. m. P. 9294.

Riobam'ba, town of Ecuador, South America, on the eastern slope of Chimborazo, at an elevation of 8616 feet above the sea, enjoys a very mild and healthful climate. It was entirely destroyed by an earthquake in 1797, which killed 30,000 people in a few minutes, and the new town is rather indifferently built. It has some manufactures of sailcloth, covers, and gloves. P. about 16,000.

Ri'o Bran'co, a river of Brazil, rises in lat. 3° N., lon. 64° W., flows E. and S., and joins the Rio Negro after a course of about 700 miles. Its navigation is much impeded by rapids and falls.

Ri'o de Jane'iro, province of Brazil, extends along the Atlantic from lat. 21° 15′ to 22° 23′ S., bounded by the provinces of São Paulo, Minas Geraes, and Espiritu Santo. Area, 18,060 sq. m. P. 556,080 in 1850; 1,400,000 in 1869; which latter figure, however, is considered to be too high. The coast-land is generally low, marshy, and unhealthy, while the interior of the country is elevated, mountainous, and healthy. The soil is extremely fertile, and sugar, coffee, cotton, and rice are the common productions; coffee is the most important and the most extensively cultivated.

Rio de Janeiro ("river of January"), the largest city of South America, the capital of Brazil, in lat. 22° 54′ S., lon. 43° 10′ W., on the western shore of the Bay of Rio de Janeiro. The bay, entered from the S. through a passage not more than 1700 yards wide, between steep hills rising more than 1000 feet, extends inland about 15 miles, with a width of from 2 to 9 miles, and forms one of the safest, most spacious, and most beautiful harbors in the world. The entrance, girded on both sides with lines of impregnable fortifications, can be made without the aid of pilots, and the largest vessels can anchor immediately at the quays of the city and enter its magnificent docks. The city, stretching for about 6 miles along the bay in a plain whose surface is diversified by several low conical hills, presents a most picturesque aspect with its gayly-colored houses among the luxuriant tropical vegetation, but when entered it proves somewhat disappointing. The older part consists of narrow, ill-arranged streets lined with insignificant houses; in the newer parts the streets are broader and the houses larger and more elegant; but the city has no buildings or public squares of any architectural merit. The churches, numbering about 60, are often decorated very richly, even gaudily, in the interior, but the exterior is generally bare and unimpressive. The imperial palace, the government buildings, the post-office are utterly insignificant. The finest buildings are the military barracks, the opera-house, and the national museum. The only architectural monument of any interest is the aqueduct, 12 miles long, commenced in the middle of the seventeenth and finished in the middle of the eighteenth century, built of huge blocks of granite, and conducting the water from Mount Corcovado, across a valley 740 feet wide and 90 feet deep, on two tiers of arches into the numerous fountains of the city. The public squares, of which that of Campo Santa Anna is the largest, are unadorned and neglected, and almost the only charm of the city is the view on the bay, with the exception of the adjacent botanical garden, containing the celebrated avenue of palm trees. Nevertheless, as the residence of the emperor, the seat of the government, and a commercial emporium of first rank, the city develops a vigorous life in many directions. Its educational institutions are numerous and good, especially the medical school and the polytechnic institute. Its hospitals and other charitable institutions are well arranged and effective. Several branches of industry are carried on to a considerable extent, such as shipbuilding and the manufacture of soap, cotton goods, machinery, cigars, etc. But it is chiefly from its commerce that the city derives its importance; the custom-house is its largest building. In 1873 the harbor was entered by 4431 foreign vessels of 2,639,362 tons burden, and 6421 Brazilian vessels of 1,051,928 tons burden; and cleared by 3358 foreign vessels of 2,807,299 tons burden, and 7203 Brazilian vessels of 1,345,648 tons burden. The value of the imports amounted in the same year to $36,511,450; that of exports to $52,643,275. The principal article of exportation is coffee, the value of which in 1873 amounted to $48,048,725; about 50 per cent. was shipped to the U. S. The Bay of Rio de Janeiro received its name from Juan Diaz de Solis, who entered it Jan. 1, 1515. The first settlement was made by the Portuguese in 1531, but it was afterward abandoned. In 1555 some French Huguenots settled here, but they were expelled in 1565 by the Portuguese, who in 1567 formed a permanent settlement. In 1763 the city became the capital of the Portuguese vice-royalty, and in 1822 of the independent Brazilian empire. P. about 260,000.

Rio de la Plata. See Plata, Rio de la.

Ri'o Gran'de, new county of S. W. Colorado, on the river of the same name, is mountainous; includes the San Juan range and the gold-mines of the San Juan Valley. Cap. Del Norte. Area, 1200 sq. m.

Rio Grande City, p.-v., cap. of Starr co., Tex., on the Rio Grande, 100 miles above Brownsville.

Rio Gran'de del Nor'te, or **Rio Bra'vo,** a large river which rises in S. W. Colorado, flows first E. and then S. through New Mexico, flows thence S. E., forming for several hundred miles the boundary between the U. S. and Mexico, and falls into the Gulf of Mexico after a course of more than 1500 miles. It is navigable for but a small portion of its lower course, is generally shallow, frequently interrupted by rocks and cataracts, and is subject to periodical inundations near its mouth. Its principal tributary is the Rio Pecos, 700 miles long. The important towns of Brownsville, Tex., and Matamoras, Mexico, are situated on opposite sides of the Rio Grande, 35 miles above its mouth.

Rio Grande do Norte, province of Brazil, extends along the Atlantic from lat. 4° 30′ to 6° 45′ S., and is bounded by the provinces of Parahiba and Ceara. Area, 16,842 sq. m. P. 50,000 in 1815, of whom one-half were Indians, and the other Europeans, negroes, and mestizoes; in 1846 the number of inhabitants was given as 147,513, and in 1864 as 200,000. The coast-land is low and unhealthy; the interior is higher, and eminently suited to agriculture and the rearing of cattle, which form the two principal branches of industry. Cotton and sugar are the chief crops. Cap. Natal.

Rio Grande do Sul, or **São Pedro do Rio Grande do Sul,** the southernmost province of Brazil, bounded S. and W. by the Argentine Republic, N. by the province of Parana, and E. by the Atlantic. Area, 85,239 sq. m. P. 341,755 in 1858, and 370,446 in 1863, of which many are Europeans (including about 40,000 Germans), and very few Indians. This province is better adapted to agriculture than any other part of Brazil. Wheat, beans, maize, and potatoes are now cultivated in regular crops, and agricultural products form a large portion of the exports, though hides, tallow, smoked and salted beef are still the principal items, but the progress of the province has been so rapid as to double the amount of exports between 1856 and 1861. Chief towns, Porto Alegre and Rio Grande do Sul.

Rio Grande do Sul, town of Brazil, in the province of the same name, has a good harbor on the mouth of the river of the same name, whence were exported, in 1872–73, hides, $5,037,312; horse-hair, $247,200; wool, $149,544, etc.; total, $5,534,611. P. about 18,000.

Riom', town of France, department of Puy-de-Dôme, is beautifully situated on a hill at the river Ambène, and

has fine broad streets provided with fountains; large distilleries, tanneries, manufactures of linen, and an active trade in corn, wine, hemp, and wax. P. 10,770.

Ri'o Ne'gro, a river of South America and the principal affluent of the Amazon on its northern side, rises in an unexplored region of Colombia, where it is known as the Rio Guainia, flows in a south-eastern direction, and joins the Amazon, after a course of about 1000 miles, at Manaos, in Brazil, in lat. 3° 10′ S. and lon. 59° W. Through its affluent, the Cassiquiare, communication has been established by canals between the Amazon and the Orinoco.

Rio Negro, a river of South America, rises in the Andes in Chili, flows eastward, forming the boundary between the Argentine Republic and Patagonia, and falls into the Atlantic in lat. 41° 3′ S., after a course of about 700 miles. It is unfit for navigation 4½ miles from its mouth, as its current is very rapid and its bed narrow and obstructed with shoals and sandbanks. Its banks are fertile and covered with willow trees.

Rione'ro in Voltu're, town of Southern Italy, province of Potenza, pleasantly situated about 7½ miles S. of Melfi, well built, not without the comforts of life. Inhabitants, industrious and thriving. P. 12,000.

Ri'ot [O. Fr. *riote*]. As defined by a writer of high authority, a riot at the common law is a tumultuous disturbance of the peace by three or more persons assembling together of their own authority, with an intent mutually to assist one another against all opponents in the execution of some enterprise of a private nature, whether lawful or unlawful, and afterward actually executing the same in a violent and turbulent manner, so as to excite terror among the people. Its exact nature may be better understood by comparing it with the minor grades of the same genus of offences. In a *riot* there is a turbulent meeting of persons upon some common purpose, which they actually execute in a violent manner; a *rout* is a similar meeting for a similar purpose, which is not executed, but where a motion merely is made to carry it into effect; while an *unlawful assembly* is a meeting for a similar purpose, but for the execution of which no motion even is made. It is essential to a riot that the object for which the persons are collected, and to accomplish which the violence is used, should be of a private nature; as, for example, it should relate to some private wrong to be remedied or to some private quarrel to be settled. When the purpose is of a public nature—as, for example, when the assembly is designed to prevent by violence the enforcement of a general law, or to compel its repeal, or to do acts of mischief and destruction under pretence of reforming a public grievance—the crime would formerly have been treason, and at the present day would be sedition or treason-felony in England. From the comprehensive definition above given it is plain that several elements must coexist in order to constitute a riot. The assembly itself must be unlawful. If among a number of persons innocently collected a sudden quarrel arises, and results in a fight between divers individuals, or even a general conflict, this would be an affray, and the parties actually engaged would be guilty of assault and battery. It is possible, however, that a lawful assembly may by the acts of its members be converted into an unlawful one, and thence into a riot. Three persons at least are required by the common law to constitute such an assembly. In the second place, there must be a common intent in this assembly to accomplish some private object or enterprise in a violent manner. It is entirely immaterial whether this object be in itself lawful or unlawful. For example, it is lawful to abate a nuisance in a peaceable manner, but if three or more should unite to do it by violence and with a breach of the peace, and should proceed to accomplish their purpose, they would be rioters. The common intent to use violence is indispensable, for three or more persons may join in doing a great variety of unlawful acts, and even trespasses, and no riot ensue. Finally, the common enterprise must be accomplished, and that in a violent and tumultuary manner, so as to inspire terror among the people. It has been said in some cases and by eminent judges that if the assembly is actually armed, it is not necessary that it should proceed to the extremity of carrying out its design in the manner above stated, since the possession of arms alone is sufficient to inspire the popular terror which seems to be the essence of the crime. The foregoing common-law features have been generally preserved in the law of this country, although slight modifications have been made by statute or by judicial decision in some of the commonwealths. It is provided in a few States that two persons may constitute a riot, and in one or two an unlawful assembly is unnecessary. When a riot actually exists, all those who form a part of the assembly, and aid, abet, or encourage its object or design, are alike guilty, since a common intent unites the whole, and each must be held responsible for whatever is done in accomplishing that purpose. JOHN N. POMEROY.

Riouw', or **Rhio,** a Dutch residency in the Malay Archipelago, consisting of several groups of islands, such as the Riouw, Lingga, Tambilan, Anambas, and Natuna, which lie in the China Sea between Banca, Sumatra, and Malacca to the W. and Borneo to the E. The entire area of these island groups is 3120 sq. m.; their population, about 75,000. They are high, covered with dense forests which yield many varieties of excellent timber, and produce rice, sago, pepper, gambir, gutta-percha, cotton, and fruits. Edible birds' nests abound. Distilling of arrack, weaving of silk, brickmaking, and fishing are the principal branches of industry besides agriculture and shipbuilding.

Ri'o Vir'gen, formerly a county of Utah, united to Washington co. since the census of 1870. P. 450.

Ri'o Vis'ta, p.-v. and tp., Solano co., Cal., on Suisun Bay, at mouth of Sacramento River. P. 319; of tp. 888.

Ripa'rian Rights. This term, derived from the Latin *ripa*, "the bank of a stream," denotes, in the technical nomenclature of the law, the rights to the water and the soil held by the proprietors of land abutting upon rivers and all other natural water-courses. The nature and extent of these rights are determined by the character of the stream itself—whether it is navigable or not navigable. At the common law—because in England the geographical or topographical fact is invariably consistent with the legal rule—a navigable stream is one in which, and as far as, the tide ebbs and flows. The absurdity of applying this narrow doctrine to the great rivers of the U. S. was admitted by our courts at an early day, and the principle is now settled by the State as well as by the national tribunals that all those streams which are navigable in fact for vessels customarily used for the operations of commerce, or which can be made so by the removal of temporary obstructions without changing their natural character, are navigable in law. The bed of navigable rivers up to high-water mark if tidal, and to the average water-mark if not tidal, belongs to the State. While the public possesses the rights of navigation and of fishing, the State has the exclusive ultimate control of the shore below the line of its jurisdiction, and the sole power to permit and regulate the construction of wharves and other erections thereon; it may grant this authority to private persons or to municipalities, as is the case in New York City. The doctrine of riparian rights has special reference to non-navigable water-courses. The owner of land abutting on such a stream, unless restricted by the conveyances under which he claims title, owns the bed thereof up to the middle line between the permanent banks, and a deed of land described as bounded by such stream includes that portion of the bed, unless the terms of the description sufficiently indicate an intent that the premises conveyed shall extend no farther than the bank. The proprietor of land lying on the opposite sides—that is, of land through which the stream runs—owns the entire bed thereof within the limits of his property. The rules of law applicable to such water-courses are based upon the principle that all the successive owners through or by whose land the stream flows have, in the absence of any different arrangements among themselves, the same rights; that while each owns the whole bed or the half of it in the manner before stated, he does not own the running water; that each has only the usufruct of the flowing water as long as it is entirely within his own territory, but cannot appreciably lessen its amount, and must permit it all to flow in its natural channel to the land immediately below his, and cannot interfere with its similar use by other proprietors either above or below him. It follows that an owner through whose land an unnavigable stream runs may use the water for mills, for irrigation, and for any other economic purpose, as long as it is completely within his bounds: he may divert it into artificial channels, but must restore it to its natural channel, so that it will flow therein out of his premises; he may erect a dam and set back the water within its natural banks, but cannot cause it to overflow upon the lands of proprietors above him. It is provided by statute, however, in a few States, that the owners of certain kinds of mills and manufactories may acquire the right of flowing the lands of others through proceedings instituted under the power of eminent domain; but the validity of such laws is denied by the courts of many States. Where there are different owners upon the opposite sides of a stream, neither possesses the rights as above described to use the water without the consent of the other, since both, while owning their respective halves of the bed, are entitled to undivided shares of the entire mass of flowing water. These common-law rules may be changed in various modes. Exclusive rights to use the water, to

permanently divert it into artificial channels, to discharge it in such manner upon the land below, or to overflow the land above, may be, and often are, obtained by express grant from the proprietors whose lands are thus burdened by an easement, or by prescription or adverse user for a period of time regulated by statute; which period in most of the States is twenty years. If the soil of one riparian proprietor is gradually increased by the deposits of the current, the addition, under the name of alluvion, becomes his own, even though the stream should slowly encroach upon his opposite neighbor; but if the water-course should suddenly desert its ancient bed, and form for itself a new channel, the original boundary-line between the opposite proprietors running through the middle of the old bed is still preserved unchanged. JOHN NORTON POMEROY.

Ripatranso'ne, town of Italy, province of Piceno, about 20 miles S. S. E. of Fermo, occupying the summit of five hills. The churches, palaces, etc. are well worthy of attention in themselves, and contain many objects of artistic and archæological interest, especially in the way of ancient inscriptions disinterred near this town. There is a curious old labyrinthine cavern in this neighborhood, known as La Santità, supposed to have been a place of retreat for the early Christians. P. 6000.

Rip'ley, county of S. E. Indiana, on Laughery Creek, has a level surface and a fertile soil, is intersected by the Ohio and Mississippi and Indiana Cincinnati and Lafayette R. Rs. Staples, Indian corn, wheat, hay, tobacco, hops, sorghum-molasses, wool, and butter. Sheep and swine are numerous. There are several manufactories, especially of carriages, saddlery, and harness, and many tanneries and flouring and saw mills. Cap. Versailles. Area, 450 sq. m. P. 20,977.

Ripley, county of S. E. Missouri, on the Arkansas frontier, traversed by Current River and many other streams, has a rugged surface. Chief products, Indian corn and butter. Cap. Doniphan. Area, about 600 sq. m. P. 3175.

Rip'ley, tp., Bond co., Ill. P. 972.

Ripley, p.-v. and tp., Brown co., Ill. P. 593.

Ripley, tp., Montgomery co., Ind. P. 1433.

Ripley, tp., Rush co., Ind. P. 1841.

Ripley, tp., Butler co., Ia. P. 299.

Ripley, tp., Somerset co., Me. P. 584.

Ripley, tp., Dodge co., Minn. P. 294.

Ripley, p.-v., cap. of Tippah co., Miss., on Ripley R. R., in the extreme N. portion of the State, contains 5 churches, 3 schools (2 for whites and 1 for colored pupils), Freemason and Odd Fellow lodges, organizations of Good Templars and Grangers, 1 newspaper, 1 furniture establishment, a first-class flouring, grist, and saw mill, 3 hotels, and a printing-office. Large quantities of cotton are annually shipped from Ripley. P. 422.
R. F. FORD, ED. "RIPLEY ADVERTISER."

Ripley, p.-v. and tp., Chautauqua co., N. Y., on Lake Erie and on Lake Shore and Michigan Southern R. R., is the extreme western township of the State, and includes the thriving village of Quincy. P. of tp. 1946.

Ripley, p.-v., Union tp., Brown co., O., on Ohio River, has 2 newspapers and considerable interest in manufacturing and in river-trade. P. 2323.

Ripley, tp., Holmes co., O. P. 1101.

Ripley, tp., Huron co., O. P. 1089.

Ripley, p.-v., cap. of Lauderdale co., Tenn., on Memphis and Paducah R. R., has 4 churches, a female college, 1 academy, 1 newspaper, and 1 steam saw and flouring mill. Large forests of excellent timber abound and the soil is very productive. P. 532.
JAMES L. SPARKS, ED. "RIPLEY NEWS."

Ripley, tp., Jackson co., West Va. P. 226.

Ripley (ELEAZER WHEELOCK), b. at Hanover, N. H., Apr. 15, 1782, a nephew of Pres. John Wheelock and a son of Sylvanus Ripley, D. D., professor of divinity at Dartmouth (d. Feb. 5, 1787); graduated at Dartmouth College 1800; practised law some years in Maine, residing chiefly at Portland; was a member of the Massachusetts legislature 1810–11; Speaker and elected State senator 1812; was appointed colonel of the 21st Infantry 1813; was wounded in the attack upon York (now Toronto), Canada, Apr. 24, 1813; became brigadier-general Apr. 14, 1814; commanded the 2d brigade under Gen. Brown on the Niagara frontier; took part in the battles of Chippewa and Niagara, being severely wounded in the latter, in which he won the brevet rank of major-general; was conspicuous for gallantry in the defence of Fort Erie, Aug. 15, and in the sortie of Sept. 17, when he was shot through the neck; was the recipient of a gold medal from Congress; resigned from the army 1820; settled in Louisiana, where he practised law; served in the State senate, and was a member of Congress 1835–39.

Ripley (GEORGE), LL.D., b. at Greenfield, Mass., Oct. 3, 1802; graduated at Harvard 1823, and at Cambridge Divinity School 1826; was pastor of a Unitarian church in Boston 1828–31; resided several years in Europe, where he made a careful study of French and German literature; wrote *Discourses on the Philosophy of Religion* (1839), *Letters to Andrews Norton on the Latest Form of Infidelity* (1840), and edited *Specimens of Foreign Standard Literature* (14 vols., Boston, 1838–42); was associated with Emerson and Margaret Fuller in conducting the *Dial* 1840–41; contributed to the *Christian Examiner* and other magazines; was the chief promoter of the celebrated socialistic experiment at Brook Farm, Roxbury, Mass., 1844–46; was one of the editors of the *Harbinger*, a Fourierite organ, 1844–48; removed to New York 1847; became literary editor of the New York *Tribune* 1849; published (with Bayard Taylor) *A Handbook of Literature and the Fine Arts* (1852), and edited (with Charles A. Dana) Appleton's *New American Cyclopædia* (New York, 16 vols., 1858–63), of which a new edition, under the title *The American Cyclopædia,* appeared 1873–76. Dr. Ripley received the degree of LL.D. from Lawrence University in 1874.

Ripley (HENRY JONES), D. D., b. at Boston, Mass., June 28, 1798; graduated at Harvard 1816, at Andover 1819; was for several years pastor of a Baptist church in Liberty co., Ga.; was from 1826 to 1860 professor at the Baptist Theological Institute at Newton, Mass., and author of numerous works upon biblical intepretation and theology. Among them are—*Notes on the Four Gospels* (2 vols., 1837–38), on the *Acts of the Apostles* (1844), on the *Epistle to the Romans* (1857), on *Hebrews* (1868), *Christian Baptism* (1833), *Sacred Rhetoric* (1849), and *Church Polity* (1867). D. at Newton Centre, Mass., May 21, 1875.

Ripley (JAMES W.), b. in Connecticut in 1794; graduated at the U. S. Military Academy, and promoted second lieutenant of artillery 1814; was advanced through grades of first lieutenant and captain, and, upon its formation in 1832, was transferred to the ordnance department, and therein promoted as major and lieutenant-colonel; chief of ordnance of the department of the Pacific 1855–57, and brigadier-general and chief of ordnance U. S. A. Aug. 3, 1861, in which capacity he continued until Sept., 1863, when he was honorably retired from active service. He served in the war with Great Britain 1814–15, against the Seminole Indians 1817–18. In 1860–61 he was sent on special duty to Japan. Brevet major-general Mar. 13, 1865. D. at Hartford, Conn., Mar. 15, 1870.

Ripley (ROSWELL S.), b. in Ohio in 1824; graduated at the U. S. Military Academy, and commissioned brevet second lieutenant of artillery in 1843; served throughout the war with Mexico, and brevetted captain and major for gallantry. In 1853 he resigned to engage in business in Charleston, S. C. In Apr., 1861, he directed the fire upon Fort Sumter, was made brigadier-general C. S. A., and wounded at Antietam; subsequently served in South Carolina. Author of a *History of the War with Mexico* (1849).

Rip'on, town of England, in Yorkshire, has a fine cathedral of the twelfth century, several tanning, malting, and founding establishments, and 6805 inhabitants.

Ripon, city and tp., Fond du Lac co., Wis., 84 miles N. W. of Milwaukee, is the site of Ripon College, containing about 400 students, and possesses in addition excellent schools, several churches, 2 banks, 2 newspapers, 2 public halls, an industrial exhibition, several large mills, 3 hotels, a pickle-factory, and a well-organized fire department. The city is supplied with gas, and stages run to all important points. It is the central point of 4 lines of railroad, affording the city excellent communication with places in every direction. P. of city, 2976; of tp. 4119.
W. H. BAILHACHE, ED. "COMMONWEALTH."

Ripon (GEORGE FREDERICK SAMUEL **Robinson**), D. C. L., MARQUIS OF, long known as Earl de Grey and Ripon, b. in London, England, Oct. 24, 1827, only son of Frederick John Robinson, first earl of Ripon (who under the title of Viscount Goderich was premier for a few months 1827); became attaché to the English legation at Brussels 1849; sat in Parliament as Viscount Goderich from 1852 until he succeeded to the earldom on the death of his father, Jan. 28, 1859; inherited the earldom of De Grey on the death of an uncle Nov. 14, 1859; became in the same year under-secretary for war, and in Feb., 1861, under-secretary for India; became secretary for war, with a seat in the cabinet, on the death of Sir G. C. Lewis, Apr., 1863; was made secretary of state for India Feb., 1866, and lord

president of the council Dec., 1868; was chairman of the high joint commission which negotiated the Treaty of Washington 1871; was rewarded with the title of marquis on his return, June 23; was installed grand master of the Freemasons of England Apr. 23, 1870, but resigned that position Aug., 1874, and was received into the Roman Catholic Church at Brompton Sept. 4, 1874.

Ripos'to, town of Italy, province of Catania, on the Ionian Sea, about 26 miles N. N. E. of Acireale. It is the emporium for the exportation of the favorite wine of Mascoli, as well as of other rich products of the vicinity; and here also are embarked the frozen snows of Etna for the ice-supply of Malta. P. 8000.

Rip'ple-Marks, so-called, in geological strata, appear in some instances to have been indeed formed on sea-beaches or river-banks, though not always on the surface. Other so-called ripple-marks are unquestionably wind-marks made in drifting sand. Many deep wave-marks were undoubtedly made by the vibration of sands beaten by waves, and it is believed that such marks may be formed at the depth of even 500 feet.

Ripp'ville, v., Chambers co., Ala. P. 709.

Rip'ton, p.-v. and tp., Addison co., Vt. P. 617.

Ris'er's, v., Talladega co., Ala. P. 1488.

Ris'ing Sun, city, cap. of Ohio co., Ind., situated upon Ohio River, 34 miles below Cincinnati, O., has communication three times a day with Ohio and Mississippi R. R., and contains 7 churches, fine educational advantages, 2 newspapers, a steam-tannery, 2 furniture-factories, 1 plough and 3 carriage factories, 1 planing-mill, and 2 flouring-mills. P. 1760. F. J. Waldo, Ed. "Recorder."

Rising Sun, p.-v. and tp., Cecil co., Md., on Philadelphia and Baltimore Central R. R. P. 277; of tp. 2618.

Risto'ri (Adelaide), b. in 1821 at Cividale, in Friuli, Italy, the daughter of humble comedians, who introduced her even in infancy upon the stage. When but four years old she played childish parts; at twelve, those of soubrette; at fifteen she was connected with a fixed troupe; at twenty she had attained distinction at Parma, and later at Leghorn. At this period her talent was in comedy; her favorite pieces were the plays of Goldoni. From comedy she passed, through drama, to tragedy. In 1847 her marriage with the young marquis Capranica del Grillo withdrew her from the profession for about two years. Her success in a performance given for charity revived her ambition, overcame the scruples of her husband's family, and she reappeared as a tragedienne. Again her career was interrupted, this time by the siege of Rome, which closed the theatres. Ristori left the stage for the hospitals, and there labored as a Sister of Charity. In 1850 she reappeared, and for several years played in the Italian cities, as Myrrha, Francesca di Rimini, Pia dei Tolomei, and Maria Stuarta. In 1855 her career began in Paris with great éclat. She was invited to establish herself at the Comédie Française, but declined. From this date her reputation was European. In 1857 she was triumphantly received in Spain; in 1860–61 her triumphs were repeated in Holland and at St. Petersburg; in 1862, King William at Berlin bestowed on her the medal of science and art; in 1864 she visited Constantinople; in 1866 came to the U. S., going thence to South America, Brazil, the Argentine Republic, and Havana; in 1874 was again in America. The popular pieces here were *Queen Elizabeth, Marie Antoinette, Mary Stuart.* She played also Judith, Medea, La Theresa, Lucrezia Borgia, Pia dei Tolomei—in fact, all her famous pieces. The circumstance that Ristori appeared in Paris during the reign of Rachel forced comparisons between them which otherwise would not have been thought of. They had little in common. Rachel was a woman of singular genius—Ristori was a woman of fine talent and most accomplished in her art. She had beauty, as Rachel had not, and she was a good woman, an excellent wife and mother, generous and sincere. At this writing Ristori has not finally abandoned the stage, though her retirement has been several times predicted. According to last advices, she was to play in London with Tomaso Salvini.

O. B. Frothingham.

Rit'chie, county of N. W. West Virginia, on Hughes River, a tributary of the Little Kanawha, has a mountainous surface, is largely covered with forests, and is crossed by Parkersburg division of Baltimore and Ohio R. R. Staples, Indian corn, oats, sorghum-molasses, tobacco, wool, and butter. Cap. Harrisville (Ritchie Court-house P. O.). Area, about 450 sq. m. P. 9055.

Ritch'ie, tp., Ohio co., West Va. P. 4126.

Ritchie (Anna Cora **Mowatt**), b. in Bordeaux, France, about 1818, being the daughter of a New York merchant, Mr. Samuel G. Ogden; returned to the U. S. when six years of age; exhibited in childhood great proficiency in private dramatic representations; married at the age of sixteen Mr. James Mowatt, a lawyer of New York; published an epic poem in five cantos, *Pelayo* (1836), and a play, *Gulzara* (1840); subsequently wrote several novels and dramas; made a successful début as an actress in New York June 13, 1845; made professional tours in England and the U. S.; lost her husband in 1851; married Mr. W. F. Ritchie, editor of the Richmond *Enquirer*, 1854, on which occasion she retired from the stage, but made several subsequent contributions to literature, including *The Autobiography of an Actress* (1854). D. in England July 28, 1870.

Ritchie (Thomas), b. at Tappahannock, Va., Nov. 5, 1778; received a good education; taught school for some time, and studied, but never practised, medicine, and founded in 1804 at Richmond a Democratic newspaper subsequently called the *Enquirer*, of which he was editor and proprietor more than forty years, wielding an immense political influence both in local and national politics. In 1845 he left the management of the *Enquirer* to his two sons, and at the request of Pres. Polk founded and edited the Washington *Union* as the organ of the administration, retiring from that post on the accession of the Whig adminstration of Gen. Taylor in 1849. D. at Richmond July 12, 1854.

Ritchie Court-house, P. O. name of Harrisville (which see), cap. of Ritchie co., West Va.

Rite [Lat. *ritus*, a "usage"] designates not merely a religious ceremony, but the aggregate of such ceremonies or the ritual system of any Church. Thus, the Roman Catholic Church is divided into the Latin and the Eastern Rite (which see), and the Latin rite has some minor rites. Thus, the Ambrosian rite in Northern Italy had 1,115,964 followers in 1861; the Mozarabian rite in Spain has a limited use, etc. (See Ritualist.)

Rites, Congregation of, a department of the constitution of the Roman Catholic Church, was first organized by Pope Sixtus V., and consisted originally of six cardinals and a corresponding number of secretaries and consultors. All belonging to the liturgy, the rites of the administration of the sacraments, the ceremonies of the Church in the beatification and canonization of saints, and in other public functions, fall under its jurisdiction. It consists of 17 cardinals, 25 consultors, and 11 secretaries.

Rit'ner (Joseph), b. in Berks co., Pa., Mar. 25, 1780, of German parentage; received in youth only six months' training in school, but while a young man working on a farm had access to a good library of German books, by which he profited richly; entered public life in 1820; ran three times for governor of Pennsylvania on the Anti-Masonic ticket, and in 1835 was elected and held the office till 1839; was one of the fathers of the Pennsylvania school system, a decided enemy of slavery and every form of intemperance. He became blind, but his sight was in a good degree restored by an operation. In 1849 he was for a time director of the mint in Philadelphia. D. at Carlisle, Pa., Oct. 16, 1869.

Ritschl (Friedrich), b. at Grossvargula, Thuringia, Apr. 6, 1806; studied the classical languages and literatures at Leipsic and Halle, and was appointed professor at Breslau in 1833, at Bonn in 1839, and at Leipsic in 1865. His principal works are—*Parerga Plautina et Terentiana* (1845); an edition of Plautus (3 vols., 1848–54), with critical annotations and an introduction on the Plautine metres; *Priscæ Latinitatis Monumenta Epigraphica*, containing on 100 large folio plates fac-similes of Latin inscriptions from the period before Augustus; and among his minor works, *Die alexandrinischen Bibliotheken und die Sammlung der homerischen Gedichte durch Peisistratus* (1838). A new edition of his *Plautus* was begun with the *Trinummus* (1871). D. at Leipsic in Nov., 1876.

Rit'son (Joseph), b. at Stockton-on-Tees, England, Oct. 2, 1752; studied law; became a conveyancer at London and deputy high bailiff of the duchy of Lancaster; devoted most of his time for many years to antiquarian researches; edited a vast number of reprints of old and rare books; was noted for industry and integrity, and for a quarrelsome disposition, which rendered him an enemy to all his fellow-workers in the antiquarian field. D. at Hoxton Sept. 3, 1803. Among his works were *Observations on Warton's History of English Poetry* (1782), *Ancient Songs from the Time of King Henry III. to the Revolution* (1790), *A Collection of Scottish Songs* (1794), *Robin Hood Ballads* (1795), *Bibliographia Poetica* (1802), and *Ancient English Metrical Romances, with Dissertation and Glossary* (3 vols., 1802). (See his *Letters*, edited, with a memoir, by Sir N. Harris Nicolas (2 vols., 1833).)

Rit'tenhouse (David), F. R. S., LL.D., b. Apr. 8, 1732, at Paper-mill Run, Roxborough tp., near Germantown, Pa.,

where his great-grandfather, William Rittinghuysen, a Hollander, established about 1690 the first paper-mill in America; worked in boyhood on his father's farm at Norriton, during which time he came into possession of a set of tools and some mathematical books left by a deceased uncle; made himself master of Newton's *Principia;* discovered for himself the method of fluxions when in his nineteenth year; made a clock at a still earlier age, and undertook clockmaking as a profession 1751; soon afterward made an orrery, which was purchased by Princeton College 1768, and subsequently a larger one for the University of Pennsylvania; was employed, in connection with Messrs. Mason and Dixon, in 1763 to determine the initial point of their survey, which he did with instruments of his own construction; fixed the boundaries of Pennsylvania with New York and New Jersey, and performed similar tasks for other States; was appointed by the American Philosophical Society to observe the transit of Venus June 3, 1769, which he did successfully in his private observatory at Norriton, though he fainted from excitement at the moment of apparent contact; published his observations in the *Philosophical Transactions;* calculated correctly the elements of the (future) transit of Dec. 8, 1874; settled at Philadelphia 1770, continuing there the manufacture of clocks and mathematical instruments; was elected to the provincial legislature 1775, in which year he published an *Oration on Astronomy* delivered before the American Philosophical Society, of which body he was an active member, and became president on the death of Franklin 1791; was a member of the convention which formed the State constitution of Pennsylvania; was State treasurer 1777–89, director of the U. S. mint 1792–95, and was chosen a fellow of the Royal Society 1795. D. at Philadelphia June 26, 1796. His papers on astronomical, physical, and mathematical subjects are found in the first 4 vols. of the *Philosophical Transactions.* A *Eulogium* upon him was delivered by Dr. Benjamin Rush 1796; his *Life* was written by his nephew, William Barton (1813), and by Prof. James Renwick in Sparks's *American Biography,* 1st series, vol. vii.

Rit'ter, tp., Moore co., N. C. P. 1524.

Rit'ter (Heinrich), b. at Zerbst in 1791; studied theology and philosophy at Halle, Göttingen, and Berlin, and was appointed professor of philosophy at Berlin in 1824, at Kiel in 1833, at Göttingen in 1837, where he d. Feb. 3, 1869. His principal work is his *Geschichte der Philosophie* (12 vols., 1829–53), ending with Kant; the most prominent of his other works, all relating to the history of philosophy, are—*Versuch zur Verständigung über die neueste deutsche Philosophie* (1853), *Die Halbkantianer und der Pantheismus* (1827), and *Ueber Unsterblichkeit* (several times reprinted).

Ritter (Karl), b. at Quedlinburg, Prussian province of Saxony, Aug. 7, 1779; studied at Halle; travelled much, and was appointed professor of geography at the University of Berlin in 1820. By his lectures, as well as by his works, he exercised a decisive influence on the study of geography, remodelling the whole science and attracting general attention to its problems and results. D. at Berlin Sept. 28, 1859. His principal works are—*Die Erdkunde im Verhältnisse zur Natur und Geschichte des Menschen* (1st ed., 2 vols., 1817–18; 2d ed., 19 vols., 1822–59, comprising only Africa (i.) and Asia (ii.–xix.)), *Europa, ein geographisch-historisch-statistisches Gemälde* (2 vols., 1807), *Die Stupas* (1838), *Einleitung und Abhandlungen zu einer mehr wissenschaftlichen Behandlung der Erdkunde* (1852). After his death were published—*Geschichte der Erdkunde* (1861), *Allgemeine Erdkunde* (1862), and *Europa* (1863). Parts of his works have been translated into English by W. L. Gage: *Comparative Geography* (1865) and *The Comparative Geography of Palestine and the Sinaitic Peninsula* (4 vols., 1866). His *Life* was written by W. L. Gage.

Rit'ualist, Ritual, Rite [Lat. *ritus*]. A rite is an outward act in divine worship, intended to assert doctrine or to express, and so strengthen, the frame of mind—the emotions which should accompany adoration. Ritual is an appointed system of rites. Worship may be as bare as the fear of error or the love of simplicity can devise, yet there can be no public worship without ritual. A purposed absence of form is formal. They who assert that all forms are counter to the teaching of Jesus forget that Jesus worshipped as a Jew. They who maintain that many forms must hinder spiritual religion forget that God, who does not change, himself ordered all the minutiæ of the Jewish ritual; and they have failed to perceive how ritualistic is the worship of heaven as revealed to John the divine. No amount of outward observances can beget the state of heart which gives worth to worship, but as little can absence of form secure it. In the New Testament may be found intimations of ritual, but not commands, even concerning the rites attending the sacraments. We know that not long after the Church ceased to be persecuted its ritual in essential matters was what it has continued to be in the greater part of the Christian world—in principle everywhere the same, without uniformity. Various explanations of this fact are offered by those who consider it to mark a change from primitive simplicity. As Divine Wisdom has taught with regard to public worship, "Let all things be done decently and in order," so is it the teaching of common sense, as well as of the Book of Common Prayer: "Different forms and usages may without offence be allowed, provided the substance of the faith be kept entire." A Ritualist is one who has made the rites and usages of the Church a matter of study. But the term, within a few years past, has been used to designate a party in the Anglican Church. In this Church there could not but be great variety of opinion touching doctrine and discipline. Apart from the rejection of the papal supremacy, and of some practices which had been abused, the Church of England at the time of her Reformation made authoritatively few changes; her constitution remained the same, and her Book of Common Prayer was, by those who framed it, asserted to be substantially identical with the old. There was no severance from the past, nor was there a separation from those churches which continued in subjection to Rome, until the anathema by the pope in the eleventh year of Elizabeth's reign. But while this is true of the Church as represented by her authorized exponents, there has been always a party in sympathy with ultra-Protestantism and hating the semblance of popery; and, on the other hand, those who care for the Church only because catholic. There have long been in the Church, and more especially among its rulers, the followers of Leiber of Baden, who consider the national Church as co-extensive with the nation, and its administration a department of the State; while others believe the Church to be older than the State, to have always maintained its divine origin, and to have had its liberties guarantied by law, and notably by Magna Charta. Against the increasing oppression of the Church by the State through Erastian views, a protest was raised by a small body of clergy. By this "Oxford movement" an Anglo-Catholic party have gained influence. A younger generation have not been content with the position of the earlier Tractarians—with asserting the apostolic character of the ministry, which derives none of its authority from association with civil government, and with setting forth the doctrines of the Fathers as the heritage of the Church—but seek to minimize the effect of the Reformation, which they stigmatize as a deformation; and, in order to show sympathy with the ante-Reformation Church, and to make prominent doctrines not accepted by the Protestant party, they have revived rites and practices which are to many, not familiar with history, simply popish. They say that some of these usages they follow in obedience to the letter of church law; others as conformable to Catholic practice, and not forbidden. From their attention to ritual this outgrowth of the Tractarians are called Ritualists, and their system ritualism, while they style themselves simply Catholics. To point out what they have reintroduced, it may be enough to say that the fling of the Puritan against the English service, "'Tis but an ill-mumbled mass," would have no meaning if spoken of a ritualistic service. As a body, the Ritualists have shown much zeal and self-denial, and in some respects resemble the early Methodists. Said an English bishop to an American bishop, "These men seem alone to have found out that the poor have souls to be saved." Denounced as Romanizers and betrayers of their Church, an association powerful through the money it commands has been formed for their prosecution; and it has done its work effectively. Suit after suit has been brought; and whatever points have been decided in favor of any Ritualist in the lower ecclesiastical court have been overruled by the committee of privy council. The Ritualists yield to force, but they do not accept as otherwise binding any decision given, as they say, by a secular court in violation of the rights of the Church. It is too soon to say whether anything has been gained or lost by these suits. Particular acts have been declared to be unauthorized. Their condemnation was obtained not because they are violations of law, but because they are supposed to symbolize popish doctrine. But the very opposite of the thing forbidden may be made to express the thing pointed out. For instance: in the English Church the table of the Lord must be "an honest table" of wood; stone symbolizes the popish doctrine of sacrifice. But a Russian will have wood only for his altar, because stone cannot betoken the tree on which the sacrifice was offered. If all symbolism were put aside, yet what is gained? It has been decided in the highest court that in the English Church it is not forbidden to "teach the people to adore Christ present in the sacrament under the form of bread and wine."

From the Church of England ritualism has extended to

her daughter in the U. S., and has occupied the attention of more than one general convention. Warm controversy has been excited, and some clergymen, distinguished both by their learning and worth, have had hard usage because of fears of ritualism. No clergyman could introduce any change in services without the consent of his congregation; and where clergy and people are of one mind, they are not likely to be disturbed in their peculiarities. Moreover, if existing laws being violated be enforced, or if they be interpreted or modified, it can only be by the authority of the Church, which all its members must acknowledge. (Art. of Relig. xx.) And even if legislation be deemed unfair as the result of prejudice and haste, it yet is submitted to when not touching faith. W. F. BRAND.

Rivan'na, tp., Albemarle co., Va. P. 4697.

Rivaro'lo Canavese, town of Italy, province of Turin, on the right bank of the torrent Orco, which often causes great damage by its inundations. The churches and the public and private buildings generally are respectable; the great campanile of San Giacomo was originally the military tower of the citadel. Ancient medals, inscriptions, and other objects of the Roman, and even of still earlier times, are often found near this town. P. 6500.

Rivarolo Ligure, town of Italy, province of Genoa, on the torrent Turbella, which divides it into Upper and Lower Rivarolo. This town is so near the city of Genoa as to command much the same enchanting sea-view, and it has been selected by the families Doria and Pallavicini as the site of magnificent rural palaces. Important Roman inscriptions have been found here. The inhabitants are distinguished for activity and courage. P. 7000.

Ri'vas (ANGEL DE **Saavedra**), DUKE OF, b. at Córdova, Spain, Mar. 1, 1791; educated in the School of Nobles at Madrid; entered the royal guards 1807; fought with gallantry during the war of independence; was severely wounded at the battle of Ocana; was taken prisoner at Malaga; escaped to Gibraltar; passed thence to Cadiz; became lieutenant-colonel and chief of staff to a division of the army; left the army with the rank of colonel 1815; settled at Seville; acquired reputation as a poet by his *Ensayos Poéticos* (2 vols., Madrid, 1813); took part in the revolution of 1820 in favor of the constitution of 1812; was elected to the Cortes, and became secretary of that body 1821; was driven into exile by the counter-revolution of 1823; resided several years in England, where he published *Florinda* (1824–25), an epic poem on the Moorish conquest of Spain; went to France 1830; supported himself by giving lessons in drawing at Orleans and Tours; returned to Spain after the amnesty of 1834; inherited the dukedom of Rivas on the death of his elder brother; was made secretary of the chamber of peers 1835; was appointed minister of the interior in the cabinet of Isturiz May, 1836; was exiled by the regent Espartero 1837; returned with Queen Maria Christina 1843; was ambassador at Naples 1843–48; was a member of the Conservative "cabinet of forty hours" overthrown by O'Donnell and Espartero July, 1854; was for several years thereafter a member of the senate, but took little part in politics; was for some time ambassador to Paris, and was appointed president of the council of state Nov., 1863. He acquired great reputation as head of the "national school" of Spanish writers, whose object was to return to the older literary style, abandoning imitation of French models. Author of many dramas, of *El Moro Exposito* (1844), a national epic, of *Romances Historicos* (1846), and of histories of Masaniello (1860) and of the Neapolitan revolution of 1848.

Rive-de-Gier', town of France, department of Loire, on the Gier, an affluent of the Rhone, has large silk-mills and glassworks, extensive manufactures of iron and steel ware, and in its vicinity very important coal-fields, in which over 50 mines are worked. P. 14,202.

Riv'er, tp., Dallas co., Ala. P. 1457.

River, tp., Warren co., N. C., on Roanoke River. P. 1500.

River Bend, tp., Gaston co., N. C., on Catawba River. P. 2248.

Riv'erdale, tp., Douglas co., Minn. P. 155.

Riverdale, tp., Watonwan co., Minn. P. 259.

Riv'er Falls, p.-v. and tp., Pierce co., Wis., 12 miles N. E. of Prescott and 12 miles S. E. of Hudson, contains the fourth normal school of the State and River Falls Institute, 4 churches, 3 newspapers, 4 flouring-mills, abundant water-power, and 1 grist-mill. Principal business, farming and flour manufacturing. P. of v. 741; of tp. 1217. A. MORSE, ED. "JOURNAL."

Riv'er Head, p.-v. and tp., cap. of Suffolk co., N. Y., at the head of navigation in Suffolk co., L. I., has 7 churches, good schools, a savings bank, woollen, cloth, and organ manufactories, chocolate, moulding, paper, and grist mills, 1 newspaper, 5 hotels, the county clerk's office and court-house. There exists direct water-communication with New York City. P. of v. 1296; of tp. 3461.

JAMES B. SLADE, ED. "WEEKLY NEWS."

Riv'er Heads, p.-v. and tp., Augusta co., Va. P. 886; of tp. 4380.

Riv'er Point, p.-v., Warwick tp., Kent co., R. I., on Pawtuxet River and Hartford Providence and Fishkill R. R., has extensive manufactories of cotton and other goods.

Riv'ers. Before people attempted to connect the various phenomena with each other and rise to general ideas, every river, brook, or spring appeared to them an individual being. Their ideas of these beings were often vague and wholly unaccounted for. It might be a god, or it might be an elf, terrible when the swelling of the waters caused danger, helpful when the waves fecundated the parched soil. Subsequently, those who sought after truth were led by simple reflection to the establishment of a general cause as the origin of the innumerable streams which flow on the surface of the continents. The Chinese, the Hindoo, the Greek, saw the inexhaustible sea expanding along the coasts, and the rivers, even the mightiest, losing themselves in it like slender threads of water. Was it not natural, then, that he should consider this gulf, "without bottom and without bounds," as a reservoir whence all the streams issued through subterraneous channels? True, it was difficult to comprehend such a rotatory movement of the waters through the hidden abysses of the earth; but by this supposition one pressing difficulty, at least, was removed—that of the origin of the springs, and the mystery of the formation of rivers seemed to have been solved. It must also be remembered that subterraneous rivers were frequent in the calcareous and much-fissured rocks of Greece. The sudden disappearance and reappearance of streams were phenomena familiar to all. Every peasant-boy knew that beneath the network of streams which appeared on the surface there existed another hidden from sight; and through that it was believed the oceanic currents rolled their billows. The greatest scientists of antiquity shared in these illusions. Aristotle believed that the waters of Pontus Euxinus passed beneath the Scythian plains and gushed out in the Hyrcanean Sea.

No doubt, the water of the sea can penetrate for some distance into the land below the surface. Instances are found on the coasts of Louisiana where the so-called *prairies tremblantes* float on the waves like a carpet. In the Bahama Islands and in most other coral formations the salt water becomes so infiltrated in the rock that wells dug to a certain depth, and not too far from the coast, reach a sheet of sea water. In the Greek island of Cephalonia, near the town of Argostoli, the unique phenomenon occurs of salt-water streams which turn several factory-wheels before they finally are swallowed up by the caverns of the island. But all these waters seek their level; they descend or they spread horizontally; none of them ascend toward the mountain-peaks.

Bernard Palissy, the celebrated potter of the sixteenth century, was probably the first who demonstrated the falsity of the ancient hypothesis with respect to the oceanic origin of rivers and brooks. "If it were so," he says, "the sea should be higher than the highest mountains, . . . for it is a rule, certain and universal, that water never rises higher than the source whence it issues. . . . Furthermore, as the tides which advance on the shores follow the movement of the great body of the sea, so, too, should the springs, brooks, and rivers, receding and drying up in their turn. . . . I will give still another proof. The sea has the same height summer and winter. . . . If, then, the sea nourished the springs of the universe at its own breasts, they should never become dry in summer, at which season, however, we find an infinite number of wells exhausted."

What, then, is the first source of all the streams which flow on the surface of the earth? Well, it is the ocean, as the ancients supposed; but the way which its waves take in order to reach the summits of the mountains and other points of efflux is not that which the ancients traced out. The water of the sea, transformed into vapor, journeys through the atmosphere, and falls again in the form of snow and rain. However trifling these precipitations of moisture may seem, when compared with the "moving seas" of the Mississippi and the Amazon, they suffice to account for the formation of all the rivers—yea, these latter would even have a liquid mass, on an average, two or three times larger if parts of the water of the snow and rain did not return to the atmosphere in the form of vapor. All streams being thus produced by atmospheric agencies, it would

seem quite logical to consider the study of rivers simply as a branch of meteorology; and, indeed, the course of the aërial water-streams, of which the terrestrial are only the counterparts, must be studied in the direction and intensity of the winds, in the formation and dissolution of the clouds, etc. That part of the great circulatory movement which takes place in the atmosphere may be considered as the arterial system, while the rivers form the venous. Nevertheless, the appearance of these phenomena and the parts they play in the terrestrial economy differ so much that the hydrology of the rivers must be treated apart from meteorology proper, and in connection with the lands which they bathe.

We have said that not all the water which is precipitated finds its way to the beds of the rivers. A considerable part returns to the air, while another enters into the circulatory current of vegetable and animal life. In all seasons, but especially in spring, when the foliage is formed, the plants absorb a great quantity of the water poured down by the sky. In the summer, during the great heats, the evaporation is very rapid, and the whole superficial layer of lakes and rivers escapes into the air. No less active than the sun are the great winds in reducing the rains to the form of vapors. And, finally, not all the water which through the pores of the earth and the fissures of the rock penetrates to deep beds, rebounds through springs to the surface; myriads of liquid threads descend into the crust of the earth lower than the level of the seas.

In the eyes of a physicist there is no essential difference between a pool and a brook, a lake and a river. The pool without efflux is formed, like the brook, by rains which do not escape immediately after their fall, but gather together in a common cavity. Water enters, and spreads laterally in all the lower parts of the ground. A stream tends to form toward the least elevated point of the circumference of the pool. But in proportion as the surface of the pool extends the evaporation increases. An equilibrium is established between the instalments of rain and the escape of vapors, and the reservoir of water, pool, lake, or interior sea, remains a locked basin. Now, it is well known that these waters, having thus become dormant, cannot retain the same purity as those which are incessantly renewed. The earth contains almost everywhere a certain amount of salts which dissolve in the water, and by degrees accumulate in it. This is the origin of the numerous salt lakes with which the steppes and other great plains are dotted. But when the waters of the rain are sufficiently abundant, and the geological strata easy to break through, and when the general slope of the ground aids the work of erosion, the lake bursts open at some weak point the reservoir which encloses it, and changes into a stream. Countries which have emerged in a recent period from the bottom of the sea, such as Sweden, present thousands of lakes which move in this manner from valley to valley. The stream which descends from the mountain to return to the sea has not yet had at its disposal a sufficiently large number of centuries in order to carve out its bed and give it its regular parabolic curve; it has not yet discarded its lakes either by filling them up with alluvion or by breaking down the bars at the outlet; it still journeys by a succession of leaps, instead of following a normal course, decreasing gradually in rapidity and increasing in width and liquid mass.

In moist regions and on surfaces of marked inclination, where one stream can join another, the river always terminates by reaching the sea. But there are other countries where the streams evaporate during their course under the scorching sun, until at last the small balance of water which remains is sucked in by the sands, and the river ends in a marsh, generally saline, or in a series of pools. The length of a river increases and decreases by the abundance of rain and the heat of the sun. Many a stream reaches the main river or the sea only during a few days or weeks or months; then it ceases to flow, partly or perhaps completely: it is a temporary apparition only, changing its appearances according to the course of the seasons. The coasts of Texas and the great plains of the Far West present numerous instances of such intermittent streams. But such locked basins, or basins which open only during a part of the year, are exceptional; the open basins whence streams descend with a continuous flow to the rivers, and these again to the central veins of the hydrographic system, are the rule. An idea may be formed of the multitude of watercourses which compose the system of a river-basin from the fact that the Isar, in Bavaria, receives from its source to its influx into the Danube 103 secondary rivers, which again are fed by 1293 rivers of the third rank, and 130 lakes; yea, if all rivulets and brooks were counted, and only the temporary trenches left out of consideration, it would be necessary to compute the number of affluents by hundreds of thousands. And yet the Isar, which Karl Ritter has chosen as an example in his *Einleitung zur Begründung einer mehr wissenschaftlichen Behandlung der Erdkunde*, is only one of the 34 great tributaries of the Danube, which itself is a river of small consequence when compared with the great streams of the globe. An estimate of the basin of the Amazon, in accordance with the proportions of that of the Isar, would give 325,000 minor affluents as the number of its proper tributaries.

What is, in each river-basin, the proportion between the water drained off and the water precipitated? If it were possible to answer this question with complete exactness, most problems relating to the climate and geology of a country would thereby be solved; but few rivers are known, even approximately, in their double dominion, aërial and terrestrial. Exceedingly delicate operations must be continued for a long series of years, at different and judiciously-selected points of the territory, in order to fix the annual average of rain in a basin. Udometers, sinimeters, anemometers must be compared, verified, studied incessantly, in order to gauge, even vaguely, the annual volume of the aërial river of the rains, while in the bed of drainage, width, depth, rapidity of current, oscillations between high and low water, must be constantly noted in order to calculate as exactly as possible the approximate amount of the surplus of rain transformed into a watercourse. These comparative observations have been started with great zeal in several countries of Europe, in the U. S., in Hindostan, and they have already yielded approximate results of the highest interest. When more precise measurements once permit us to press closer to the truth, the circulatory movement of the waters will reveal itself to our eyes in all its details, like the movement of the water which flows in the pipes of a machine, and which is directed and regulated by the art of the engineer.

Denys de Papin, a man of genius, who, like Bernard Palissy, had the honor of being persecuted and the glory of remaining firm during adversity, was the first who, while seeking new paths for the human intellect, observed in a methodical manner the quantity of water brought down in a river-basin by the rains, and again carried away by the river itself. He studied the Seine from 1669 to 1674. But although at that period the dimensions of the basin were not exactly known, and although the rain could not be measured in the different parts of the region where its average fall is very different, the approximation which the illustrious physicist attained is, nevertheless, very remarkable. According to him, the annual discharge of the river represents one-third of the water precipitated by the rains, while the more precise measurements obtained during the last years at different stations in the basin of the Seine give to the drainage of the river an average of a little above two-fifths. Followed up subsequently with the most rigorous precision, the method of observation inaugurated by De Papin has led to general results with respect to tolerably extensive regions of the earth. The estimates by different physicists of the rain which falls in France and the water drained from her soil vary very little, and the total discharge of the French rivers amounts to about 5400 cubic mètres, or a little more than one-fourth of the average discharge of the Mississippi, for each second. The admirable researches made under the direction of Humphreys and Abbot on the physics and hydraulics of the great river of the U. S. are also well known. When all these details are added together, and verified by a comparative study of all the movements which take place on the surface of the planet, the time will perhaps soon come when it will not be too hazardous to give a valuation of the relation between the humble watercourses on the surface of the earth and the immense reservoir of the ocean. At present, however, only hypotheses, approaching more or less to truth, can be given on this point. The valuation which seems most plausible is that according to which the average rainfall on the whole surface of the continents amounts to about half a mètre, and the average drainage to about one-half of the rain received; in this case the sea would receive 1,000,000 cubic mètres a second. By adding together the masses of water poured into the ocean by rivers which have already been gauged by engineers and geographers in the different parts of the world, the total average drainage of the whole of these river-basins, comprising an area of about 29,000,000 quadrate kilomètres, is found to be approximately 265,000 cubic mètres a second; which is very near the proportion presumed with respect to the whole earth. In accordance with results well ascertained, a classification of the rivers after their importance can now be attempted; and, as was to be foreseen, it is the rivers of the zone of the tropical rains, the Amazon, the Parana, the Congo, and the Mekong, which occupy the foremost rank on account of the amount of water which they pour into the sea. As for the Mississippi, a river of the temperate regions, and receiving only a comparatively small amount

of rain in the western part of its basin, it is, in spite of the length of its course, only a river of the second order. Estimating, with Humphreys and Abbot, its discharge at 17,440 mètres a second, it carries on an average only half as much water as the Mekong, one-third as much as the Congo, one-fifth as much as the Amazon.

Considering what good or evil man may expect from the running waters, the action of the rivers on their shores interests us more than the amount of water which they pour into the immense abyss of the ocean. Continual changes take place in the river-basins in accordance with the ever-varying phenomena of climate and soil. Everywhere the geological strata bear traces of rivers which have had a different course from that of those which now traverse the country, or which have carried a different amount of water, either greater or less. Thus, in the Sahara, in Toorkistan, large river-beds are seen, with their shoals, meanderings, *accores*, *battures*, banks, and islands; only the running water is wanting. In France, in the valley of the Seine, which M. Belgrand has studied, the height of the cliffs and the extension of the alluvion prove the existence of an ancient stream which at high water discharged nearly 50,000 cubic mètres of water a second—that is, about three times as much as the Mississippi. Furthermore, in Westphalia traces are seen of an ancient delta formed by a powerful river whose basin occupied a large part of the basin of the present German Ocean, and whose sources were situated in the present Great Britain. Finally, the observations of De Verneuil and Collomb, corroborated by those of several other geologists, have led them to believe that the vast Tertiary plains of Central Spain are alluvial deposits from rivers coming from the N. W.—that is, from a continent which has now disappeared, but which must have been the Atlantis of the ancients. It is known that the Red River did not join the Mississippi until within a comparatively recent geological period, but flowed directly to the Mexican Gulf through the large bed now occupied by Bayou Teche. According to Ellet, the Washita also was an independent river, and descended to the sea through the depression in which Bayou Atchafalaya now flows. These changes of course, which united the Red River, the Washita, the Mississippi, and the Atchafalaya in one system, form a recent phenomenon, and are the work of flood and erosion. But what are they in comparison with those modifications which have taken place in the upper course of the Mississippi, above its junction with the Ohio? The cliffs which range here on both sides of the river, and bear on their walls perfectly plain traces of ancient lines of erosion, prove that the Mississippi formerly flowed 50 mètres above its present level. At that time these rocks no doubt formed a dam from above which a cascade plunged down, similar to that of Niagara, and, like that, constantly eating into the geological strata which formed its bed. Above this barrier of rocks the waters of all the larger affluents were purified in a lacustrine reservoir whose vast surface, situated 180 mètres above the ocean, extended N. to the mouth of the Wisconsin, united E. with Lake Michigan, and covered the immense prairies of all the intermediate peninsulas. Perhaps there was a period in the history of the earth when the great mediterranean fresh-water sea poured forth the surplus of its liquid mass over two Niagaras, forming, on the one side, the Mississippi, on the other the St. Lawrence.

The great hydrological changes are the work of centuries. In our short lives, however, mere moments though they are in comparison with the life of the globe, we see very considerable modifications taking place. Thus, the rivers of Germany, from the Rhine to the Vistula, have all decreased regularly since the commencement of the century. In France the Doubs was recently on the very point of disappearing entirely in the fissures of its calcareous bed, and the manufacturers along the shores were compelled to guard their river by closing the clefts with solid masonry. In Italy all the streams which enter the northern extremity of the Gulf of Venice change their outlet with every new flood. The Timavus of Virgil, which the ancients considered one of the mouths of the Ister or Danube, on account of the great mass of its waters, and which gave the name of Istria to the peninsula of Monte Maggiore, flows through a subterranean channel to the Isonzo, and is now only a modest rivulet. And who has forgotten the wonderful changes which the Yellow River or Hoang-Ho in China has undergone? This stream, which justly bears the name of the "scourge of the children of Ham," has continued for at least 2500 years to change its outlet in the sea from the right side of the peninsula of Shantoong to the left, and back again from the left to the right, a distance of 550 kilomètres. During historical time it has changed its bed nine times, each time devastating a territory as large as Great Britain. The last change took place from 1851 to 1853, a short distance above the city of Kai-Foong. The river made a gap in the dam on its left side, and threw itself, first in parts, then with the whole mass of its waters, across the plains which extend toward the Gulf of Pe-Chee-Lee. In many places it resembles a permanent inundation, not yet having had time to carve out a bed; in other places it borrows the natural and artificial canals, which it enlarges and deepens in order to make them fit. In the lower part of its course it has taken possession of the bed of the Tat-Sing, formerly an independent river, but now a mere tributary, lost in the waters of the large stream. The displacement of the course of the Hoang-Ho was a double disaster. On the one side, the waters have inundated fertile regions; on the other, they have relinquished fields which can produce nothing without being irrigated, and which owed their population and richness to the fertilizing canals fed by the Hoang-Ho. The direct injury which the inundation has done in the regions now traversed by the river is small in comparison with that it has done indirectly by turning its course away from sandy wastes which derived all their fertility from it.

It is sufficient, however, simply to look at any great river with a rapid current and earthy banks in order to notice the incessant mobility of the bed under the action of the running water. Along the hollow of the creeks where the current sets with force, the sandy molecules become loose, detach themselves, sometimes in large masses, and, spreading in the muddy water, pass on to deposit themselves down-stream, especially at the mouth, where the current, retarded at the bottom, has not sufficient rapidity to hold the sand or clay suspended. Islands, pitched at their front point and elongated at their base-line, are formed, and then carried away to be formed again farther down: they are incessantly displaced, changing form and aspect according to the size of the river and the power of the current.

Besides the continual displacements of the bed caused by the sinuosities of the current, which undermines on the one side, sanding up on the other, there is the normal displacement caused by the rotation of the earth from W. to E. Some of the greatest physicists, however—as, for instance, the celebrated hydrologist Lombardini—have doubted the existence of this normal pressure of running waters from left to right in the northern hemisphere, and from right to left in the southern; but the laws of mechanics make a movement necessary, and thousands of facts prove its reality. In the plains of Russia and Siberia, where the uniformity of the ground both in topographical and in geological respects allows the running water full liberty in choosing its course, there is not one river which does not, from year to year, encroach on its right bank, generally known as the "high bank," because the current incessantly saps the cliffs; and there is not one river which does not at the same time retreat from its left bank, its "basis," which has been levelled by the waters and made straight by the regular deposition of alluvions. Even when traversing regions which he has never seen before, the Siberian knows what aspect the rivers which he is to cross must have. In the same manner, travellers who journey in a direction parallel with the ranges over the plateau of débris carried down by the ancient glacier-torrents at the base of the French Pyrenees will notice that at every river-crossing they must descend to the eastern bank, which is here also the right, through a steep declivity, while they ascend the opposite western bank gradually through long slopes. In this part of France, the right banks are eroded and crumble down, the left stretch out large and level. Nevertheless, several rivers present a striking exception to this law, and the North Americans may quote as an instance the Mississippi. This powerful stream, rising in the northern regions, where the angular rapidity of the terrestrial rotation is less than under a more southerly latitude, should, according to theory, gradually deviate in a western direction—that is, retreat incessantly to the W.—on account of the movement of the earth. But it does not. On the contrary, it abandons its old beds in the Western plains, which are transformed into annual lakes, such as Lake Tensas, Lake Providence, etc., and throws itself to the E. against the cliffs on which stand the cities of Memphis, Natchez, and Port Hudson. Farther on, when issuing from its middle course into a region where it is not restrained by the rising eastern ground, but can choose what direction it likes toward the sea, it flows to the S. E., instead of taking the shortest way directly S. or deviating to the W. But all natural phenomena are complex, and controlled at the same moment by several laws. While the Mississippi is pressed to the W. by the movement of the rotation of the earth, it may be thrown back to the E. by another power; and, indeed, it seems that the whole North American continent slopes from W. to E., toward the Atlantic coast. This would be, according to a hypothesis which still awaits the support of scientific ob-

servation, the cause of the easterly movement of the waters of the Mississippi. The rivers of Texas—the Sabine, Trinity, Colorado, and Rio Grande—flow in the same direction, probably under influence of the same causes.

The geographers who quote the Mississippi as an exception to the law of normal deviation may, on the other hand, characterize it as the greatest artisan among the rivers. In the present geological period no stream has thrown out into the sea a peninsula of a more extraordinary form. The long channel enclosed by narrow banks, which are bathed on the one side by the waters of the river and beaten on the other by the waves of the sea, resembles an arm thrust far out into the sea, and the beds of the various passages spread like the fingers of a hand. As is well known, the estimates of different geographers with respect to the average advance of the mouth of the Mississippi are far from agreeing. Kohl, who is a geographer of merit, declares that the delta is now nearly stationary—an assertion which certainly sounds strange, since Élie de Beaumont—who, however, had not all necessary documents at his disposal—estimated the advance of the mouth at 350 mètres per annum. Humphreys and Abbot confine themselves in their great work on the river to a comparison between the hydrographic maps of Calcott (1839) and the Coast Survey (1851), which gives an advance of the alluvial peninsula of 79 mètres per annum, whereby it must be remembered that the rapidity of the advance decreases necessarily from year to year. Soundings have shown that the mouth of the Mississippi will soon reach the brink of the deep abyss where the coast-current of the Gulf of Mexico passes. At a distance of 18 kilomètres from the South-West Passage the bottom of the sea is only reached at a depth of 270 mètres below the surface; and this depth increases rapidly to 1500 mètres. Incapable of filling up such gulfs, on whose surface the rapid waters of the current will carry away its alluvions to the open sea, there will be nothing left for the Mississippi but to fill up its side bays. The Po, one of the most active rivers of Europe with respect to the filling up of the sea, has a much greater facility in continuing its work. The increase of its peninsula of alluvions has been calculated with precision during the last two centuries, and amounts to about 70 mètres per annum. As the sea in front of it is not very deep, it would require only 1000 years in order to form a peninsula 10 kilomètres broad across the Adriatic, and to meet the banks of the Istria. But it must not be taken for granted that the existence of abundant alluvion in a river-current necessarily results in a considerable encroachment of the land on the ocean. The Amazon, for instance, which carries such great quantities of débris that it could fill up vast and deep gulfs, retreats, nevertheless, from century to century before the sea. The entrance into the delta widens steadily, and, consequently, the salt water penetrates farther and farther. Formerly, the different rivers of the Brazilian provinces of Ceara and Maranhão were tributaries of the Amazon, while now they flow directly to the sea. Even the river Tocantins has ceased to unite directly with the great current of fresh water, and the island of Marajo decreases little by little, eaten into by the sea. There is a general sinking of this part of the American coast, which compensates, and more than compensates, for the effect of the alluvions, which, moreover, are partially caught by the coast-current and deposited on the shores of Guiana. In nature all phenomena are complex, and depend on many causes which may cross each other in many ways.

This cross-action of laws manifests itself in the most curious manner in the annual history of the rivers—that is, in the changes of their level and discharge according to the seasons. The rivers of the temperate zone, which descend from high mountains, offer a striking instance. At the time of the great autumn rains which fall in the river-basins of Western Europe, only one part of the moisture swells the current and finds its way to the sea; another is carried away by the winds to the slopes of the mountains, and remains there bound up under the form of snow and ice. Thus, the height which might be expected for the floods is considerably diminished, and it is in the summer, in the season when the waters of the rivers should be at their lowest, that the mountains deliver up to the rivers their treasures of liquefied snow. The mass of the current is thus sustained. The Rhone, the Rhine, the Danube, and the Po regulate their discharge in this manner: they fall when their tributaries from the plains swell, and they rise when these affluents decrease.

A similar contrast between the different affluents of the same river is produced in other basins by the alternation of the rains in the different parts of the surface drained. The Amazon is the most remarkable instance of this hydrological phenomenon. When the sun, on its annual round, is N. of the terrestrial equator, a belt of rain-clouds cover the lands below with their shade and inundate them daily by their showers. The rivers which receive the surplus of these rains, the Pastaza, Tapura, Rio Negro, etc., become filled to the very brim, and soon after flood the adjacent fields. The Amazon is thus sustained in its course by its great northern affluents. But when the sun again crosses the equator, and journeys toward the boundary of the southern tropical zone, the rains fall in the other part of the basin, and it is the Huallaga, Ucayati, Purus, Madura, Tapajoz, and all the other great southern tributaries which flow with full current and bring to the Amazon that liquid mass which the northern affluents have ceased to offer. Spix and Martins were the first to demonstrate—and they did it in a most elegant manner—this movement of oscillation, so similar to that presented by the plates of a balance in motion, never ceasing to raise or lower alternately the levels of the rivers on the two sides of the "visible equator" formed by the immense river of the Amazon. In other basins the phenomenon of alternation between the affluents is not produced by the seasons, but the general management of the affluents, although less regular, presents, nevertheless, as a whole, oscillations of the same kind. When the pluvial winds bear toward one side of the basin, it is the heights of this side which receive the abundant rains, and whose watercourses rise in floods, while on the opposite side the upper torrents remain dry and the permanent streams fall or stand at a low level. When, then, the moist winds change their direction, and the waters which feed the principal current of the river consequently change, the rivers of the one side fall, while those of the other suddenly rise. This phenomenon is easily observed in the valley of the Rhone. Now, it is the rivers descending from the Cevennes, the Gardons, Ardèche, Doux, Erieux, which raise the level of the Rhone; then, again, it is those which originate in the Alps, the Durance, Drome, and Isère. But a flood of all the affluents from both the opposite slopes never occurs. If all these rivers delivered at once the highest floods of which they are capable, the Rhone would precipitate as much water over the low plains of its delta as the Amazon carries to the sea; for, however strange the fact may seem, it is nevertheless incontestable that the Ardèche carries during its periods of flood as much water as the Mississippi, and rivers like the Doux and Erieux, which are visible only on large maps, may reach, and even surpass, the average discharge of the Ohio.

The geological difference of the regions produces also a difference in the management of the watercourses which traverse them. The impermeable strata, solid rocks, stiff clays, etc., do not allow the rain-water to penetrate into the depths of the soil; it hurries immediately to the beds of the rivulets, and thence to the common river. The permeable strata, on the contrary, such as the cracked layers of limestone, permit the water to penetrate into hidden grottoes: its course is retarded by a thousand obstacles; it wanders through long subterraneous galleries; and when at last it reappears in abundant springs, the superficial waters have been drained off days and weeks before. In this way the volume of the navigable rivers is maintained by the tributary waters arriving in succession: when one affluent has discharged its surplus, another is in its period of swelling, and then a third, issuing from a subterranean cavern, will rise in its turn. The Seine, which is one of the most remarkable rivers of the world on account of its equable carriage, presents a striking equilibrium between its tributaries from the permeable and the impermeable strata.

The overflowing river tends itself to regulate and moderate its course. While the exceeding rapidity of the current hurries the billows of the flood down-stream, the waters which expand laterally over the regions inundated slacken little by little on account of the innumerable obstacles which they meet. In regions not yet under cultivation or defended by levées the river generally finds natural reservoirs—lakes, swamps, etc.—in which it can store up a large part of the surplus of the flood, which then afterward flows back to the principal river when this has lowered its level. Any great river presents instances of such reservoirs, in which the surplus of the inundated liquid mass is temporarily gathered up, and which, in their turn, supply the fluvial volume in times of drought. Thus, before the Danube carries its waters across the slightly-elevated threshold of the Iron Gate it fills the swamps of Lower Hungary to the left and the right; which waters it receives back through the Save and the Tisza. In the same manner the Mississippi changed, before it was dammed in laterally, the whole marshy region to the W. of New Madrid, the deltas of the White River, the St. Francis, and the Arkansas, and the low plains of the Yazoo, into an interior sea; yea, even now it inundates immense regions on both sides of its principal bed, though to a smaller extent. It is said that the liquid mass which the river carries diminishes steadily down-stream. Sometimes the Mississippi carries 3000 or 4000 cubic mètres more at Cairo than between the

levées of New Orleans. It is the same phenomenon, though on a smaller scale, as that of the regulation of a river by traversing a lake. Thus, at the point where the Rhone enters the Leman its discharge sometimes amounts to 1100 cubic mètres; and yet at its exit from the lake, under the bridges of Geneva, it carries only about 400 cubic mètres. On the other hand, while it sometimes is only a small rivulet at its entrance into the lake, at Geneva it always continues to be a noble river.

The intervention of man may aid in regulating the management of watercourses, but it may also contribute to spoil; and the latter has frequently been the case. The best means which can be employed to reduce the floods is that used by the agriculturists in the hot regions, where abundance of water is indispensable for the cultivation of plants. They divide the current into secondary canals, and these again into other threads, which finally branch off into innumerable trenches. The water, thus divided into a multitude of beds, each of which is regulated with embankments and locks, is retarded in its course, and the loss by evaporation is increased. The river does not gush forth afterward with that frightful suddenness which characterizes streams not yet brought under control. The agriculturist must also, in order to secure the necessary quantity of water to his fields at any season, establish reservoirs, which during the periods of flood receive the superabundant liquid mass. The utilization of streams for industrial purposes has the same consequences with respect to their management as the employment of their waters to irrigate fields. The lateral basins formed beside the works, the canals which pass through the establishment over wheels perpetually in motion, the dams which change the river into a series of terraces, and finally the discharge-channels which open at times of inundation, result, so to speak, in the domestication of the river, and man, if not able to regulate it according to his fancy, can at least control its course. Unless under very exceptional circumstances, it is rare that great inundations occur in basins in which agriculture and manufacturing industry have taken hold of the streams. The considerable changes which human labor accomplishes in these river-basins may be realized from the very aspect of the country. In many instances, the river, utilized to the last drop, ends by disappearing long before it reaches the term of its normal course; in others it arrives half exhausted at the sea. According to Antonio de la Mesa, the Ebro carried formerly 200 cubic mètres of water per second to the Mediterranean, while now, bled by irrigations, its discharge has decreased to about 100 cubic mètres. The Po furnishes about 1000 cubic mètres to the fertilization of Lombardy, which is one-third of its liquid mass.

Along the great rivers the principal occupation of man, while yet only half civilized, is not to utilize its waters, but to secure himself against its wrath. He then often happens to act with imprudence, and in many cases the very means of safety which he chooses become causes of disaster to him. It seems at first glance a very simple matter to heighten the river-banks by means of a levée in order thereby to protect the adjacent fields and restrain the waters to their bed; but in the construction of these artificial banks what obstacles are to be overcome, what constant care is to be taken, what foresight is to be exercised! They must be sufficiently large in order to resist the most violent pressure of the water, and sufficiently high in order to command the most exceptional level of the floods; at the most exposed points they must be strengthened by transverse supporters, which again lean against secondary dams; the maintenance of these levées must constantly be watched; their slopes must be consolidated; any subsidence of the ground must be repaired; all burrowing animals must be hunted out. If wars, lack of money, rivalry between states or proprietors, cause any neglect in the maintenance of the dams at any point of their immense length, one day, one hour, will suffice, and a disaster may occur: the fluvial current will make a breach, and carve for itself a new bed in the fields. The selfishness of the inhabitants of the river-banks is generally the first cause of the evil. "Your death is my life," says an old Italian proverb, which exhibits the battle for existence in all its ferocity. Padua and Venice were at war with each other for centuries; the former wished to throw the rivers of its territories into the neighboring lagunes; the latter wanted to maintain the depths of their marine waters even with a risk of inundating the firm land.

Avarice creates dangers of another kind by narrowing the river-bed for the profit of cultivation. Almost all the levéed rivers occupy a part only of their original bed of inundation, and consequently the flood must gain in height what it loses in width; it rises instead of spreading; reaches the level of the levées, overflows them if it has not broken them, and expands far away across cities and fields. The Loire, so very dangerous a river, has only a width of 400 mètres, or even of 300 mètres, at certain points of its course where it formerly had a width of 3 kilomètres, and it is of course at these points of compression that the river begins its ravages. The town of St. Cyprien, which was razed by the Garonne in 1875, while several hundreds of the inhabitants lost their lives, was built just opposite Toulouse, at a point where the quays and houses had encroached on the bed of the river from both sides; in order to gain more room, the inhabitants had even closed a canal which surrounded the town to the W., and was designed to carry away the surplus water.

In all the countries in which cultivation does not profit directly from the waters of the inundation, as is the case in the valley of the Nile, the system which ought to be followed is evidently that applied by the inhabitants along the Po. The original bed of inundation is here carefully maintained in its whole width, and the principal dam, the levée which is called insubmergible, is raised along this line. The space between this dam and the low-water marks of the current can be cultivated, but the levées which protect it should be two feet lower than the principal dam. They do not arrest the flood; the inundation spreads over this whole territory, depositing its fertilizing mud, but retarded by a thousand obstacles. With respect to towns and villages, it is safest to construct them on a large basis of embankments above the level of the floods, as the ancient Egyptians did, as has been done with the modern Sacramento, and as every prudent engineer will do when he has to build a railway-station or a factory in a place exposed to the erosion of floods. The art of preserving human constructions is sufficiently well known, and when it is not applied by the inhabitants along the rivers, the reason is either lack of foresight or avarice.

When the bars formed by the deposit of alluvion, in so many cases obstructing the entrance to river-mouths, have often proved incorrigible, as Vauban said of the Rhone, the reason is not any fault of science, but human carelessness and often the conflict between various influences. Two thousand years ago Alexander demonstrated that the deep waters which the isle of Pharos protects are the true port of the Nile; Claudius and Trajan turned the bar of the Tiber by constructing a lateral canal whose depth it was much more easy to regulate; finally, the Canal of St. Louis, from the Rhone to the Gulf of Fos, proves that it is possible to open an entrance for vessels into the interior of a river if the sea at any point in the neighborhood presents a deep gulf.

A river must be considered as an individual. Our ancestors looked at it as a god; we must at least look at it as a living organism, and treat its details with regard to the effect produced on the economy of the whole. In nature and in the controlling works made by human action this organism holds its parts closely connected. The rains which fall from the clouds in the river-basins, the trees which cover the slopes of the mountains, the swamps which border the river, and the reservoirs which accompany it along its course, the canals of irrigation distributing portions of the waters for agricultural purposes, the dams and levées which serve to shield the cities and fields, the piers, moles, and stockades of the outlet, all taken together constitute one whole, a living body whose organs react on each other and cannot be touched without affecting the whole body. And the prosperity of men, does it not partly depend on the work which nature accomplishes in the fluvial basins? Are they not all interested in the changes which may take place in the economy of the running waters? Let them, then, after learning to appreciate the improvements which science teaches, also learn to lay aside small private interests in order to occupy themselves with general interests, and associate in a spirit of honesty for the common work. Let them cease to be each other's enemies, and in the other strides of progress which they make let them learn how to defend their fields against the invasions of the rivers, how to make the running waters their most active helpers, and how to transform the streams into the chief ornaments of the earth they inhabit.

ELISÉE RECLUS.

Riv'ers (ANTHONY **Wydeville**, or **Woodville**), EARL OF, son of Sir Richard Wydeville by his wife, Princess Jacqueline of Luxemburg, widow of the duke of Bedford, b. in England about 1442; accompanied his father on an expedition against the earl of Warwick at Calais, and was there taken prisoner 1459; married the heiress of Lord Scales and assumed that title 1467; succeeded his father as Earl Rivers 1469; was made a knight of the Garter, chief butler, and captain-general by King Edward IV., who had married his sister Elizabeth; attended him to Holland 1470; became governor of Calais about 1471, governor of Prince Edward, the heir to the throne, 1482; possessed a good education, and was the principal patron

of Caxton in the introduction of printing into England; translated from the French *The Dictes and Sayinges of Philosophers*, printed in folio by Caxton at London in 3 eds., all bearing date 1477; *The Morale Proverbes of Crystyne of Pise* (1478), and *The Booke named Cordyale, or Memorare Novissima* (1480), and is said by Caxton to have "made divers balades agenst the seven dedely synnes." On the death of Edward IV., Lord Rivers assembled a body of troops for the purpose of proclaiming his nephew, but was seized by the duke of Gloucester (Richard III.) at Stony Stratford Apr. 30, 1483, confined in the castle of Pontefract, and there beheaded without trial about June 13, 1483.

Rivers (Richard H.), D. D., b. Sept., 1814, in Tennessee; graduated at La Grange College, Ala., under Pres. (now Bishop) Paine in 1835, and elected assistant professor of languages, and in 1836 professor of languages in that institution; was president of the conference school at Athens, Ala., in 1843; vice-president and professor of moral science in Centenary College, La., in 1848, and president in 1849; was called to the presidency of La Grange College in 1854, and remained in that position after the removal of the institution to Florence, Ala., and the change of the name to Wesleyan University, until it was broken up by the war; was subsequently president of Centenary Institute, Summerfield, Ala., Somerville Female College, Tenn., and Logan Female College, Ky.; then took charge of Broadway church, Louisville, Ky.; is now president of Martin Female College, Pulaski, Tenn., and a member of the Tennessee conference of the M. E. Church, South; has published a volume on mental science and another on moral science, and has written largely for periodicals. T. O. Summers.

Riv'ers, Hydrau'lics of. A large river illustrates upon a grand scale the modern theory of conservation of energy. The heat of the sun's rays, acting upon the surface of the ocean, induces evaporation, thus raising in endless succession ton after ton of water into the atmosphere. The normal currents of the latter, due also primarily to the sun's heat, sweep this vapor over the land, where, condensed by polar counter-currents, ranges of mountains, and other heat-absorbents, it assumes the form first of clouds, then of rain or snow, and ultimately is precipitated upon the surface of the earth. A certain portion of the original heat has thus been returned in kind to other colder bodies, but a part has been transformed into the potential energy represented by the height of the deposited water above the sea-level. This portion again changes into other forms of energy, as, overcoming friction, the water gathers into rivulets, unites in brooks, increases by aggregation into larger streams, and finally, bearing a rich burden of sedimentary matter for the making of alluvial lands, sweeps in the majestic curves of a great river back to the sea. In the lapse of centuries mountains are thus degraded and lowlands are built up by the energy contained in the sun's rays. Hydraulics of rivers explain how the potential energy represented by height above the ocean-level undergoes transformation in overcoming the resistances that impede the downward flow of the water. In other words, they treat of the physical laws which govern the phenomena presented in natural channels.

Historical Notes.—So long as the fundamental principles of the mechanics of solids were unknown, but little could be discovered respecting the more intricate theory of water in motion. Nevertheless, gigantic works of construction, like the Roman aqueducts, and hydraulic inventions of great value, like that of the canal-lock, were made by a system of tentative experiment. In the early part of the seventeenth century Castelli and Torricelli, pupils of Galileo, applied the principles of that master to hydraulics. The latter discovered the law governing the issue of fluid-veins from small orifices in the sides of a reservoir—viz. that, neglecting resistances, their velocities are in the subduplicate ratio of the pressures due to the head of water. He suggested this law as applicable to the flow of rivers. Near the close of the century Guglielmini elaborated this theory, which was generally adopted by the scientific world because no one attempted to verify its consequences by actual experiment. In 1732, Pitot, by observing sub-surface changes of velocity with the tube which bears his name, overturned this school of hydraulics. Attention being thus called to the importance of a practical treatment of the problem, experiment was multiplied; and finally, in 1786, Dubuat laid the foundation of the modern school by announcing his great principle that the flow is due to gravity acting through the slope of the surface, and that the true method of enunciating in mathematical language the law of motion is to equate expressions for the accelerating and retarding forces. During the present century many investigators have attacked the problem upon this general basis, but their observations have generally been made upon artificial troughs or small canals. Even when rivers have been subjected to measurement—as, for instance, those of Holland by Kräyenhoff, in 1813; the Neva by Rancourt, in 1824–26; the Rhine by Defontaine, in 1820–33; the Neva by Destrem, in 1835; the upper Rhine by Hennocque, in 1839; the Garonne by Baumgarten, in 1837–46; the Mississippi by Marr, in 1849–51—either the observations were so restricted in number and scope, or attention was so exclusively directed to the construction and effect of practical works of improvement, that no sufficient data for a scientific discussion of general river-hydraulics were secured prior to the observations conducted upon the Mississippi between the years 1850–60 by Capt. A. A. Humphreys (now brigadier-general and chief of engineers of the U. S. army). These investigations will soon receive further notice. Since their date a few observations have been made by Mr. Révy upon the La Plata and its chief branches; the rivers draining the great American lakes have been subjected to measurement by the U. S. Lake Survey parties; the Connecticut River has been gauged by Gen. Ellis, assistant to Gen. Warren, U. S. engineers; the flow of the Irrawaddi has been elaborately investigated by Mr. Gordon; and the upper Mississippi has been gauged by Col. Farquhar of the U. S. engineers. The two last-named surveys are as yet unpublished; the others in a theoretical point of view have tended to confirm the results announced in the *Physics and Hydraulics of the Mississippi*, by Humphreys and Abbot.

Two advantages may be expected to attend the selection of a very large river for hydraulic investigations. The energy represented by a great volume of water in motion reduces to insignificance the minor and exceptional disturbances which may mask the laws of flow in a small stream; while the magnitude of the pecuniary interests involved will provide the funds requisite for extended and thorough measurement. The following is a brief resumé of the system of river-hydraulics which resulted from the investigations conducted for ten years upon the Mississippi:

Distribution of Velocity.—These measurements established experimentally the law under which the effect of resistances applied to the exterior layer is transmitted through the fluid mass—in other words, the law by which cohesion regulates motion among the fluid particles. This law was shown both in horizontal and vertical planes to be parabolic, the abscissæ representing velocities, and the ordinates distances from the exterior layers. The axis of the curve is parallel to the direction of the motion, and marks the place where the retarding effects of the exterior resistances transmitted inward become equal. As the mean velocity changes, the parameter of this parabola varies inversely with its square root. In horizontal planes this law is usually masked by variations in depth and in the direction of the motion of the mass of water; but at one station, Columbus, Ky., the entire curve from bank to bank constituted a single well-marked parabola at all stages of the river, the parameter varying as stated above. In vertical planes the parabolic law appears to be universal, but it is often masked by a rapid oscillation of the axis, occasioned by variations in surface-resistance. The cause of this latter resistance in calm weather is obscure. It is clearly proved not to be wholly or chiefly due to friction against the air, but probably is largely a secondary effect transmitted from the bottom through the agency of upward currents. Upon the Mississippi in calm weather the mean depression is about three-tenths of the depth; upon the Connecticut it is about one-tenth; probably it is largely influenced by the rugosity of the bed. An up-stream wind depresses and a down-stream wind raises the axis, the amount of the change being directly proportional to the force of the wind; indeed, in a natural channel the axis seems rarely to be at rest. The parameter of these vertical parabolas varies with the square root of the mean velocity and with a small function of the depth. The absolute variation of velocity in a vertical plane is small, usually but little exceeding 10 per cent. of the maximum. The ratio between the mid depth and mean velocity is sensibly constant, being about 0.96, and it is independent of wind effect. The great value of this last discovery in reducing the labor of gauging streams is apparent.

In algebraic language, the most important of these laws for sub-surface velocity are expressed as follows: D, $d_{,}$, and d denoting, respectively, the total depth, the depth of the axis, and the depth of any particular point; and v, V, V_o, $V_{d_{,}}$, V_m denoting, respectively, the mean velocity of the river, the velocity at any depth d, the surface velocity, the maximum velocity, and the mean of the whole vertical curve:

$$(1) \qquad b = \frac{1.69}{\sqrt{D + 1.5}}.$$

(2) $$V = V_{d_1} - \sqrt{bv}\left(\frac{d - d_1}{D}\right)^2.$$

(3) $$V_m = \tfrac{2}{3} V_{d_1} + \tfrac{1}{3} V_D + \frac{d_1}{D}\left(\tfrac{1}{3} V_0 - \tfrac{1}{3} V_D\right).$$

(4) $$V_{\frac{1}{2}D} = V_m + \tfrac{1}{12}\sqrt{bv}.$$

Mean Velocity of Rivers.—The general principles which govern a constant flow of water through the channel of a river are next to be considered. The motion is opposed by three distinct resistances: first, that due to the adhesion of the fluid to the materials forming its bed, and to the cohesion of the different particles to each other; second, that due to inequalities of cross-section, which occasion eddies, whirls, and in general loss of *vis viva;* third, that due to bends, which like dams directly oppose the flow, and check it until a certain head is acquired sufficient to restore the lost motion. The potential energy transformed during the flow from one station to another—measured by the product of the weight of the water into the difference of level of its surface at the two stations—may therefore be considered as divided into three parts; and if it were possible to frame three practically useful formulæ based on the corresponding resistances, the whole circumstances of the flow might be algebraically expressed. Unfortunately, the second expression would be excessively complex, and would require a knowledge of the conformation of the bed more precise than could usually be obtained at any reasonable cost. Accordingly, Humphreys and Abbot framed only two formulæ—one to represent the flow in straight portions of the river, and the other to determine the portion of the head expanded in overcoming the resistance of the bends between the terminal stations. The second class of resistances necessarily affected the constants deduced for both of these formulæ; and for this reason the authors insist that their first formula must never be applied to smooth artificial channels; nor, on the other hand, to rivers which include bends between the terminal stations, without first subtracting from the observed fall in water-surface the amount indicated by the bend formula. Indeed, this treatment of the problem assumes a normal inequality of bed in rivers; and if the formulæ be applied to channels smoother or rougher than those from which the constants were derived, the computed discharge must be respectively too small or too great. This difficulty is unavoidable in all river formulæ; but by correcting for bend resistance, Humphreys and Abbot have narrowed the usual limits of the error. The following are their formulæ, expressed in English feet: v denotes the mean velocity per second; a, the area of cross-section; p, the wetted perimeter; W, the width; b, the value given in Eq. (1); s, the sine of the slope corrected for bends—its numerical value is the quotient of the total fall in water-surface between the terminal stations, less the value of h in the bend formula, by the total distance between them measured on the middle line of the channel; N represents the number of angular changes each 30° of the latter line. The value of v in the bend formula is found by successive approximations. The quantity z is equal to $0.93\,v + 0.167\sqrt{bv}$; and when p is not known by measurement, it may be assumed at 1.015 W.

(5) $$v = \left(\sqrt{0.0081b + \left(\frac{225\,a\sqrt{s}}{p + W}\right)^{\frac{1}{2}}} - 0.09\sqrt{b}\right)^2.$$

(6) $$h = \frac{v^2\,N \sin^2 30^\circ}{134} \quad \text{(bend formula).}$$

(7) $$s = \left(\frac{(p + W)z^2}{195a}\right)^2.$$

(8) $$a = \frac{(p + W)z^2}{195\sqrt{s}}.$$

(9) $$p + W = \frac{195a\sqrt{s}}{z^2}.$$

These formulæ were restricted by Humphreys and Abbot to natural channels having an area exceeding 100 square feet and a slope less than 0.0008. From additional data, chiefly derived from an important report by MM. Darcy and Bazin, published after the *Physics and Hydraulics of the Mississippi*, the slope-limit was shown to admit of considerable extension, and the following approximate term was added to the mean-velocity formula for the case of natural channels less than 100 square feet in cross-section: v', denoting the value of v as first deduced:

$$-\frac{2.4\sqrt{v'}}{1 + p}.$$

The following are other mean-velocity formulæ recently proposed for rivers by hydraulic engineers:

Darcy and Bazin: $$v = \frac{a}{p}\sqrt{\frac{1000\,s}{0.08534\dfrac{a}{p} + 0.35}}.$$

Hagen: $$v = 4.39\sqrt{\frac{a}{p}}\,\sqrt[6]{s}.$$

Ganguillet & Kutter: $$v = \frac{\left(23 + \dfrac{0.00155}{s} + \dfrac{1}{n}\right)\sqrt{\dfrac{as}{p}}}{0.5521 + \left(23 + \dfrac{0.00155}{s}\right)\dfrac{n}{\sqrt{\dfrac{a}{p}}}}.$$

In the latter n is a coefficient depending on the rugosity of the bed. Its value for earthen beds is 0.025, and for mountain-torrents sweeping over boulders, 0.030.

Measurements upon Natural Channels.

Number.	Stream.	Original. Number.	Original. Series.	Cross-section. Area.	Cross-section. Width.	Cross-section. Wetted perimeter.	Cross-section. Mean radius.	Slope.	Observed mean velocity per second.
				sq. ft.	ft.	ft.	ft.		ft.
1	Feeder Chazilly..	1	37	9.5	....	9.9	0.96	0.000,792	1.234
2	....	2	..	14.9	....	12.3	1.21	0.000,808	1.667
3	....	3	..	19.4	....	13.8	1.41	0.000,858	1.815
4	....	4	..	22.9	....	14.7	1.56	0.000,842	1.998
5	....	1	38	9.3	....	9.7	0.96	0.000,957	1.244
6	....	2	..	14.1	....	11.9	1.18	0.000,929	1.703
7	....	3	..	18.8	....	13.3	1.41	0.000,993	1.798
8	....	4	..	22.2	....	14.4	1.54	0.000,986	1.959
9	....	1	41	11.3	....	10.8	1.04	0.000,445	0.962
10	....	2	..	18.1	....	13.1	1.38	[illegible]	1.296
11	....	3	..	22.9	....	14.6	1.57	0.000,455	1.401
12	....	4	..	27.2	....	15.9	1.71	0.000,441	1.510
13	Feeder Grosbois..	1	47	11.8	....	10.8	1.09	0.000,464	0.820
14	....	2	..	17.2	....	12.5	1.38	0.000,450	1.326
15	....	3	..	23.0	....	14.1	1.63	0.000,479	1.434
16	....	4	..	26.8	....	15.7	1.71	0.000,493	1.683
17	....	1	48	10.1	....	10.2	0.98	0.000,555	0.984
18	....	2	..	15.4	....	11.8	1.30	0.000,555	1.480
19	....	3	..	20.9	....	13.4	1.56	0.000,525	1.575
20	....	4	..	25.9	...	14.1	1.71	0.000,515	1.746
21	....	1	49	10.9	....	11.4	0.96	0.000,250	0.886
22	....	2	..	17.1	....	12.9	1.32	0.000,275	1.336
23	....	3	..	24.2	....	15.5	1.57	0.000,246	1.362
24	....	4	..	30.8	....	17.3	1.78	0.000,275	1.467
25	....	1	50	11.8	....	11.3	1.05	0.000,310	0.817
26	....	2	..	18.0	....	12.7	1.42	0.000,290	1.260
27	....	3	..	25.4	....	15.4	1.69	0.000,330	1.296
28	....	4	..	32.0	....	17.3	1.85	0.000,330	1.411
29	Canal Marseille..	7	1	66	....	23	2.9	0.000,430	2.536
30	Seine at Paris....	1	..	1,978	....	349	5.7	0.000,127	2.094
31	....	2	..	2,570	....	363	7.1	0.000,133	2.264
32	....	3	..	3,176	....	377	8.4	0.000,135	2.418
33	....	4	..	3,692	....	390	9.5	0.000,140	3.370
34	....	5	..	4,421	....	405	10.9	0.000,140	3.741
35	....	6	..	5,108	....	419	12.2	0.000,140	3.816
36	....	7	..	6,372	....	439	14.5	0.000,140	4.232
37	....	8	..	6,929	....	461	15.0	0.000,140	4.512
38	....	9	..	8,034	....	504	15.9	0.000,172	4.682
39	....	10	..	8,668	....	516	16.8	0.000,131	4.800
40	....	11	..	9,522	....	518	18.4	0.000,103	4.689
41	Seine (Meulan)....	1	..	5,982	....	842	7.1	0.000,090	2.310
42	....	2	..	6,488	....	845	7.7	0.000,087	2.313
43	Seine (Triel).....	3	..	5,640	....	502	11.2	0.000,057	2.363
44	....	4	..	6,375	...	513	12.4	0.000,060	2.359
45	Seine (Poissy)....	5	..	7,475	....	551	13.6	0.000,050	2.372
46	....	6	..	7,952	....	560	14.2	0.000,054	2.595
47	....	7	..	8,996	....	567	15.9	0.000,062	2.911
48	....	8	..	9,733	....	578	16.8	0.000,067	3.101
49	....	9	..	10,400	....	582	17.8	0.000,075	3.330
50	Mississippi River.	1	..	193,968	2653	2693	72.0	0.000,020,5	5.929
51	....	2	..	195,349	2656	2696	72.4	0.000,017,1	5.887
52	....	3	..	180,968	2421	2461	73.6	0.000,003,4	4.034
53	....	4	..	183,663	2429	2469	74.4	0.000,003,8	3.977
54	....	5	..	148,042	2214	2247	65.9	0.000,068,0	6.957
55	....	6	..	178,137	2729	2779	64.1	0.000,063,8	6.949
56	....	7	..	179,502	2732	2782	64.5	0.000,043,6	6.825
57	....	8	..	78,828	2507	2530	31.2	0.000,022,3	3.523
58	....	9	..	134,942	2556	2589	52.1	0.000,030,3	5.558
59	....	10	..	150,354	2580	2621	57.4	0.000,018,1	6.319
60	B. Plaquemine....	11	..	5,560	292	303	18.3	0.000,206,4	5.198
61	....	12	..	4,259	268	278	15.3	0.000,143,7	3.959
62	B. La Fourche....	13	..	3,738	223	238	15.7	0.000,044,7	[illegible]
63	....	14	..	3,025	223	232	13.0	0.000,037,3	[illegible]
64	....	15	..	2,957	223	231	12.8	0.000,036,6	2.807
65	....	16	..	2,868	223	230	15.7	0.000,043,8	[illegible]
66	C. and O. C. feeder	17	..	121	23	32.7	3.7	[illegible]	[illegible]
67	....	18	..	119	23	32.5	3.7	[illegible]	2.723
68	Ohio River........	19	..	7,218	1073	1074	6.7	0.000,093,3	2.515
69	River Haine.......	20	..	248.5	48	50.5	4.9	[illegible]	2.495
70	....	21	..	306.4	50.5	53.4	5.7	0.000,155,9	[illegible]
71	Canal.............	22	..	50	18	20.6	2.4	0.000,063,1	1.134
72	River Rhine.......	23	..	19,135	1155	1163	16.5	0.000,097,7	3.575
73	....	24	..	6,304	557	563	11.2	0.000,099,9	3.277
74	River Waal........	25	..	14,782	1328	1334	11.1	0.000,104,4	3.165
75	Rhine.............	26	..	5,341	700	704	7.6	0.000,117,4	2.917
76	Yssel.............	27	..	1,930	321	324	5.9	0.000,116,6	2.773
77	Tiber.............	28	..	2,355	243	249	9.4	0.000,130,6	3.413
78	Neva..............	29	..	43,461	1218	1227	35.4	0.000,013,9	3.230
79	Great Nevka.......	30	..	15,554	881	893	17.4	0.000,014,9	2.049
80	River Schwarza..	1	..	46.7	56.6	58.3	0.80	0.009,000	2.528
81	....	2	..	52.3	50.8	52.9	0.99	0.005,200	2.544
82	Hockenbach, I.-II	..	..	10.5	11.1	12.0	0.87	0.000,778,3	1.440
83	" II.-III.	..	..	10.3	11.0	11.8	0.88	0.000,796,6	1.463
84	Speyerbach	..	..	30.2	16.1	19.7	1.54	0.000,466,6	1.814
85	Hubengraben......	..	..	3.8	4.8	6.4	0.59	0.001,300,0	1.424
86	Salzach...........	1	..	4,005.6	375.9	377.8	7.00	0.000,360,0	4.118
87	Saalach...........	2	..	86.9	60.4	61.2	1.38	0.001,035,7	2.155
88	"	3	..	96.7	71.3	71.8	1.34	0.001,136,4	1.970
89	Isar..............	5	..	300.1	153.7	161.6	1.85	0.002,500,0	[illegible]
90	"	6	..	1,063.4	172.2	176.0	6.04	0.002,500,0	7.212
91	Rhine.............	1	..	4,650.1	590.5	606.3	7.67	0.001,250,0	4.921
92	"	2	..	13,725.5	590.5	633.8	21.65	0.001,000,0	[illegible]
93	"	3	..	14,149.8	1440.0	1458.3	9.72	0.000,112,0	2.910
94	Lauter Canal......	4	..	56.4	29.6	31.0	1.82	0.000,664,0	2.106
95	Upper Mississippi	..	..	5,010.1	462.0	467.0	10.85	[illegible]	1.509
96	" "	..	..	3,441.0	773.0	778.0	4.42	0.000,222,7	2.611
97	" "	..	..	15,911	1607	1612	9.87	[illegible]	2.941
98	" "	..	..	51,610	3160	3172	16.27	[illegible]	[illegible]
	Sum	..	..	......	....	....	....	....	282.183

As the ultimate test of formulæ of this character rests upon their accordance with standard observations, the preceding carefully-prepared list is given to serve as a criterion for these and others which may appear hereafter. The data include nearly all published observations of value upon rivers, being compiled from good modern authorities to represent a great variety of natural channels. The first forty-nine were published by Darcy and Bazin; the next thirty by Humphreys and Abbot; the next fifteen by Grebenau; the remaining four by Warren.

Mr. Robert Gordon, who has recently conducted a very extensive, but as yet unpublished, series of experiments upon the Irrawaddi, has proposed, in a paper published at Milan in 1873, to reject the general theorem of Dubuat, and to revert to the Guglielmini basis in a modified form. As the constants of his formula are not as yet definitely announced, it is not given here.

Tested by these standard observations, the Humphreys-Abbot formula gives a mean discrepancy of 8.2 per cent.; the Darcy-Bazin formula, 16.3 per cent.; and the Hagen formula, 13.5 per cent. Two-thirds of these data were not available in framing the first-named formula. The investigations of Francis have shown that the most careful measurements are liable to an error of from 1 to 5 per cent.

Gauging of Rivers.—For practically gauging the discharge of a large river the following plan is recommended: Select a locality in a straight portion where the current is regular. Lay out a base-line 200 feet long parallel to the direction of the flow, and determine accurately the cross-section in front. Establish two theodolites, and, for numerous floats well distributed between the banks, note the angular distance from, and the time of transit past, each end of the base. These floats should be made double, the surface float being a tin ellipsoid or other light body bearing a little flag. The lower float may be a large open keg, ballasted with lead so as to hang vertically. The connecting cord should be as small as practicable. The rate of movement of the whole will thus be essentially that of the lower keg. The centre of this keg should be placed at the mid-depth of the stream in each vertical plane of transit, because the wind will there have no influence upon the rate of movement. With a regular cross-section the average mid-depth may be adopted for all floats without sensible error. The exact level of the water upon a gauge-rod should be noted when the observations begin and end. The following is the method of reducing the observations: Upon a sheet of section-paper the base-line and two perpendiculars to mark the lines across which the times of transit were noted are laid down. From the recorded angles and a table of natural tangents the paths of each float are plotted, and upon each is written the seconds of its transit past the base. The total width of the river is next divided into as many equal "divisions" as show sensibly unvarying velocity. The mean of all the seconds of transit in each division is then reduced to feet per second, and adopted as the true mid-depth velocity in that division. A mean of all these mid-depth velocities, interpolations being made if any are missing, closely approximates to the true velocity of the river. Two errors which nearly balance each other are involved in this method—viz. the inequality of the areas of the divisions, and the difference between the mid-depth and mean velocity in any vertical plane. The correction ratios for these errors are, respectively, about 0.93 and 0.98 for large rivers, giving a mean resulting velocity $\frac{0.93}{0.98} = 0.95$ of its true value. If a very exact computation is required, the "divisions" are laid down on the plot of the cross-section of the river, and the area of each is computed for the stand on which the gauging was made. The different division mid-depth velocities—including interpolations if any are wanting—are those substituted for $V_{\frac{1}{2}D}$ in the expression

$$V_{\frac{1}{2}D} - \tfrac{1}{12}\sqrt{bv}.$$

Each result is multiplied by the corresponding area of cross-section; and, finally, the sum of these products is equated with va. The lesser root of this equation is the true mean velocity. A value for v less exact than the last, but involving only a small error, may be found with little labor by the following computation: Substitute for $U_{\frac{1}{2}r}$ in the following equation the grand mean of the different "division" mean velocities, including interpolations if any be missing. The value of b is that given in Eq. (1), with $\frac{a}{p}$ substituted for D:

$$(10) \qquad v = \left(\sqrt{1.08U_{\frac{1}{2}r} + 0.002b} - 0.045\sqrt{b}\right)^2.$$

The theory of these different computations is explained in the *Physics and Hydraulics of the Mississippi.*

In gauging small streams various forms of meters are often employed for observing the velocity. They consist essentially of a submerged wheel, with apparatus designed to record the number of its revolutions; and the accuracy of the result, of course, depends entirely upon the precision with which these revolutions can be translated into feet per second. Quite recently electricity has been skilfully applied by Mr. Henry, Gen. Ellis, and others to record the number of revolutions of the wheel.

Oscillations of Rivers.—As the volume of water in the channel increases, the surface-level of the river rises. The amount of this rise varies greatly in different parts of the course, especially when the stream discharges into the sea or a large lake. In such cases the oscillation is insignificant near the mouth, and the range between high and low water regularly increases for a certain distance until the influence of the sensibly unchanging level of the recipient of its waters disappears. Above this point the range becomes more uniform for the main river, but ultimately diminishes as the sources are approached. The mathematical laws governing this oscillation were first experimentally studied upon the Mississippi, and with the following results: (1) The local slope at any station is far from constant, since the measured discharge exhibits extraordinary but normal changes at different epochs for any given reading of the gauge, when the other conditions upon which the flow depends must be identical. Near the mouth of the Ohio these variations at high stages exceed 30 per cent., the discharge being much larger with a rising than with a falling river. (2) This variation is not the same in all rises, the difference being greater in high than in low stages, and larger in the upper river than near its mouth. (3) The local slope in any particular rise increases regularly as the river rises, and more rapidly in large than in small oscillations; it attains its maximum value when the surface still lacks a few inches of extreme height. In falling, the slope is always much less than at corresponding levels in rising. (4) During any given oscillation the rate of the increase of local slope in rising is usually the same as that of the loss in falling.

The following theory explains these observed facts: When a tributary discharges a sudden flood into the main river, causing a rise, the water moves downward in the form of an immense wave, of which the convexity depends upon the volume added and upon the stage of the river above and below the point of influx. The local slope at any place is governed by this convexity. Hence, as the front of the wave moves past, the slope and discharge are great; when the crest arrives they both diminish; as the rear of the wave is passing they fall below their values at corresponding levels during the rise. Finally, since the general form of the wave is regular, the rate of change in local slope during the rise and fall is normal and similar. This experimental theory suggested the basis of a mathematical analysis of the problem, which, applied to the Mississippi, resulted as follows: If in any locality an equation showing the increase of slope between the foot and the top of a rise can be framed, it may be applied to any part of that rise (except near the top and near the bottom, where inflections occur), since the rising and falling branches are sensibly parallel. If, then, a general equation can be framed showing the increase of slope between the foot and top of rises at all stages of the river at any locality, the problem is solved for that locality. Such an equation was deduced for one gauging-station on the Mississippi, and was ultimately proved to be general for the whole river. It is the following, in which $s_{,}$ denotes the primitive, and $s_{,,}$ the new slope; e the elevation in feet above extreme low-water mark of the primitive surface of the river; P, a constant for each locality; and x, the rise or fall of the water-surface in feet:

$$(11) \qquad s_{,,} = s_{,} + \frac{1}{2P}(e + x)^2 x.$$

The value of P at any locality can readily be found from this equation when the numerical values of the other variables are known, the slopes being computed by equation (7) from known cross-sections and discharges when the river is rising or falling uniformly. To apply this method to the computation of the change of level in water-surface which will be caused by a given variation in discharge at a locality where P is known, compute the primitive slope by Eq. (7). Assume a value of x, and find $s_{,,}$ from equation (11); and next the first member of the following equation, in which letters marked ($_{,}$) denote values already defined corresponding to the primitive stage, and those marked ($_{,,}$) those for the new stage:

$$(12) \qquad \frac{a_{,,}}{p_{,,} + W_{,,}} = \frac{a_{,} + W_{,}x}{p_{,} + W_{,} + 2x}.$$

With these values compute $v_{,,}$ from the following equation, which is a simplified form of Eq. (5):

$$(13)\quad v_{,,} = \left(\left[225 \sqrt{s_{,,}} \frac{a_{,,}}{p_{,,} + W_{,,}} \right]^{\frac{1}{4}} - 0.0388 \right)^2.$$

With this value of $v_{,,}$ find the value of x in the following equation, in which $\phi_{,,}$ denotes the new discharge:

$$(14)\qquad x = \frac{\phi_{,,} - a_{,} r_{,,}}{W_{,} r_{,,}}.$$

If this value be identical with that assumed, it is the true value sought; if not, repeat the computation until such accordance is obtained; which by a few approximations is readily accomplished. This method, applied to twenty-four measured oscillations upon the Mississippi varying from 2 to 25 feet, gave results showing a mean error of only about 5 per cent.

Mechanical Work of Rivers.—The boulders, large and small, which in general form the beds of mountain-torrents resist any but secular changes, but their smooth and rounded forms and abraded surfaces sufficiently mark the effects of the continued flow of water. As the stream increases in size, bars of coarse gravel begin to appear, forming a succession of pools and rapids, which regulate the velocity of the current by dams constructed through its own agency. The gravel becomes sand, and the sand, mudbanks and other fine alluvial deposits as the stream gradually assumes the characteristics of a great river. While thus pushing along the bottom the materials too heavy for more rapid transportation, the water, at first clear, gradually becomes turbid from earthy matter held in suspension. In fine, a great river is constantly performing an immense amount of mechanical work in pulverizing and moving forward solid material. Its capacity for this work is proportional to the *vis viva* of its waters, but the amount actually performed depends in great measure upon the nature of its bed and upon the geological formations through which it flows. The Mississippi annually transports in suspension to the sea a mass of alluvion 1 square mile in area and 241 feet in height, weighing over 400,000,000 tons, while at the same time it is pushing over the bars at its mouth an additional amount equal to one-tenth of this enormous quantity.

The fact that, in general, under the moving waters lies a moving bed, presents in a forcible light the difficulties encountered by the hydraulic engineer in attempting to permanently improve the navigable channel of a great river. The experience of ages has shown that a bar removed at one point often reappears, perhaps in an aggravated form, below. The river is always at work, and to oppose it or modify its action usually exacts continuous labor. On many rivers the banks, especially in the bends, are abraded by the current; and this action, occurring in the sinuous course which is characteristic of large volumes of water in motion, often results in cutting off a bend, thus violently changing the regimen of the stream for long distances, and entailing difficulties not easily foreseen or prevented. The general effect of such "cut-offs" is the following: Immediately above the site the water-surface is lowered by the full amount of the bend resistance (Eq. 6) and by one-half of the fall of the river in a straight portion of its course equal in length to the shortening effected by the cut-off. Immediately below the site the water-surface is raised by the latter quantity. In receding from the site, both above and below, these effects become less, and ultimately disappear. Where the banks are liable to erosion by the river a cut-off is always a misfortune. Any immediate benefit above is compensated by injury below, and the ultimate effects upon the channel are liable to be disastrous to both sections.

When a sediment-bearing river flows through a district below the level of its floods other peculiar phenomena are presented. The water escaping over the natural banks loses its velocity and deposits the matter held in suspension. The heavier particles drop first, and the result is to gradually raise the level of the banks near the river, and thus cause it apparently to traverse a low ridge sloping in both directions from the main channel. If the banks are sufficiently tenacious to resist erosion, this action, continued for a long period, may result in confining the stream between natural embankments. Such cases, however, are rare, but artificial works are often employed to assist nature when the fertility of the region to be thus reclaimed offers sufficient pecuniary inducements. Many of the chief rivers of Europe, and some of those of America, Asia, and Africa, are thus more or less perfectly confined to their channels throughout their alluvial regions. The Po is a well-known example of this kind, and is often cited as proving that the ultimate effect of levees is to raise the bed of the main river by preventing the escape of the sediment brought down by the floods. This is an error of fact, as has been fully demonstrated by Lombardini, the most eminent hydraulic engineer of Italy now living. Indeed, no effect of this kind has ever been established as occurring upon any river. In this country the Mississippi is the most conspicuous example of the application of levees to the prevention of inundations. A gigantic system has been inaugurated, extending from the mouth of the Ohio to the Gulf, and, although imperfect in its details and execution, it has added immensely to the wealth of the region. Similar artificial embankments upon a grand scale are now in progress of construction upon the Irrawaddi in British Burmah. Upon the Nile a different plan has been in operation for centuries. The surplus flood-water is drawn from the river by artificial canals, and employed for irrigating a narrow strip of country thus reclaimed from the surrounding deserts; but even here the river is never permitted to cause a general inundation of the country, as has often been erroneously asserted.

Bars at the Mouths of Rivers.—Experience has shown that whenever a river discharges into a body of still water large enough to be acted upon by winds and waves, and having a shore and bottom of movable materials, a bar invariably is formed at the mouth. Such bars owe their origin to one or more of three primary causes, which usually act in combination. In the case of a sediment-bearing stream, if the recipient be fresh, its inertia will oppose the river-current, and the inflowing water will be checked in velocity and spread out over a wider channel. The result will be a partial dropping of the matter held in suspension, which at first will simply increase the amount pushed along the bottom. As the velocity continues to diminish, a point will be reached at which it is no longer sufficient to keep this matter in motion, and a bar will begin to form. As more matter reaches this point, it will accumulate; the incipient bar will give an upward motion to the water, and thus the obstruction will retrograde until the reduced cross-section of discharge so increases the velocity as to enable the current to roll up and distribute in layers the new material brought down by the river. Ultimately, a bar of sensibly equal depth will thus form around the point of efflux. As the channel becomes contracted by lateral deposits the current over the middle of the bar will increase, and will there cause a gradual erosion and advance. Beyond the bar the remainder of the matter held in suspension will be gradually dropped as the moving water loses its inertia and comes to rest. The permanency of the form and position of the bar will depend upon the constancy of flow of the river, and upon the exterior influences due to winds, waves, and foreign material moved thereby in the recipient.

When the river discharges into the ocean, the conditions of the problem are complicated by the introduction of a new force, the lifting power of the salt water due to its greater specific gravity, and the bar-formation will be modified accordingly. When the fresh water encounters the salt it will rise and spread out over it, thus leaving the matter rolled along the bottom sooner than in the case already considered. The angle of rise will be a function of the reciprocal of the velocity and of the difference in specific gravity; hence, at different stages of the river the point of deposit and the inner slope of the bar will vary, the low-water contribution being the innermost. Subsequent floods will erode the latter and (as the banks extend) the whole bar, thus pushing the matter forward and giving rise to an annual advance which will be governed by the amount of the material brought down by the river, and by the distributing effects of storms and littoral currents. Ultimately, an equilibrium between the erosive force and depositing action will be established, and the bar will assume a sensibly constant form, depth, and annual rate of advance.

The mouths even of clear-water rivers are often obstructed by bars occasioned by an entirely different cause from the foregoing. Where the sea breaks upon a low sandy shore the oscillation of the waves becomes transformed into a motion of translation, which rolls up the sand into a long *cordon littoral*, thus partially closing the entrances of bays, harbors, and rivers. The currents of the latter and of tidal basins tend to break through and erode these deposits, thus opening certain channels to navigation. The Southern Atlantic coast of the U. S. offers many examples of this class of bars. HENRY L. ABBOT.

Rivers, Regulation of. See RIVERS and RIVERS, HYDRAULICS OF.

Riv'erside, p.-v. and tp., Burt co., Neb., on Missouri River. P. 139.

Rivers, Rights on. See RIPARIAN RIGHTS.

Riv'ersville, v., Marion co., Va. P. 63.

Riv'erton, p.-v., Litchfield co., Conn.

Riverton, tp., Floyd co., Ia. P. 953.

Riverton, p.-v. and tp., Mason co., Mich. P. 438.

Rives, tp., Montgomery co., Ala. P. 1800.

Rives, tp., Jackson co., Mich. (Rives Junction P. O.), at junction of Jackson Lansing and Saginaw with Grand River Valley division of Michigan Central R. R. P. 1345.

Rives, p.-v. and tp., Prince George co., Va. P. 1723.

Rives (John C.), b. in Kentucky about 1796; educated himself; became cashier of a bank at Edwardsville, Ill.; removed in 1824 to Washington, D. C., where he was clerk in the office of the third auditor, and was connected with Francis P. Blair in founding the *Congressional Globe*, of which he ultimately became sole proprietor. He exercised great influence during the Jackson administration; was highly esteemed for impartiality, for benevolence and patriotism, having given large sums during the civil war for the equipment of regiments and the support of the wives of soldiers. D. near Georgetown, D. C., Apr. 10, 1864.

Rives (William Cabell), b. in Nelson co., Va., May 4, 1793; educated at Hampden-Sidney and William and Mary colleges; studied law under Jefferson; served as a volunteer in the war with England 1812–15; became prominent in Virginia politics; was a member of Congress 1823–27; minister to France 1829–32, and again 1849–53; U. S. Senator from 1832 to 1845, with a brief interruption; a member of the peace conference of 1861, and of the Confederate congress at Montgomery. D. near Charlottesville, Va., Apr. 26, 1868. Author of *The Life and Times of James Madison* (Boston, 3 vols., 1859–69) and other works.

Rive's Ring. See Polarity.

Rivière' du Loup (en Bas), p.-v. (called also Fraserville), Temiscouata co., Quebec, Canada, on the S. E. shore of the river St. Lawrence, 125 miles below Quebec, and on Grand Trunk Railway, at the mouth of the picturesque stream of the same name. It is the seat of Fraserville Institute, a convent, and an academy, and has a good trade. It is a place of summer resort. P. 1541.

Rivière du Loup (en Haut), p.-v., cap. of Maskinongé co., Quebec, Canada, on the N. shore of Lake St. Peter, 66 miles below Montreal. It has a good trade and manufactures of leather. P. about 1500.

Riv'ington (James), b. in London, England, about 1724; became a bookseller in London; acquired and lost a fortune; settled at Philadelphia 1760 and in New York 1761; established the New York *Gazetteer* Apr. 22, 1773, which became so obnoxious to the patriots that Capt. Isaac Sears with 75 horsemen from Connecticut destroyed the press and melted the types into bullets Nov. 23, 1775. Rivington, who had been confined by order of Congress May, 1775, went to England at the close of that year; was appointed king's printer for New York; brought over a new press, and commenced Oct., 1777, the publication of *Rivington's New York Loyal Gazette*, a title which he exchanged Dec. 13 for that of *Royal Gazette*. In 1781 he began to act as a spy for the patriots, furnishing Washington with important information on the British movements; remained in New York after the evacuation 1783, changing the title of his paper to *Rivington's New York Gazette and Commercial Advertiser*, but soon suspended its publication, and his remaining years were passed in obscurity and comparative poverty. D. at New York in July, 1802. He was well-informed, witty, and of elegant manners.

Ri'voli, town of Italy, province of Turin, on a hillside about 7½ miles W. of the city of Turin. On the top of the hill stand two castles—one ancient, the other modern—the former being very ruinous, though even now containing fine frescoes; the latter, begun in 1633, is still more rich in pictures, statuary, etc. The old collegiate church (founded 1304) and the present collegiate church, still older (1287), have been almost entirely rebuilt, and are remarkable for rich marbles, wood-carvings, and *intarsiatura*. The mediæval history of Rivoli was very stormy—a succession of civil broils and foreign sieges and sackages, followed by famine and pestilence. It is now a favorite country retreat for the Turinese aristocracy, and their beautiful villas are everywhere conspicuous in its picturesque vicinity. P. 6000.

Rivoli, tp., Mercer co., Ill., on Chicago Burlington and Quincy R. R. P. 1298.

Rix-Dol'lar [Sw. *riksdaler;* Da. *rigsdaler;* Ger. *Reichsthaler*], a silver coin formerly used in the Scandinavian countries, and formerly in Germany. Its name signifies a dollar of the realm, and its value varied in the different countries from a little less than 40 cents to a little more than one dollar.

Riyad. See Riad.

Ri'zah, a small town, capital of a fertile district of the same name in Asiatic Turkey, on the Black Sea, 35 miles E. of Trebizond. Flax is extensively cultivated in this district, and the linen manufactured in Rizah obtained the first prize at the exhibition in Paris in 1855. The district contains 27,891 male inhabitants, most of whom are Mohammedans.

Riz'zio, or **Riccio** (David), b. at Turin, Italy, in 1540, his father being a dancing-master; was brought up in France; became an accomplished musician, excelling especially on the lute; obtained favor at the court of Savoy, where he was selected on account of his skill in languages to accompany an embassy sent to Scotland about 1563. Having attracted the attention of Mary, queen of Scots, by his musical talent, she appointed him one of the pages of her chamber, and soon afterward (Dec., 1564) made him her secretary for foreign languages. He acquired great influence over her, and was accordingly hated by less fortunate courtiers; was an advocate of the marriage to Darnley, after which he was appointed keeper of the privy purse to the king and queen; was bitterly denounced by Knox and the Reformers on account of his Roman Catholicism; has even been regarded by some writers as a secret papal legate, and was regarded by many as the Queen's paramour and father of Prince James, the future founder of the Stuart dynasty of English monarchs. Several of the most powerful nobles, especially Morton, Ruthven, Lindsay, and Maitland, formed a conspiracy to assassinate him, and obtained the written concurrence of the weak Darnley by working upon his jealousy and by promising him the title of king. Introduced by Darnley into the queen's chamber, Ruthven and George Douglass struck down Rizzio in her presence, dragged him into the adjoining room, and despatched him with 56 wounds, Mar. 9, 1566. It has been charged that Knox and other Reformers were privy to this murder. This is improbable, but Knox wrote of it in his *History of Scotland* as "a just act, and most worthy of all praise." The hatred of Darnley which Mary then conceived led to the tragedy of Kirk o' Field (see Darnley) in the following year, and indirectly to the long series of crimes which stained the annals of Scotland for the remainder of the century.

Roach [Ang.-Sax. *hreoce*], a species of fish (*Leuciscus rutilus*) of the family Cyprinidæ, and the type of the genus *Leuciscus*. It is placed with its associates in a group distinguished by the pharyngeal teeth being in single series of five or six each, with crenate ridges and slightly hooked tips, the presence of twelve to fourteen anal rays, and the position of the dorsal fin opposite to the ventrals; the body is silvery, and the lower fins tinged with red, at least in the adult; the mouth is terminal. The species generally attains a length of about seven to nine inches, and sometimes reaches as much as ten or twelve. It is distributed throughout Europe N. of the Alps, and, although insignificant as a game-fish, it is generally included in European works on angling. In America the same name is applied to several species belonging to the same or related genera, and even, in some places, to the sun-fish (*Pomotis aureus*). Theodore Gill.

Roach'ester, v., Salem tp., Warren co., O., on Little Miami River. P. 155.

Road [Ang.-Sax. *râd*], **Law of the,** *including Rules to avoid Collisions at Sea.* In England the law of the road consists of three well-settled rules—namely, (1) when two vehicles meet, each must bear to the left; (2) when one vehicle overtakes another, the foremost gives way to the left, and the other passes by on the off side; (3) a vehicle crossing the direction of another keeps to the left and crosses in its rear. In the U. S. two vehicles meeting turn to the right instead of to the left, but with this modification the law of the road is the same as in England. It has been decided in several States that the foregoing rules do not apply to pedestrians nor to equestrians, nor are they so peremptory in their nature that they must always be observed by drivers of wagons and carriages. The true doctrine is that all persons traversing a highway, whether walking, riding, or driving, must use reasonable care and diligence to avoid collision, even though it should be necessary, in order to effect that object, to turn in exactly the opposite direction from that prescribed by the customary law of the road; and what is such reasonable care must depend, in great measure, upon the circumstances of each particular case. The method of avoiding collisions at sea is now a matter of international concern. Different rules have hitherto been prescribed by different states, but at the present day the tendency is toward the adoption of a single system by all maritime countries. To this end the U. S. Congress and the British Parliament have enacted the same code of regulations for the government of all steam or sailing vessels at sea, of which the following is an abstract:

I. *Steering and Sailing Rules.*—It should be observed that the position of the two vessels contemplated in all these rules must be such that a risk of collision arises.

(1) When two sailing or steam vessels are meeting end on, or nearly so, both helms must be put to port, so that each may pass on the port side of the other. (2) When two sailing-vessels are crossing, and have the wind on different sides, the one with the wind on the port side shall keep out of the way, except that when the one with the wind on the port side is close-hauled and the other is free, the latter must keep out of the way: if both have the wind on the same side, or one has it aft, the windward vessel shall keep out of the way of the leeward one. (3) When two steam-vessels are crossing, the one which has the other on her own starboard side shall keep out of the way. (4) When a steam-vessel and a sailing-vessel are proceeding in such a direction as involves the risk of collision, the steam-vessel shall keep out of the way. (5) Every steam-vessel when approaching another vessel shall slacken speed, and if necessary stop and reverse, and in a fog shall go at a moderate speed. (6) Every vessel overhauling another shall keep out of the way of the latter. (7) Whenever by any of the foregoing rules one of two vessels is to keep out of the way, the other shall keep on her course, subject to the general limitation contained in the next rule. (8) In construing and obeying these rules due regard must be had to all dangers of navigation, and to any special circumstances which may exist in any particular case rendering a departure from them necessary in order to avoid immediate danger.

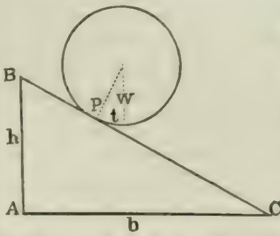
II. *Rules in regard to Lights.*—The following-described lights are required to be carried by sea-going vessels between sunset and sunrise, and by means thereof, and of their relative position as seen from two approaching vessels, the course upon which each of such ships is proceeding can be easily determined. In all the following cases except that mentioned in Rule 4 the vessels are to be under way: (1) Steamers must carry at the foremast head a bright white light, on the starboard side a green light, on the port side a red one; and these two side lights must be so arranged with inboard screens that they cannot be seen across the vessel's bow. (2) Steamers towing other vessels must carry two white masthead lights vertically, instead of one. (3) Sailing-vessels shall carry the two side-lights as above described, but none at the masthead. (4) All vessels, whether steam or sailing, when at anchor in roadsteads or fairways, shall show, not more than 20 feet above the hull, a white light in a globular lantern 8 inches in diameter. In addition to the foregoing regulations for vessels at sea, the U. S. statutes prescribe the following for coasting and inland steamers: Those plying upon the rivers flowing into the Gulf of Mexico and their tributaries shall carry a red light on the outboard side of the port smoke-pipe, and a green one on the outboard side of the starboard smoke-pipe; while coasting steamers, and those navigating the bays, lakes, and other rivers of the U. S. (except ferryboats), shall carry the red and green lights prescribed for sea-going vessels, and also a central range of two white lights, the after one of which is to be at least 15 feet higher than the one at the bow. Special rules are also provided for pilot-boats, ferryboats, and other small craft.

III. *Fog-Signals.*—In fogs, either by day or by night, steamers under way shall sound a steam-whistle at intervals of not more than one minute; sailing vessels under way shall sound a fog-horn at least every five minutes; and both steamers and sailing-vessels at anchor shall ring a bell at intervals of not more than five minutes. (For the foregoing code in detail see *Rev. Stat. of U. S.*, tit. "Commerce and Navigation," ch. v., and 25 & 26 Vict. ch. 63 (1862), schedule C.) JOHN NORTON POMEROY.

Roads and Pavements. A road [Ang.-Sax. *rad*, *rade*, "a ride," "a passing on horseback"] is an open way or public passage appropriated for travel, and generically includes highway, street, and lane. A pavement (Lat. *pavimentum*) is a covering of stone, bricks, or other hard and solid material laid firmly on a road or street in order to give a smooth and convenient surface for travel and traffic. The limit assigned to this article will not admit of any discussion of the considerations governing the location of country roads, or of the details of their construction with respect to excavations, embankments, side-ditches, cross-drains, culverts, the protection of earthen slopes, and the building of bridges, etc. Our remarks will be restricted to a description of the methods of treating the surfaces of roads and streets in order to adapt them to the requirements of traffic, assuming that in other particulars they have been properly constructed.

The *grade* of a road or street is the angle which the axis makes with a horizontal line. It should never, except for very short distances, be steeper than the angle of repose, or that angle upon which a loaded wheeled vehicle of the kind in common use would not be set in motion by its own weight, but would slowly descend if a slight motion be imparted to it. The *tractive force* is the power required to move a vehicle and load on a horizontal road. At the angle of repose the force acting parallel to the grade to sustain the vehicle in its position on the incline is equal to the tractive force. Assume, for simplicity, that the load W rests on one wheel, that $p =$ the pressure in pounds normal to the road, $t =$ the tractive force in pounds, that $h =$ the perpendicular, and $b =$ the base of a right-angled triangle of which the hypothenuse B C (Fig. 1) represents the slope of the angle of repose. In the smaller similar triangle the tractive force t is the perpendicular, the normal pressure p the base, and the load W the hypothenuse.

FIG. 1.



$$t : p :: h : b,$$

and by substitution $$\frac{t}{\sqrt{W^2 - t^2}} = \frac{h}{b}$$

But t is so small in proportion to W that it may be omitted in practice, and we have

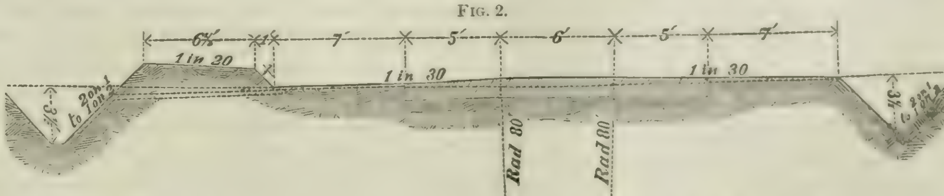
$$\frac{t}{W} = \frac{h}{b}.$$

But $\frac{h}{b}$, or the perpendicular divided by the base, represents the angle at the base or the slope of the angle of repose—that is, the steepest admissible grade. Hence, the proper grade in any case is found by dividing the tractive force by the weight of vehicle and load. A suitable grade for a good gravel or broken-stone road is $\frac{1}{34}$, or at greatest $\frac{1}{30}$. For short stretches $\frac{1}{25}$ will answer, and if very short, $\frac{1}{20}$.

The width of roads will depend largely on local circumstances. A width of 27 to 30 feet prepared for vehicles will amply suffice for the principal route between cities, which must be increased within or near the suburbs to 40 or 50 feet, or more. For branch roads, or roads connecting small towns, the width may be much less, the metalled portion not exceeding 16½ to 17 feet, while the wings may be left as earth-roads. In order to carry off the rainfall the surface slopes from the centre toward the side-ditches or gutters. This inclination may be 1 in 20 for rough roads, 1 in 30 for good broken-stone or gravel roads, 1 in 40 to 50 for streets paved with blocks, and 1 in 50 to 60 if covered with asphalt.

The best transverse form is secured by two planes sloping gently toward the side-gutters, and connected in the middle of the roadway by a short convex surface, as shown

FIG. 2.



in Fig. 2, where the road is shown 30 feet wide, metalled in the middle for a width of 16 feet, with a footpath on one side, and side-ditches.

Road-coverings have for their object the reduction of the tractive force to the lowest possible limit at the least cost for construction, maintenance, and repairs, and they should be composed of tough and durable materials, such as the basaltic, the doloritic, and other trap-rocks, the sienitic granites, and some of the limestones, laid upon a firm bed suitably drained. For country roads the material is generally used in the form of coarse gravel, or broken stone of all sizes up to pieces of 2½ inches in longest di-

mensions, applied in successive layers, each of 3 to 4 inches in thickness, well compacted by ramming, rolling, or traffic. During the consolidation of the top-layer the material must be kept moist, and men with rakes should be in constant attendance to fill in ruts and depressions, so as to give the finished surface the required form and secure uniform density in the covering. The aggregate thickness of the covering need not exceed 10 to 12 inches. When composed of broken stone only, it is sometimes called a Macadam road. A Telford road (Fig. 3) is made with layers of broken stone, aggregating 6 to 7 inches in thickness, resting on a sub-pavement of stone blocks, from 6 to 7 inches in depth and 4 to 5 inches in thickness, set on their broadest edges in contact in courses across the roadway. All the irregularities in the upper surface of the sub-pavement are broken off, and the joints are filled by wedging in small pieces of stone with a hammer. When finished, its top is parallel to the required road-surface, and the layer of broken stone which surmounts it should therefore be of uniform thickness. It is consolidated in the same manner as for a road of all broken stone. In soft soils a layer of rubble-stones is sometimes first laid as a foundation for the Telford sub-pavement, or the latter may be omitted entirely and rubble-stones, varying in thickness from $3\frac{1}{2}$ to 5 inches and in width and length from 8 to 18 inches, substituted therefor. Such a foundation should be constructed with great care, the larger stones being laid down first, side by side, upon the road-bed, and firmly set to their places by rammers. The interstices are then levelled up with smaller stones, and the superstructure, whether of gravel or broken stone, placed thereon. The first layer, of broken stone, should not exceed 2 inches in thickness, and it should be thoroughly compacted by ramming or rolling, in order that it may penetrate and thoroughly unite with the foundation, so as to prevent subsequent movement among the parts. When the soil is quite soft, it is well to set the rubble-stones in contact on their edges in lines across the road, although they may vary greatly in shapes and sizes, as shown in plan in Fig. 5, and in vertical section across the road in Fig. 4. In very soft clayey soils, especially where constantly saturated with water, cases have occurred where it was necessary to resort to a concrete foundation about 6 inches thick to prevent the road-material from sinking into and mixing with the clay. Rubble-stones on edge, but not in contact, with the interstices filled in with concrete, as shown in Fig. 6, would be equally good.

Fig. 3.

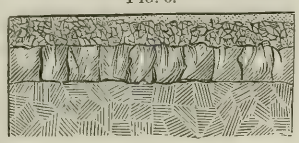


Fig. 4.

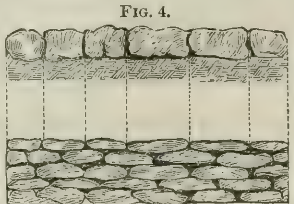
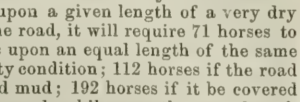


Fig. 5.

Fig. 6.



The value of a good road, and the importance of keeping it in good condition in districts where the road-traffic is large, cannot well be overstated. It may be remarked, by way of comparison, that if 50 horses are just sufficient to conduct a given traffic upon a given length of a very dry and smooth broken-stone road, it will require 71 horses to conduct the same traffic upon an equal length of the same road in a moist and dusty condition; 112 horses if the road be covered with ruts and mud; 192 horses if it be covered with deep ruts and thick mud; while upon the same length of solid earthen causeway covered with gravel $1\frac{1}{2}$ inches thick 240 horses would be necessary to accomplish the same work. In France two methods of maintaining broken-stone roads are practised. The first method is one of minute daily repairs, by which the road-covering is preserved at a constant thickness by filling in the ruts and depressions as fast as they begin to appear, and thus systematically restoring fresh material in the place of that removed as dust or mud by sweeping and scraping. This method is applicable to roads upon which the average daily traffic does not exceed 600 tons upon a road-covering 18 to 20 feet wide. The other method is one of partial repairs, accompanied by periodical additions of fresh material, by which the diminished thickness of the covering is restored at stated intervals, applicable to roads upon which the daily traffic exceeds 600 tons on a road 18 to 20 feet wide. In practice, this method consists in allowing the broken stone to wear down gradually and evenly, limiting the repairs to a preservation of the unity of surface by filling in holes and ruts until the depth of the road-metal is reduced to 4 or 5 inches, when a thorough repair is made to the extent of restoring the original thickness, by layers of new material suitably compacted by rolling and by traffic. The wear of road-material is not in direct ratio to the tonnage passing over it, but, other conditions remaining the same, it augments more rapidly than the tonnage.

A street-pavement ought to be smooth and hard in order to give a secure foothold for animals; not become slippery from use; be as noiseless and as free from dust and mud as possible; be easily and cheaply cleansed; and be of such material and construction that it can be readily taken up and relaid in places at all seasons of the year. Economy of maintenance also requires that the material at the surface shall be durable. A good foundation is as necessary for the stability of a pavement as for that of any other structure, and a street-surface which satisfies all the foregoing conditions will inevitably fail as a pavement if it rests upon a yielding foundation. The following are among suitable foundations—viz. (1) hydraulic concrete 6 to 8 inches thick; rubble-stones set on edge, but not in contact, with the voids filled in with concrete, as shown in Fig. 6; (2) rubble-stones set in contact on edge, as in Figs. 4 and 5; cobble-stones firmly set in a form of sand or gravel, as for a cobble-stone pavement; small rubble-stones of random sizes in a well-compacted bed 7 to 8 inches thick; or a layer of broken stone of about the same thickness laid as for a broken-stone road. A form of compacted sand or gravel is the foundation in most common use for all pavements except those of asphalt applied in a continuous sheet, and it answers tolerably well when it is not over 5 or 6 inches deep, is underlaid by firm soil, and cannot escape laterally. Road-surfaces of broken stone or gravel, although they give a secure foothold for animals, are comparatively noiseless, and are well adapted to park-drives and suburban streets, require such constant supervision to arrest the formation of ruts, and are so infested with either dust or mud, as to render them entirely unsuitable for thickly-settled districts in cities or large towns.

The best stone pavement is one of rectangular blocks set in contact on their longest edges, in lines across the street, and resting on a foundation of concrete, or rubble-stone filled in with concrete. The blocks should be $3\frac{1}{2}$ to $4\frac{1}{2}$ inches broad, measured along the street; 9 to 12 or even 15 inches long, measured across the street; and 8 to 10 inches in vertical depth. The Belgian pavement, of which the form of the blocks more nearly resembles a cube varying from 5 to 7 inches on each side, is but little inferior to the one last named if the foundation be equally good. When the blocks, whether rectangular or cubical, rest on a sand foundation, they should all be equal in bed-area, to prevent as far as possible unequal settlement from the blows of passing vehicles. The layer of cobble-stones in common use for street-coverings scarcely deserves the name of pavement. It is noisy, rough, difficult to clean, severe upon animals and vehicles, and unpleasant to travel over, while an animal cannot draw upon it when in its best condition more than one-third his ordinary load upon a good surface of stone blocks.

The most valuable wooden pavement is composed of rectangular blocks set on their longest edges close together in courses across the street, with an open joint about $\frac{3}{4}$ inch wide between the courses. The blocks are 3 to 4 inches wide, 8 to 14 inches long, and 6 to 8 inches deep, and they should rest on a well-compacted bed of sand or a layer of boards. Wood-blocks would soon be destroyed by crushing if set upon a rigid, inelastic foundation. The wood should be creosoted to prevent early decay. The open joints are filled with a mixture of prepared coal-tar and gravel. Many of the details of construction are covered by patents, but a combination of the best features of them all will not produce a durable pavement.

A good asphalt pavement requires a solid foundation, preferably either the first or second of those mentioned above. The asphalt covering may be the natural asphalt rock derived from the Jurassic region on the confines of Switzerland, or it may be composed of asphaltic cement suitably prepared by refining natural bitumen, to which is added a calcareous powder to take the place of the amorphous carbonate of lime contained in the natural asphalt rock. It is usually applied upon the foundation in a continuous sheet 2 to 3 inches thick, although it may be used in the form of a rectangular block prepared under heavy pressure. Its application in this form is of quite recent date, and its value not yet well established. No description of the process of laying these pavements can be given here, but it should be mentioned that a capital distinction must be made between pavements of genuine asphalt, properly prepared, and all those patented imitations of or substitutes for it composed of wood-tar, coal-tar, pitch,

resin, etc., mixed with either sand, gravel, ashes, scoriæ, sulphur, lime, etc., or with two or more or all of them. They are unfit for carriage-way pavements.

The advantages of a good monolithic asphalt pavement are—(1) that it produces no dust, and therefore no mud; (2) it is comparatively noiseless; (3) it does not absorb and retain noxious liquids; (4) it is impermeable to moisture, and neither emits nor allows the emission from the subsoil of unwholesome and poisonous vapors; (5) it reduces the force of traction, and consequently the wear and tear upon animals and vehicles, to a minimum; and (6), although furnishing a somewhat less secure foothold for animals than blocks of stone or wood, it does not become polished and slippery from continued wear. It is adapted to all streets not steeper than 1 in 48 or 50, except perhaps those that are thickly crowded with heavy loads and are kept constantly wet from urine, and where the vehicles are subjected to the inconvenience of frequent and sudden halts, starts, and sharp turns. In other localities, where there is more room or the traffic is lighter, or where a large portion of it is pleasure-driving, and especially where the streets are lined with residences on either side, the many advantages of a good asphalt pavement, its cleanliness, its noiselessness, and its imperviousness to noxious fluids—important features in which it stands unrivalled—should not be lost sight of.

The comparative merits of wood, stone, and monolithic asphalt pavements may be briefly stated as follows:

1. *Durability.*—Stone possesses the longest life, and wood very much the shortest, while asphalt lies between the two, and very near to the stone. Unless the stone be of excellent quality for paving purposes, it takes the second place, and asphalt the first.

2. *First Cost.*—At present prices a good asphalt pavement on a concrete foundation can be laid for $3.50 per square yard, with 30 per cent. profit to contractor. This somewhat exceeds the first cost of a wooden pavement, but is less by at least $1 per square yard than one of stone set on a concrete foundation. In economy of first cost wood, therefore, stands first, asphalt second, and stone third.

3. *Cost of Maintenance and Repair.*—Under this head the life or endurance of the pavement must be considered, and the total expense must cover a period representing that endurance, and leave the pavement as good as new at the end of that time. The order of merit will be—first stone, second asphalt, and third wood, and the stone must be both hard and tough in order to maintain the first place.

4. *Facility of Cleansing.*—Mud and dust adhere more tenaciously to wood than to stone, especially after the fibres of the former begin to crush and abrade. They are also more easily removed, by either sweeping or washing, from a continuous surface than from one traversed by numerous joints. The order of merit under this head will therefore be asphalt first, stone second, and wood third.

5. *Convenience.*—The asphalt pavement is the most pleasing to the eye, and is the smoothest and cleanest of the three. Stone is the most noisy of all pavements. The noise produced by wood is a constant rumble—that by asphalt an incessant clicking of the horses' feet, with very little noise from the carriage-wheels; while stone gives out a deafening din from feet and vehicle combined. If the surface be clean, the difference in slipperiness between wood, stone that does not polish, and asphalt is not great, although enough to place asphalt last, while a horse falls more frequently and recovers himself less often and less easily upon it than upon the others. Mud will render either of the pavements slippery, but asphalt the most so, although it is not slippery when dry or if free from mud when wet. As usually kept up, a slight rain adds to the slipperiness of each, with this difference, that upon asphalt and stone this state begins with the rain, while the worst condition of the wood ensues later and lasts longer. With regard, therefore, to the safety of the animals and the convenience and comfort of those using the street, as well as those living upon it, the weight of opinion places asphalt first, wood second, and stone third for all except very crowded business-streets, in which case stone rises to the first place and asphalt sinks to the third.

6. *Hygienic Considerations.*—Among the hygienic objections to stone are its constant noise and din and its open joints, which collect and retain the surface-liquids and throw off noxious vapors and filthy dust. In populous towns there is scarcely a moment of silence, night or day. The writings of eminent medical practitioners are full of testimony to the pernicious influence of street noise upon the health of the population, particularly upon invalids and persons with sensitive nerves. The noisome and noxious exhalations emanating from fæcal and other putrescent matter collected and held in the joints of block pavements, whether of wood or stone, constitute another sanitary objection to their use in populous towns. The joints comprise, after enlargement by wear, fully one-third the entire area of the carriage-way, and under the average care the surface of filth exposed to evaporation covers three-fourths of the entire street. This foul organic matter, composed largely of urine and the excrement of different animals, is held in the joints, ruts, and gutters, where it undergoes putrefactive fermentation in warm, damp weather, and becomes the fruitful source of noxious effluvium, or it floats in the atmosphere and penetrates the dwellings in the form of unwholesome dust, irritating to the eyes and poisonous to the organs of respiration. These objections apply in common to wood and stone. There are others peculiar to wood alone arising from its rapid decay, its porosity, and the spongy and absorbent character conferred upon it by crushing and wear. M. Fonssagrives, the eminent professor of hygiene at Montpellier, France, says: "The hygienist cannot look favorably upon a street-covering consisting of a porous substance capable of absorbing organic matter, and by its own decomposition giving rise to noxious miasma, which, proceeding from so large a surface, cannot be regarded as insignificant. I am convinced that a city with a damp climate paved entirely with wood would become a city of marsh-fevers. . . . The absence of dust, the abatement of noise, the omission of joints—permitting a complete impermeability, and thus preventing the putrid infection of the subsoil—are among the precious benefits realized by asphalt streets." Upon hygienic grounds, therefore, asphalt conspicuously stands first, stone second, and wood third in order of merit.

It will be inferred from the foregoing that in order to obtain the best pavement for any given locality a judicious balancing of characteristic merits is generally necessary. The most suitable pavement for the busiest streets of a city, where the traffic is dense, heavy, and crowded, is one of rectangular stone blocks set on a concrete foundation, while for streets of ample width, or those largely devoted to light traffic or pleasure-driving, or lined on either side with residences, asphalt is the best for all grades not steeper than 1 in 48 or 50.

Objection is sometimes made to the concrete foundation that it is difficult to take up in order to reach the gas and water pipes. This is true only in the sense that good work is not easily taken to pieces. The fact is, that such a foundation affords a thorough protection to the pipes against frost, and were it otherwise they should, of course, be laid deeper. A concrete foundation when torn up or deranged from any cause can readily be restored to its former condition, and the surface-covering relaid upon it with all its original smoothness, firmness, and stability—conditions which do not obtain with any kind of pavement laid upon a form of sand or gravel. (See Prof. Gillispie on *Roads and Railroads;* Gen. Gillmore on *Roads, Streets, and Pavements;* Prof. Mahan, *Civil Engineering* and *Constructing and Repairing Common Roads*, in Weale's series.)

Q. A. GILLMORE.

Roane, county of E. Tennessee, intersected by Holston and Clinch rivers, which here unite to form the Tennessee, bounded W. by a spur of the Cumberland Mountains and traversed by East Tennessee Virginia and Georgia R. R., is largely devoted to stock-raising, produces Indian corn, sorghum-molasses, wool, and butter, and has several tanneries and wool-carding establishments. Cap. Kingston. Area, about 600 sq. m. P. 15,622.

Roane, county of the western part of West Virginia, on Pocotaligo River, is mountainous and abounds in iron and coal. Chief staples, Indian corn, hay, flax, tobacco, sorghum-molasses, wool, and butter, and raises considerable numbers of sheep and swine. Cap. Spencer. Area, 450 sq. m. P. 7232.

Roane, tp., Lafayette co., Ark. P. 1150.

Roanne′, town of France, department of Loire, on the Loire, which here becomes navigable and is crossed by an elegant bridge. It is a handsome town, with large manufactures of cotton, muslins, jewelry, and paper, and considerable importance as an intermediate station of the traffic between Southern and Northern France. P. 20,037.

Roanoke′, a river formed by the union of the Dan and Staunton rivers at Clarkesville, Va. It flows 250 miles in an E. S. E. course, and finally flows into Albemarle Sound near Plymouth, N. C. It is a tidal stream to Halifax Falls, N. C., 75 miles from its mouth, is navigable 75 miles farther to Weldon by steamboats, and throughout its course by bateaux. Its valley is picturesque and fertile.

Roanoke, county of S. W. Virginia, intersected by Staunton River, and lying across the "Valley of Virginia" from the Alleghany Mountains to the Blue Ridge, has an extremely fertile soil, and is crossed by the Virginia and Tennessee division of Atlantic Mississippi and Ohio R. R. Chief staples, wheat, tobacco, and butter. Cap. Salem. Area, 200 sq. m. P. 9350.

Roanoke, p.-v. and tp., Randolph co., Ala. P. 1750.

Roanoke, tp., Randolph co., Ark. P. 1614.

Roanoke, p.-v. and tp., Woodford co., Ill., on Chicago Pekin and South-western R. R. P. 998.

Roanoke, p.-v., Jackson tp., Huntington co., Ind., on Wabash River, Wabash and Erie Canal, and Toledo Wabash and Western R. R. P. 627.

Roanoke, p.-v., Howard co., Mo. P. 220.

Roanoke, tp., Northampton co., N. C. P. 1778.

Roanoke, tp., Charlotte co., Va. P. 4830.

Roanoke, tp., Halifax co., Va. P. 6182.

Roanoke College, a Lutheran educational institution located at Salem, Roanoke co., Va., chartered as a college by the legislature of Virginia in 1853, and was the only one within the bounds of the Southern Confederacy that kept up its regular sessions during the civil war. Up to 1868 its graduates were few in number, but have increased to 133 in 1875, in which year there were 167 students and 9 instructors. More than half its graduates have entered the Christian ministry. The curriculum of studies is extensive and peculiar. It is peculiar (1st) in the embodiment of Christianity in the course, the connection of religion and the sciences in the departments of ethnology, geology, natural theology, and the evidences of Christianity; (2d) it is peculiar in the extension of the department of metaphysics: Haven's *Mental Philosophy*, Hickok's *Psychology*, and Morell's *History of Philosophy*, together with Mahan's *Logic*, are thoroughly studied as textbooks, and written examinations conducted upon them. A normal department has lately been introduced in connection with the college, in which scientific lectures are delivered upon the art of teaching. The college library has 9000 vols., many costly and scarce books, and has a cabinet of 11,000 specimens of minerals, with apparatus and facilities for the study of the natural sciences. The location of the institution is upon the line of the Atlantic Mississippi and Ohio R. R., in a most picturesque and fertile valley of Upper Roanoke River. The climate of the locality is remarkable for mildness and salubrity. From the productiveness of the Roanoke Valley, *cheapness* is a prominent feature of the college. D. F. BITTLE.

Roar'ing [Ang.-Sax. *rärian*], in the horse, is the noise made by some horses while drawing in the breath, especially while travelling fast. It is a sign of unsoundness. It depends upon a kind of wasting disease of the muscles of the larynx, and is incurable. Nevertheless, some of the best of horses, like the great Eclipse, have been confirmed roarers. In England tracheotomy and the continued use of the tracheotomy-tube have been successfully employed for its relief.

Roaring Creek, p.-v. and tp., Columbia co., Pa. P. 486.

Roaring River, p.-v. and tp., Barry co., Mo. P. 667.

Roaring Spring, p.-v., Trigg co., Ky. P. 120.

Roark', tp., Gasconade co., Mo. P. 3033.

Roasting. See METALLURGY, by PROF. J. A. CHURCH, E. M.

Roast'ing [D. *roosten*] of meats should be at first rapid, so as to seal up the albuminous juices in a rather strong crust; and the dredging on of flour is useful as entirely completing this crust. After this is formed the cooking process should be more slow. Baking is a more economical form of roasting, but there is a decided impairment of the flavor.

Robb, tp., Posey co., Ind. P. 1781.

Robbery [O. Fr. *roberie*]. At the common law *robbery* is the felonious taking of money or goods from the person of another, or in his presence and against his will, by violence or by putting him in fear. It is distinguished from mere larceny from the person by the indispensable ingredients of either violence used against the person robbed, or such threats, gestures, or other accompanying acts and circumstances as will naturally put a reasonable man in fear of his life, or of bodily injury, or of loss or destruction of his property; and this violence or intimidation must precede or be simultaneous with the act of taking. It is not necessary that the money or goods should be actually taken by the robber; if, under the influence of the fear produced by his threats or by a sufficient show of force, the person surrenders up the property to the one thus unlawfully demanding it, the offence is committed. In the U. S. the several States have generally legislated in respect of this and other crimes, and have defined it in precise statutory terms, sometimes separating it into degrees, but they have all preserved the essential elements of a taking from the person or in his presence, with violence or by means of fear aroused in his mind through threats or other species of intimidation. The following instances are given as illustrations of this legislation. In New York and some other States it is enacted that the felonious taking the personal property of another from his person or in his presence and against his will, by violence to his person or by putting such person in fear of some immediate injury to his person, shall constitute robbery in the first degree; while the felonious taking the personal property of another in his presence or from his person, which shall have been delivered or suffered to be taken through fear of some injury to his person or property, or to the person of any relative or member of his family, threatened to be inflicted at some different time—which fear shall have been produced by the threats of the person so receiving or taking such property—shall constitute robbery in the second degree. The punishment imposed for the first degree as thus described is imprisonment in the State prison for a term not less than ten years, and for the second degree a like imprisonment for not more than ten years. The statutes of Massachusetts, Maine, Michigan, Wisconsin, Vermont, and Iowa also make a distinction unknown to the common law with two grades of the crime, and provide (1) that if any person shall assault another, and shall feloniously rob, steal, and take from his person any money or other property, such robber being armed with a dangerous weapon, with intent if resisted to kill or maim the person robbed, or if being so armed he shall wound or strike the person robbed, he shall be punished, in Massachusetts and in Maine, by imprisonment for life, in Michigan for life or any number of years, in Wisconsin for not more than ten nor less than three years, in Vermont for not more than twenty years, and in Iowa for not more than twenty nor less than ten years; and (2) if any person shall by force and violence, or by assault or putting in fear, feloniously rob, steal, and take from the person of another any money or other property, such robber not being armed with a dangerous weapon, his punishment shall be, in Massachusetts and in Maine, imprisonment for life or for any term of years, in Michigan for not more than fifteen years, in Wisconsin for not more than three years nor less than one year, in Vermont for not more than ten years, in Iowa for not more than ten nor less than two years. In several other States a statutory distinction is also made, and two grades of the offence are created, depending upon the use of actual force and violence by the robber, or the use of mere threats and intimidation without violence, the punishment being apportioned to the degrees, and always consisting of imprisonment in the State prison or penitentiary, although the period of such confinement varies in different States from that for life down through the decreasing terms of twenty, fifteen, ten, seven, five, four, three, and two years, and in a few instances even one year. In all these statutes, even when degrees are established, the essential elements which entered into the notion of the crime at the common law, as described above, are plainly preserved. Property must be taken of some value, which might be the subject of larceny. The taking must be from the peaceable possession of the individual robbed, but if the goods are taken from his immediate presence and under his eye they are regarded as abstracted from his person. The taking, however, may be constructive, for if the one robbed is induced to surrender his property by his own manual act through fear, the law declares this a taking. There must also be actual violence, or a reasonable putting in fear before or at the time of the taking. In respect of what shall constitute a sufficient violence, the courts have refined and drawn very nice distinctions between acts which are robbery and those which only amount to larceny from the person. Finally, the fear, which is the alternative of violence, may be either of injury to the owner's own person or to the person of his wife or child, or of injury to his property; and a few special cases have held that a fear of injury to his character is sufficient when a prosecution for some peculiarly heinous or abominable crime was threatened by the robber.

JOHN NORTON POMEROY.

Rob'bins (ASHUR), LL.D., b. at Wethersfield, Conn., in 1757; graduated at Yale College 1782; was tutor in Rhode Island College (now Brown University) 1783–90; became a lawyer at Newport, where he attained high professional distinction; served in the State legislature 1818–25; was U. S. district attorney 1812, and U. S. Senator 1825–39. D. at Newport Feb. 25, 1845.

Robbins (CHANDLER), D. D., b. at Lynn, Mass., Feb. 14, 1810; graduated at Harvard 1829, and became pastor of the Second church (Unitarian) at Boston 1833, which position he has since retained. Author of many addresses, sermons, and occasional publications, of a *History of the Second Church* (1852), of memoirs of Maria E. Clapp (1858) and William Appleton (1863), and one of the editors of the *Proceedings* of the Massachusetts Historical Society, of which he is an active member.

Robbins (Royal), D. D., b. at Wethersfield, Conn., Oct. 21, 1788; graduated at Yale College 1806; was ordained (June 26, 1812) pastor of the Congregational church at Kensington parish, Berlin, Conn., and filled that post until June 26, 1859. D. at Berlin Mar. 26, 1861. Author of *The World Displayed,* of a popular manual for schools entitled *Outlines of Ancient and Modern History* (1839), of a *History of American Literature* (1837), intended as a supplement to the work of Chambers on English literature, of brief biographies of the poets Percival and Brainerd prefixed to editions of their writings, of many published sermons and contributions to the theological reviews.

Robbins (Thomas), D. D., b. at Norfolk, Conn., Aug. 11, 1777; graduated at Yale College 1796; was pastor of a Congregational church at East Windsor 1809–27, at Stratford 1830–31, and at Rochester, Mass., 1832–42; afterward resided at Hartford, Conn.; was one of the founders of the Connecticut Historical Society, and its secretary and librarian from 1844, and bequeathed to it his valuable library. D. at Colebrook, Conn., Sept. 13, 1856. Author of a *Century Sermon* preached at Danbury, Conn., Jan. 1, 1801, and other published sermons, of *An Historical View of the First Planters of New England* (Hartford, 1815), and of a *View of all Religions* (1824), and editor of Tytler's *Elements of General History,* revised and continued to 1815 (1820).

Rob′bins Plantation, tp., Washington co., Me. P. 4.

Rob′binston, p.-v. and tp., Washington co., Me., on St. Croix River. P. 926.

Rob′binsville, p.-v. and cap., Graham co., N. C.

Rob′ert II., surnamed the Devil, succeeded his brother as duke of Normandy in 1027. He humiliated his vassals and kept order in his realm; conquered districts from his neighbors and regulated his frontiers; supported Count Baldwin IV. of Flanders against his sons; King Henry I. of France against his mother; his nephews, Alfred and Edward of England, against Canute of Denmark; and was the very image of mediæval energy, audacity, unscrupulousness, and cruelty (hence his surname). From the height of his success he suddenly fell into melancholy. He repaired to Rome with a magnificent retinue; thence he went next year to Constantinople with a more modest train; and from Constantinople he journeyed on foot to Jerusalem. At the Holy Sepulchre he found consolation, but on his return d. suddenly at Nicæa July 2, 1035. His only child, borne to him by a mistress, was William the Conqueror, who succeeded him. The text of the famous opera by Meyerbeer, *Robert le Diable,* is based on a romance of 1496, and has very little to do with history.

Robert I., king of Scotland. See Bruce (Robert).

Robert II., king of Scotland, founder of the Stuart dynasty, b. in Scotland Mar. 2, 1316, son of Lord Walter Stewart by Marjory, daughter of Robert Bruce; succeeded his father in 1326 as seventh high steward of Scotland (whence the family surname); distinguished himself at the battle of Halidon Hill (1333); became joint regent with the earl of Murray 1334, and sole regent 1338–41, during the minority and absence in France of his nephew, King David II.; was again regent with the earl of March from the capture of the king at the battle of Nevill's Cross, Oct., 1346–57; opposed a successful resistance to the project of imposing Lionel, duke of Clarence, upon Scotland as king, and renewed his oath of fealty to David II. 1363; was imprisoned 1363–69; declared king after the death of David, Feb., 1371; was crowned at Scone Mar. 26, 1371; conducted two wars with Richard II. of England, in the second of which took place the successful forays of Richard II. and the duke of Lancaster, into Scotland, and of the "doughty Douglas" into England, and his victory and death at Otterburn (or Chevy Chase) July 21, 1388; suffered much from the disorders of his turbulent barons and the border wars with England. D. at Dundonald Castle May 13, 1390.

Robert III., king of Scotland, son of Robert II. by his first wife, Elizabeth Mure of Rowallan, b. in Scotland about 1340; was first known as John Stuart, earl of Carrick; succeeded to the throne May 13, 1390; was crowned at Scone Aug. 14, 1390; renewed the war with England 1399; was an imbecile ruler, and left the administration in the hands of his ambitious and unscrupulous brother, Robert Stuart, earl of Menteith, by whom the heir to the throne, David, duke of Rothsay, was imprisoned and starved to death in Falkland Castle 1402 (see Scott's *Fair Maid of Perth*); suffered the invasion of Henry IV. of England 1400, and the terrible defeat of Homildon Hill 1402; sent his surviving son, Prince James, to France for safety against the designs of Menteith, and became the victim of incurable melancholy on learning the imprisonment of his son by the English, May, 1405. D. at Rothsay, Bute, Apr. 4, 1406.

Robert′ (Louis Léopold), b. at La Chaux-de-Fonds, near Neufchâtel, Switzerland, May 13, 1794; went to Paris in 1810 to learn engraving under Girardet; studied painting under David; went in 1818 to Italy; attracted great attention in 1822 by his *Neapolitan Improvisator,* and subsequently by other representations of Italian life—*The Reapers* (1831), *The Fishermen of the Adriatic* (1834), etc., and committed suicide in Venice Mar. 20, 1835.

Robert′-Fleury′ (Joseph Nicolas), b. at Cologne Aug. 8, 1797; studied painting in Paris under Girodet, Gros, and Horace Vernet; travelled in Italy; began to exhibit in 1824; was appointed professor at the Academy of Fine Arts in Paris in 1855, and director of the French Academy in Rome in 1865, whence he returned in 1866. His most celebrated pictures are—*Une Scène de la St. Barthélemy* (1833), in the Luxembourg; *L'Entrée de Clovis à Tours* (1837), in Versailles; *Charles V. in Yuste* (1857).

Robert Guiscard. See Guiscard.

Robert of Gloucester, probably a monk of Gloucester Abbey, supposed to have been born early in the reign of Henry III., but nothing whatever is known of his personal history except that he was living at the time of the battle of Evesham (1265). He was author of a metrical chronicle of England from the time of the fabulous Brutus to his own times, chiefly based upon Geoffrey of Monmouth. It extends to 10,000 lines, and is valuable as one of the earliest specimens of the English language when assuming its final form. It was printed by Thomas Hearne (1724), reprinted 1810.

Rob′erts, tp., Marshall co., Ill., on Illinois River and Lacon branch of Chicago and Alton R. R. P. 883.

Roberts, tp., Beaufort co., S. C. P. 1771.

Roberts (Benjamin S.), b. at Manchester, Vt., in 1811; graduated at the U. S. Military Academy in 1835; served in the army till 1839; civil engineer 1839–42; admitted to the bar, and practised 1843–46; served in the Mexican war, and brevetted lieutenant-colonel; on frontier duty 1848–61; served during the civil war in various capacities, and was brevetted brigadier-general U. S. A. and major-general U. S. V. D. Jan. 29, 1875.

Roberts (David), R. A., b. at Stockbridge, near Edinburgh, Scotland, Oct. 24, 1796; was in early life a house-painter, afterward a scene-painter for the London theatres; visited Spain 1832–33, painting many pictures, from which he prepared a lithographic collection of *Picturesque Sketches in Spain* (1837); travelled in the East 1838–39; published a splendid series of drawings under the title, *The Holy Land, Syria, Idumæa, Arabia, Egypt, and Nubia* (4 vols. folio, 1842–48), and became an academician 1841. D. at London Nov. 25, 1864. He left in his studio 73 oil-paintings and 800 water-color pieces, the sale of which realized a sum of $80,000. His *Life* was written by James Ballantine (1866).

Roberts (Ellis H.), LL.D., b. at Utica, N. Y., Sept. 30, 1827; learned the printing trade; graduated at Yale College 1850; became in 1851 editor and proprietor of the Utica *Morning Herald,* an influential newspaper of Whig, and subsequently of Republican principles; was a member of the Presidential conventions of 1864, 1868, and 1876, of the State legislature 1867, and of Congress 1871–75.

Roberts (George C. M.), b. in Baltimore, Md., June 29, 1806; received the degree of M. D. from the medical department of the University of Maryland 1826; was soon afterward offered the chair of obstetrics in one of the colleges of Philadelphia, and accepted the same professorship in the University of Baltimore; was one of the organizers of the American Medical Association and a zealous Methodist minister. D. in 1868 or 1869. Paul F. Eve.

Roberts (George Washington), b. in Chester co., Pa., Oct. 2, 1833; graduated at Yale College 1857; became a lawyer in Chicago, Ill.; entered the Union army as major of the 42d Illinois Vols.; distinguished himself by spiking Confederate guns on Island No. 10, also at the battle of Farmington and at the siege of Corinth; became colonel 1862; commanded a brigade of the Army of the Mississippi, and was killed while heading a successful bayonet-charge of his own regiment Dec. 31, 1862.

Roberts (Robert Richford), D. D., b. in Frederick co., Md., Aug. 2, 1776; emigrated with his father's family in 1785 to Ligonier Valley, Western Pennsylvania, then the frontier of that State, where he was found "in the woods" by the earliest Methodist itinerants, "a stalwart youth in hunting-shirt of tow linen, buckskin breeches, and moccasin shoes." They supplied him with Methodist books, licensed him to "exhort" in 1800, and to preach in 1802. In the latter year he joined the Baltimore conference, which then stretched over the Alleghanies. He soon became pre-eminent by his natural talents and studious habits. After itinerating in Western Virginia and Pennsylvania some

years, he was appointed to important churches in Baltimore, Philadelphia, etc., and in 1816 was elected bishop. He immediately removed his family to his old log cabin in Western Pennsylvania, and thence to Indiana, then "the far West," where with his own hands he built another cabin as his "episcopal palace," made his rude furniture from the forest wood with such tools as he had carried in his emigrant wagon, and ate his first meal in it of roast potatoes only. His subsequent history is interwoven with that of his whole Church. For many years he was one of its most powerful preachers and most judicious administrators, influential alike in the Eastern and Western States —a man of noble presence, of considerable self-culture, of great native talents and characteristics, and of admirable Christian simplicity and charity. He did much for Western missions, and the Indians called him "the grandfather of all the missionaries." D. in Lawrence co., Ind., Mar. 26, 1843, mourned by his denomination throughout the nation. ABEL STEVENS.

Rob'ertson, county of N. E. Kentucky, between Shannon Creek and Licking River, has a mountainous surface and a fertile soil. Staples, Indian corn, tobacco, and butter. Cap. Mount Olivet. Area, 175 sq. m. P. 5399.

Robertson, county of N. Tennessee, adjoining Kentucky, watered by Sulphur and Terrapin creeks and other affluents of Cumberland River, traversed by Edgefield and Kentucky division of St. Louis and South-eastern R. R., is mountainous, and well adapted to grazing and cattle-raising. Staples, Indian corn, wheat, oats, tobacco, sweet potatoes, wool, and butter. There are several flouring and saw mills and distilleries. Cap. Springfield. Area, 490 sq. m. P. 16,166.

Robertson, county of Central Texas, between Navasota and Brazos rivers, intersected by Little Brazos River, and traversed by International and Great Northern R. R., whose two lines meet at Hearne in this county, constituting it an important railroad centre; has a broken surface, partly forest and partly prairie, with rich bottom-lands along the streams. Staples, Indian corn, cotton, cattle, sheep, and swine. Cap. Calvert. Area, 500 sq. m. P. 9990.

Rob'ertson, tp., Madison co., Va. P. 2280.

Robertson (CHARLES FRANKLIN), S. T. D., b. in New York City Mar. 2, 1835; graduated at Yale College 1859, at the General Theological Seminary of the Protestant Episcopal Church 1862; took orders in that Church; officiated as rector of several churches, and was consecrated bishop of Missouri Oct. 25, 1868.

Robertson (FELIX), M. D., b. at Nashville, Tenn., Jan. 17, 1780, being the first male child born in that city; studied medicine in the University of Pennsylvania, where he graduated in 1806. Returning home, he soon obtained an extensive practice, which was retained for more than forty years, when ill-health and declining days compelled him to relinquish it. Dr. Robertson was twice mayor of the city of his nativity, president of the Bank of Tennessee, and long the presiding officer of the trustees of the University of Nashville. Between himself and Gen. Jackson there existed a cordial intimacy. D. at Nashville Sept. 10, 1865. PAUL F. EVE.

Robertson (FREDERICK WILLIAM), b. in London Feb. 3, 1816; abandoned the plan he had formed of entering the army; entered Brasenose College, Oxford, 1837, and graduated 1840; was settled in Winchester 1840–42, in Cheltenham 1842–47, in Oxford 1847, going that year to Brighton, where he d. Aug. 15, 1853. Of his works, there have been published—*Sermons preached at Trinity Chapel, Brighton* (five series, 1855–64), *Lectures and Addresses on Literary and Social Topics* (1858), and *Expository Lectures on St. Paul's Epistles to the Corinthians* (1859). (See his *Life and Letters*, edited by Stopford A. Brooke (2 vols., 1865).) R. D. HITCHCOCK.

Robertson (GEORGE), LL.D., b. in Mercer co., Ky., Nov. 18, 1790; studied at Transylvania College and at Finley's Classical School at Lancaster; was admitted to the bar 1809; member of Congress 1817–21; Speaker of State legislature 1823 and 1825–27; secretary of state 1828; judge of the court of appeals 1828; chief-justice of Kentucky 1829–43, and professor of law in Transylvania University twenty-three years. He published a *Biographical Sketch of Hon. John Boyle* (Frankfort, 1838), and many of his speeches, addresses, and other writings were collected by him in a *Scrap-book on Law and Politics, Men and Times* (1856). Judge Robertson declined the governorship of Arkansas and the missions to Colombia and Peru. D. May 17, 1874.

Robertson (JAMES), b. in Fifeshire, Scotland, about 1725; served as deputy quartermaster-general in the campaigns against Louisbourg and Ticonderoga 1758–59; was appointed lieutenant-colonel of the 55th regiment; exchanged into the 16th; was stationed at New York 1763–75, becoming colonel 1772; went to Boston July, 1775; was appointed major-general Jan. 1, 1776; commanded a brigade in the battle of Long Island; went to England 1777; returned with a commission as royal governor of New York 1779; took the oath of office Mar. 23, 1780; exerted himself with Gen. Greene to procure the exchange of Major André; became lieutenant-general Nov. 20, 1782; returned to England Apr., 1783; and d. Mar. 4, 1788.

Robertson (JAMES), b. in Brunswick co., Va., June 28, 1742; settled at Watauga, Tenn., 1769; was the founder of the settlements on Cumberland River; became brigadier-general and commander of the Tennessee militia 1790, and during the later years of his life was U. S. agent to the Chickasaw Indians. D. at the Chickasaw Agency, Tenn., Sept. 1, 1814. A volume on his *Life and Times* was published by A. W. Putnam (1859), and constitutes a history of the settlement of Middle Tennessee.

Robertson (JAMES CRAGIE), D. D., b. at Aberdeen, Scotland, in 1813; graduated at Trinity College, Cambridge, 1834; became vicar of Bekesbourne, Kent, 1846, canon of Canterbury 1859, and professor of ecclesiastical history in King's College, London, 1864. Author of a *History of the Christian Church from the Apostolic Age to the Reformation* (new ed., 8 vols., 1874–75), of a biography of Becket (1859), and of various other treatises on ecclesiastical history and antiquities.

Robertson (J. P.), b. Dec. 4, 1840, in Pennsylvania; graduated at Naval Academy in 1861; became lieutenant in 1862, lieutenant-commander in 1866, commander in 1875; served in the Wabash at bombardment of Forts Hatteras and Clarke in 1861, and at the battle of Port Royal, Nov. 7, 1861, "and by his efficient service did honor to the Naval School." FOXHALL A. PARKER.

Robertson (THOMAS WILLIAM), b. in England in 1829; became an actor in a travelling company of which his father was manager; produced a play, *A Night's Adventure*, in 1851; settled at London and devoted himself to literature 1860, and wrote several very successful dramas—*David Garrick, Society, Ours, Caste, Play, School, M. P.*, and *War*. D. at London in Feb., 1871.

Robertson (WILLIAM), D. D., b. at Borthwick, near Edinburgh, Scotland, Sept. 19, 1721; graduated at the University of Edinburgh 1741; became a minister of the Scottish Church at Gladsmuir 1743; became principal of the University of Edinburgh and minister of Greyfriars church 1762, and was appointed historiographer of Scotland 1764. D. at Grange House, Edinburgh, June 11, 1793. Author of a *History of Scotland during the Reigns of Mary and James VI.* (2 vols., 1759), *History of the Reign of the Emperor Charles V.* (3 vols., 1769), a *History of America* (2 vols., 1777), and an *Historical Disquisition concerning the Knowledge which the Ancients had of India* (1791). During his lifetime and long afterward his name was ranked with those of Gibbon and Hume, and his complete *Works* have been often reprinted, but are now little read. His *Life* was written by Dugald Stewart (1801), and by Lord Brougham, who was a family connection.

Rob'eson, county of Southern North Carolina, adjoining South Carolina, watered by Little Pedee and Lumber rivers and their tributaries, and traversed by Carolina Central R. R., has a generally level surface, and a fertile soil, with extensive pine forests. Staples, Indian corn, sweet potatoes, rice, cotton, wool, honey, cattle, sheep, and swine. There are 15 establishments for the production of tar and turpentine. Cap. Lumberton. Area, 780 sq. m. P. 16,262.

Robeson, p.-v. and tp., Berks co., Pa. P. 2458.

Robeson (GEORGE M.), b. in Warren co., N. J., in 1827; graduated at Princeton College 1847; studied law; was admitted to the bar 1850; practised with success at Newark for several years, and afterward at Camden, where he became in 1859 prosecuting attorney for the county; was appointed a brigadier-general by the governor of New Jersey early in 1861; took an active part in the organization of the State volunteers; served in the war of the rebellion; was attorney-general of New Jersey from 1867 to June 22, 1869, when he resigned to accept the position of secretary of the navy in the cabinet of Pres. Grant, a post which he held during the latter's administration.

Rob'eson (HENRY B.), b. Aug. 5, 1842, in Connecticut; graduated at the Naval Academy in 1860; became master in 1860, lieutenant in 1862, lieutenant-commander in 1866, a commander in 1874; served in the New Ironsides in her many fights with Fort Sumter, and in the Colorado during both the Fort Fisher fights, commanding the boats of the former in the capture of the outer end of Morris Island, and the detachment of seamen sent from the Colorado to engage in the naval assault on Fort Fisher. Highly commended in official reports. FOXHALL A. PARKER.

Robespierre′ (Maximilien Joseph François Isidore), b. at Arras May 6, 1758. His father, who was a lawyer in poor circumstances, abandoned the family and went to the U. S. His mother died early, and the four children, of whom Maximilien was the eldest, were educated by the grandfather in decent but hard and hopeless poverty. Maximilien distinguished himself at the college of Arras, so that the bishop sent him to the college of Louis le Grand at Paris, where he went through the preliminary course with great honor. He then studied law, still living in deep poverty, and thus early contracted those regular, almost abstemious habits which were all that he had of a character, and imbibed that abstract sympathy for people whose lot is resignation, which was all that he had of a heart. After finishing his studies he returned to his native city and began to practise law. He wrote verses, and became a member of the academy of Arras. He was passionately devoted to the philosophy of the age, especially to its morals, which were nothing but philanthropy, and he succeeded in making a sort of sensation by putting its doctrines into cheap practice. He was also a smart lawyer, and made a good living. But now, as afterward, he was slow in making an impression, though it must be added that the impression he made was peculiarly valuable, because it referred not to his talents, which were not great, but to his character, which was "incorruptible;" and it became singularly powerful, because he confided in it himself and used it. He was a theorist. But his theory was not a brilliant speculation, still less a fanciful dream; it was a conviction, and it put him to work. This peculiarity explains at once the cold-bloodedness with which he employed terror and cruelty as the means of carrying out his plans, and the sentimental yearning after peace from which these plans sprung; the matchless audacity and energy with which he strove toward the realization of his ideas, and the singular hesitation and exhaustion which overcame him the moment he and his theory became victorious. In the Constituent Assembly, to which he was returned by Artois, Robespierre did not play any very conspicuous part. It was outside the assembly he first made himself noticed as a successful popular speaker and energetic revolutionary leader. In the Jacobin Club he soon acquired a predominant influence by his radicalism, fanaticism, and "incorruptible" character, and he grew in importance with the club. Mirabeau noticed him, and after the death of that most powerful parliamentary leader he began to make himself felt even in the assembly. Some time before its dissolution, in May, 1791, he proposed that no member of the Constituent Assembly should be eligible to the first Legislative Assembly; and for this decree, which was not carried without some opposition in the assembly, but which was received by the nation with great enthusiasm on account of the noble disinterestedness of which it bore witness, Robespierre was greatly applauded. He did not lose anything by it himself, however. It prevented him from being elected to the Legislative Assembly, but it did not prevent him from being the head of the Jacobin Club, and by composing the Legislative Assembly merely of political novices it weakened this body to such a degree as to deliver it up wholly to the guardianship of the club. At the close of the session, Oct., 1791, he made a visit to Arras, and was received by his constituents with military parades, illuminations, fireworks, and banquets, from which he returned to his work in the club. What part Robespierre really took in the insurrections of June 20 and Aug. 12, and in the September massacres of 1792, is doubtful, but from his entrance into the National Convention (Sept. 21, 1792), to which he was returned by the city of Paris, and in which he took his seat as the head of the radical party, the so-called Mountain, his career was unmistakable. It was he who brought first the king, then the Girondists, then the opponents of the radical party, Camille Desmoulins and Danton, and at last his own tools, Hébert and Chaumette, to the scaffold. Against the king he argued that the question was not one of legal procedure, but of public safety, as Louis Capet was not simply a criminal, but an enthroned king, and the members of the Convention were not judges, but statesmen. By this sophistry fell the king's head Jan. 23, 1793. Oct. 24, 1793, the trial of the Girondists before the Revolutionary Tribunal began. They were accused of having conspired against the Republic with Louis XVI., the emigrants, the duke of Orleans, La Fayette, and Pitt. The accusation was utterly false, but at a time of convulsive action it was possible to ascribe any kind of crime to people like the Girondists, whose principal characteristic was that they could not act at all; and it is probable that Robespierre, although he seems to have felt a sort of envy against men like Vergniaud, Gensonné, Roland, and Condorcet, actually misunderstood their deliberations and hesitations, and considered their conduct as traitorous. Their defence was nevertheless so brilliant and impressive that the Committee of Public Safety, of which Robespierre was the president, felt compelled to order the investigation stopped and the sentence given without any further argument. On the 31st followed the execution. Robespierre's wrath against Hébert is very characteristic. No doubt he was afraid of him, as he was of Danton. The influence which Hébert exercised over the lower classes was enough for Robespierre to wish him removed. But there was something more in the relation between them. Hébert had collided with Robespierre's theory, and that was probably much worse than to collide with his ambition. At the instigation of Hébert and Chaumette the bishop of Paris, Gabel, and with him a great number of priests, solemnly renounced their offices Nov. 7, 1793, and three days after, the first festival of Reason was held with great splendor in the cathedral of Notre Dame. This was more than abominable in the eyes of Robespierre. He was a strong deist. His theory was based on deism, and he was entirely blind as soon as he came outside of this philosophy. Hébert was accused of ultra-revolutionism, and guillotined Mar. 22, 1794. After the execution of Danton (Apr. 5, 1794), Robespierre actually stood alone, without a rival or adversary, the dictator of France; and now came the grandest moment of his life. On May 23, 1794, he made the Convention decree that faith in the Supreme Being was a law for the French people, and June 8 he ordered a great festival, at which he appeared in the Tuileries and on the Field of Mars with an immense bouquet in his hand and making speeches in honor of the Supreme Being. In view of this scene a sense of the ludicrous overpowered the terror in which people lived. It is difficult to say what it was that turned away the masses from Danton, but it is probable that it was the ridiculous which overtook Robespierre. People began to laugh at him, and soon they ceased to fear him. When the Convention were made aware that Mademoiselle Catherine Théot worshipped him as Messiah and had a throne consecrated to him, people did not feel so much afraid that he would overthrow the Republic and establish a despotism. They laughed, and in this laughter his power and his prestige were dissolved.

The last days of Robespierre have been minutely described by Thiers, Mignet, Carlyle, Lewes, and Hamel, and are very interesting to study. The same proceedings that he had employed against Danton and the Girondists were now employed against himself. He was accused, and not allowed to defend himself. The decree of his arrest was carried in the Convention in the midst of a complete uproar. He howled like a hyæna, but nobody would hear him. After being arrested he was rescued by his friends, and a general insurrection was proposed in order to save him. But he had lost his own balance, and while he hesitated the Convention acted. He was guillotined the day after his arrest, July 28, 1794. Clemens Petersen.

Robideaux′, tp., Pulaski co., Mo. P. 677.

Rob′in, the name applied in England to several well-known singing birds of the family Erythacinæ, and improperly given in the U. S. to a species of thrush, the *Turdus migratorius*. There are fifteen genera of robins in Europe, Western Asia, and Northern Africa, most of them widely spread, resembling each other in their chief characteristic, the short tapering bill, curved at the extremity and partly covered with bristles. They all feed on worms, insects, and fruits, generally living on cultivated grounds, and having but slight fear of man. The best-known species is the robin redbreast (*Erythacus rubecula*), whose song is familiar to every English country household.

Robin′ (Charles Philippe), b. at Jassiron, department of Ain, France, June 4, 1821; studied medicine at Paris; was appointed professor of general anatomy in 1847, of histology in 1862; became very celebrated for his microscopical researches in physiology. His principal writings are—*Du Microscope et des Injections dans leur Application à l'Anatomie et à la Pathologie* (1849), *Tableaux d'Anatomie* (1851), *Traité de Chimie anatomique et physiologique* (1853), *Histoire naturelle des Végétaux parasites* (1853), *Anatomie microscopique* (1868).

Rob′in Good′fellow, a famous personage in English folk-lore, reputed to be a son of Oberon, king of the fairies, by a mortal mother, noted for his roguish tricks, his fondness for disturbing the peace of families, and his power of assuming various shapes, the "shrewd and knavish sprite" whose characteristics are fully given by Shakspeare in a well-known passage of *A Midsummer Night's Dream*. A popular volume entitled *The Mad Pranks and Merry Jests of Robin Goodfellow* appeared in 1628, and was reprinted by the Percy Society 1841.

Robin Hood. See Hood (Robin).

Rob′ins (Benjamin), b. at Bath, England, in 1707; was self-educated; obtained an extraordinary knowledge of mathematics, which he taught at London, and on which he published a series of tracts (2 vols., 1761); made experiments on the resisting force of the air to projectiles, and studied fortification in Flanders; became engineer-in-chief to the East India Company 1749; fortified Madras, and d. there of fever July 29, 1751. He prepared for the press in the name of Rev. Richard Walter, chaplain of the Centurion, the narrative of Anson's *Voyage around the World* (1748), and was author of *New Principles of Gunnery* (1742), besides other scientific writings.

Rob′inson, p.-v. and tp., cap. of Crawford co., Ill., on Paris and Danville R. R., has 2 churches, an academy, and a fine graded school (public), 2 newspapers, and a banking-house. P. 1851. G. W. Harper, Ed. "Argus."

Robinson, tp., Posey co., Ind. P. 1683.

Robinson, p.-v. and tp., Ottawa co., Mich. P. 406.

Robinson, tp., Greene co., Mo. P. 2419.

Robinson, tp., Allegheny co., Pa., on Allegheny River and on Pittsburg and Steubenville R. R. P. 2275.

Robinson, tp., Washington co., Pa. P. 937.

Robinson, tp., Wise co., Va. P. 769.

Robinson, tp., Mason co., West Va. P. 1145.

Robinson (Beverley), b. in Virginia in 1723; was a major under Wolfe at Quebec 1759; married a daughter of Frederick Phillipse, thereby coming into possession of immense tracts of land on the Hudson; was opposed to the despotic measures of the British ministry, but was loyal to the government; removed into New York City at the outbreak of the Revolution; recruited and commanded the Loyal American regiment, of which he was colonel; was concerned in the negotiations preliminary to the treason of Arnold (who at that time occupied Robinson's country-seat); lost his property by confiscation; at the conclusion of the war went to England, and d. at Thornbury in 1792.—His son Beverley, a graduate of Columbia College 1773; settled near St. John, New Brunswick; became a lieutenant-colonel in the British army. D. at New-York in 1816.

Robinson (Edward), D. D., LL.D., b. in Southington, Conn., Apr. 10, 1794; graduated at Hamilton College 1816; was tutor there 1817–18, when he married Eliza, youngest daughter of Rev. Samuel Kirkland, missionary to the Oneidas, who died the year following, her father having died some years before; remained in Clinton, engaged in classical studies, till the autumn of 1821, when he went to Andover, Mass., to publish an edition of eleven books of the *Iliad* (the first nine, the 18th, and the 22d); was instructor in Hebrew in Andover Seminary under Prof. Stuart, whom he assisted in preparing the 2d ed. (1823) of his *Hebrew Grammar* from 1823–26, publishing meanwhile (1825) his translation of Wahl's *Clavis Philologica Novi Testamenti;* studied in Europe, mostly at Halle and Berlin, 1826–30; in 1828 married Therese Albertine Luise von Jacob, daughter of a distinguished professor at Halle; returned to the U. S., and was professor extraordinary at Andover 1830–33; broke down in health, and resided in Boston 1833–37, and in 1837 accepted a professorship in Union Theological Seminary, New York City, which he held till his death, Jan. 27, 1863. In 1838, and again in 1852, he travelled in Palestine with the learned missionary Rev. Eli Smith, doing more for biblical geography than any other one man that has ever lived. Besides the works already mentioned, he published Taylor's *Calmet* (1832), *A Dictionary of the Bible for the use of Schools and Young Persons* (1833), Buttman's *Greek Grammar* (1833; 2d ed. 1839; 3d ed. 1851), Gesenius's *Hebrew Lexicon* (1836; 5th ed. 1854), *Greek and English Lexicon of the New Testament* (1836; 2d ed. 1847), *Greek Harmony of the Gospels* (1845; 2d ed. 1851), *English Harmony of the Gospels* (1846), *Memoir of the Rev. William Robinson* (1859). He also wrote much for reviews and newspapers. In 1831 he founded the *Biblical Repository,* which he edited for four years, and in 1843 the *Bibliotheca Sacra,* for which he continued to write till 1855. But the great work of his life was the *Biblical Researches* (1841, 3 vols.; compressed into 2, and a 3d added 1856), for which in 1842 he received the gold medal of the Royal Geographical Society of London. He also received the degree of D. D., previously (1831) conferred by Dartmouth College, from the University of Halle in 1842, and LL.D. from Yale College in 1844. His *Physical Geography of the Holy Land* was edited by Mrs. Robinson in 1864, and published in 1865. The original manuscript of the *Researches* is now in the library of the Union Theological Seminary, to which he gave also many volumes. What remained of his library was purchased after his death for Hamilton College. (See *The Life, Writings, and Character of Edward Robinson,* by R. D. Hitchcock, with *Remarks* by H. B. Smith (New York, 1863).) R. D. Hitchcock.

Robinson (Ezekiel Gilman), D. D., LL.D., b. at Attleborough, Mass., Mar. 23, 1815; graduated at Brown University 1838, at Newton Theological Seminary 1842; was pastor of Baptist churches at Norfolk, Va., 1842–45, and at Cincinnati, O., 1849–52; was professor of Hebrew in the theological seminary at Covington, Ky., 1846–52; became professor of biblical theology in the seminary at Rochester, N. Y., 1852, and president of that institution 1860, remaining until 1872, when he was chosen president of Brown University, a position which he still holds (1876). Author of various discourses, addresses, and review articles; was editor of the *Christian Review* 1859–64; in 1864 published a careful revision of Ryland's translation of Neander's *Planting and Training of the Christian Church,* and *The Relation of the Church to the Bible* (1866).

Robinson (Sir Frederick Phillipse), son of Col. Beverley, b. on the Phillipse Manor, N. Y., in Sept., 1763; became an ensign in his father's Loyal American regiment Feb., 1777; was wounded and taken prisoner at Stony Point; served in the West Indies, and with great distinction under Wellington in the Peninsular war, rising to be general; was commander-in-chief of the British forces in Canada 1812; participated in the campaign on Lake Champlain Sept., 1814; was knighted 1815, and made governor of Upper Canada, and became full general 1841. D. at Brighton, England, Jan. 1, 1852.

Robinson (Henry Crabb), F. S. A., b. at Bury St. Edmund's, England, May 13, 1775; was articled to a lawyer at Colchester, and afterward at London; studied several years (1800–05) at Jena and other German universities, where he acquired a very thorough knowledge of modern German literature and philosophy; enjoyed the intimate friendship of Goethe, Wieland, Schiller, the Schlegels, and other eminent poets; furnished data to Madame de Staël for her work on Germany; was correspondent of the *Times* in Spain at the beginning of the Peninsular war, 1808–09; was engaged on his return to London as a regular writer for that journal; was thus introduced to the acquaintance of the literary circles of London; was called to the bar at the Middle Temple 1813; became a highly successful and prosperous lawyer on the Norfolk circuit, from which he retired with a fortune 1828, and for the remainder of his life devoted himself to society and literary leisure, being prominently known as the intimate friend of Wordsworth, Blake, Clarkson, and Flaxman, as he was also of Lamb, Coleridge, Southey, and their compeers. He was one of the first members of the Athenæum Club, one of the founders of University College, London, and of the Flaxman Gallery, to which latter institution he left liberal bequests. D. unmarried at London Feb. 5, 1867. He published little, but left a copious *Diary and Correspondence,* from which very entertaining selections were published in 1869.

Robinson (Horatio Nelson), LL.D., b. at Hartwick, N. Y., Jan. 1, 1806; received an ordinary common-school education until the age of sixteen, when his mathematical talent led a wealthy gentleman to assist him in entering Princeton College; was professor of mathematics in the U. S. navy 1825–35; was afterward principal of academies at Canandaigua and Genesee; removed to Cincinnati 1841, to Syracuse, N. Y., 1850, and to Elbridge 1854, where he d. Jan. 19, 1867. Author of *University Algebra, Differential and Integral Calculus,* and other mathematical textbooks of high merit.

Robinson (James S.), b. near Mansfield, O., Oct. 14, 1828; enlisted in the 4th Ohio Vols. June, 1861; participated in the Rich Mountain campaign; became major Oct., 1861, lieutenant-colonel Apr., 1862, colonel Aug., 1862; served in the Shenandoah Valley under Fremont; was at the second battle of Bull Run, at Chancellorsville, and at Gettysburg, where he was severely wounded; commanded a brigade in Sherman's Atlanta campaign and march to the sea; became brevet brigadier-general Dec. 12, 1864, full brigadier-general Jan. 12, 1865, and brevet major-general Mar. 13, 1865.

Robinson (John), b. in England, probably in Lincolnshire, 1575; entered Cambridge University 1592; pursued his studies either in Emanuel or Corpus Christi College, and there became attached to Puritan doctrines; took preliminary orders in the Church of England; obtained a benefice near Great Yarmouth, Norfolk; was suspended by the bishop for non-conformity in ecclesiastical ceremonials 1602; gathered an Independent congregation at Norwich; formally separated from the Church of England 1604; resigned his fellowship at Cambridge; became assistant, and soon after sole pastor, of a dissenting congregation (1604) gathered at Scrooby, Nottinghamshire (near the borders of Yorkshire and Lincolnshire), where the

Brewsters, Bradfords, and Mortons were among his flock; suffered a persecution which led many of his congregation to emigrate with him to Amsterdam, Holland, 1608; removed to Leyden 1609; gathered there a numerous church, constantly reinforced by arrivals from England; attended lectures at the university, of which he afterward became a member; held a notable public discussion with the Dutch professor Episcopius, the successor of Arminius, upon the Calvinistic doctrine of free-will, 1613; entered into the plans for colonization in New England about 1617; was active in promoting the negotiations, through Cushman, Carver, and Brewster, with the Plymouth Company of capitalists; dismissed a portion of his congregation with a memorable farewell sermon on their embarkation for America July 22, 1620, intending to follow them the next year, but before the negotiations were completed he d. at Leyden Mar. 1, 1625. He was buried in St. Peter's church, the members of the university and the ministers of the city attending his funeral. The remainder of his church emigrated to Massachusetts soon afterward, with his sons John and Isaac, through whom his American descendants are numerous. He was well versed in the classics, a skilled debater, and a ready writer. Among his numerous controversial publications were—*A Justification of Separation* (1610), *Of Religious Communion* (1614), *Apologia Justa et Necessaria* (1619), *A Defence of the Doctrine propounded by the Synod of Dort* (1624), *Essays or Observations, Divine or Moral* (1628), *A Treatise of the Lawfulness of Learning of the Ministers in the Church of England* (1634), and *An Apology for Certain Christians no less contumeliously than commonly called Brownists or Barrowists*. His complete *Works*, with a memoir by Robert Ashton, secretary of the Congregational board, appeared in London and Boston in 3 vols., 1851. Vol. i. also contains an account of his American descendants, from the pen of Pres. William Allen of Northampton.

Robinson (Sir John Beverley), Bart., D. C. L., a relative of Col. Beverley, b. at Berthier, Lower Canada, July 26, 1791; studied law; was clerk of the assembly 1811; attorney-general 1812, being only twenty-one years of age; served as a volunteer under Gen. Brock at Detroit; was solicitor-general 1815–18; again attorney-general 1818–29; was appointed chief-justice of Upper Canada July 15, 1829, and held that office until his death at Toronto Jan. 30, 1863. He was created a baronet 1854; was eighteen years a member of the legislature of Upper Canada, chancellor of Trinity College, Toronto, and author of several miscellaneous publications on Canada.

Robinson (John Cleveland), b. in Binghamton, N. Y., Apr. 10, 1817; entered the U. S. Military Academy 1835, but without graduating commenced the study of law in 1838. In 1839, however, he accepted a second lieutenancy in the 5th Infantry, and served in the war with Mexico and in Florida against the Indians. In Sept., 1861, he was appointed colonel of the 1st Michigan Vols., and in May, 1862, brigadier-general of volunteers, serving in command of a brigade with the Army of the Potomac in the Virginia peninsular campaign of 1862, at the second battle of Bull Run, Chantilly, and Fredericksburg. At Gettysburg and in the Richmond campaign of 1864 he commanded a division with great bravery, losing a leg on the third day of fighting in the latter campaign, at Todd's Tavern. Brevet brigadier and major-general for gallantry. In 1866 he attained the colonelcy of the 43d Infantry, and in 1869 was retired from active service on the full rank of major-general. In 1872 he was elected lieutenant-governor of the State of New York.

Robinson (Robert), b. at Swaffham, Norfolk, England, Oct., 1735; studied in the grammar school at Scarning; was apprenticed in his fifteenth year to a London hair-dresser, who, however, gave up his indenture to enable him to prepare for the pulpit; commenced preaching as a Calvinistic Methodist 1755; soon became a Baptist and formed a congregation at Cambridge, eking out his small stipend by selling corn and coals; applied himself to the study of languages; acquired a deservedly high reputation for eloquence, wit, goodness, and liberality (being the Sydney Smith of the time); made a translation of Saurin's *Sermons* (5 vols., 1775–84); published *A Plea for the Divinity of our Lord Jesus Christ* (1776), popular hymns and tracts, and left a learned *History of Baptism* (1790), posthumously published. D. at Birmingham June 8, 1790. He was said to have become a Socinian (*i. e.* Unitarian) in his later years. His *Life*, by George Dyer (1796), is a valuable work.

Rob'inson (Solon), b. near Tolland, Conn., in 1803; wrote in early life for the *Albany Cultivator;* was for many years agricultural editor of the New York *Tribune;* wrote agricultural articles for other journals; was author of a popular novel, *Hot-Corn, or Life-Scenes in New York Illustrated* (1853; 50,000 copies sold), *How to Live, or Domestic Economy Illustrated* (1860), *Facts for Farmers* (1864 *seq.*), a work published by subscription which had an immense circulation, and *Me-won-i-toc* (1867). About 1870 he settled on a farm at Jacksonville, Fla.

Robinson (Stuart), D. D., b. at Strabane, about 10 miles S. of Londonderry, Ireland, Nov. 26, 1816; graduated at Amherst College 1836; studied theology at Union Theological Seminary, Prince Edward, Va.; taught two years, and then spent part of a year (1840) at Princeton, N. J.; was settled at Kanawha Salines, West Va., 1841–47, at Frankfort, Ky., 1847–52, at Baltimore, Md., 1852–56; was professor of ecclesiology at Danville, Ky., 1856–58, and since 1858 has been pastor of the Second Presbyterian church in Louisville, Ky. In 1852 he declined the degree of D. D. offered him by Centre College, Ky. He has published *The Church of God an Essential Element of the Gospel* (1858) and *Discourses of Redemption* (1866), reprinted in Edinburgh. He established and edited in Baltimore the *Presbyterial Critic* (1855–56), and in Louisville *The True Presbyterian*, suppressed during the war, and then revived under the name of *The Free Christian Commonwealth* (1861–68). He has also put forth many pamphlets on various issues between Northern and Southern Presbyterians. In 1873 he visited Egypt and the Holy Land, and since his return has preached 100 *Discourses on the Pentateuch*, which have been published in the *Courier-Journal* of Louisville, Ky. R. D. Hitchcock.

Robinson (Thérèse Albertine Louise von **Jakob**), daughter of Prof. L. H. von Jakob, b. at Halle, Germany, Jan. 26, 1797; resided with her father in Russia 1807–16, becoming acquainted with the Slavic languages; returned to Halle 1816; became known as a poetess; enjoyed the friendship and correspondence of Goethe, the Humboldts, Grimm, Savigny, and Ritter; translated Scott's *Old Mortality* and *Black Dwarf* into German (1822); published *Psyche, Original Tales* (1824), under the *nom de plume* of "Talvi" (the initials of her name), and *Servian Songs* (2 vols., 1825–26); married Prof. Edward Robinson 1828; translated John Pickering's essay *On Indian Languages* into German (1834); contributed largely to the *Biblical Repository*, edited by her husband, in which periodical appeared several essays constituting an *Historical View of the Slavic Languages;* resided in Germany during her husband's exploration of Palestine; published there her *Characteristics of the Popular Songs of the German Nations* (1840) and a treatise *On the Authenticity of the Poems of Ossian* (1840); wrote in New York two small works on American history for circulation in Germany, and several novels which were translated into English by her daughter. In 1850 appeared her chief work (in English), *An Historical View of the Languages and Literature of the Slavic Nations*. After her husband's death she resided at Hamburg, where her son was American consul. D. at Hamburg Apr. 13, 1869. A posthumous work has appeared under the title *Fifteen Years, a Picture from the Last Century*.

Robinson (William E.), b. near Cookstown, co. Tyrone, Ireland, May 6, 1814; received a good English and classical education; came to the U. S. 1836; studied for a time at Yale College, from which he received the degree of A. M. 1841; graduated at the Yale Law School; was a frequent writer upon the New York *Herald* 1838–44; afterward was well-known by his writings in the New York *Tribune* over the signature "Richelieu;" edited a weekly paper, *The People*, 1848–49; practised law in New York 1853–62; travelled in Europe 1859; was appointed U. S. assessor of internal revenue 1862, and sat in Congress 1867–69. Author of many poems published in newspapers, and of numerous lectures and literary addresses.

Robinson (William S.), b. at Concord, Mass., Dec. 7, 1818; was editor of the Lowell *Courier* 1842–48, of the Boston *Daily Whig* 1849, afterward of the *Republican*, the *Commonwealth*, and the *Telegraph;* represented Lowell in the legislature 1852–53; was clerk of the constitutional convention of Massachusetts 1853, and clerk of the Massachusetts legislature since 1862. Under the *nom de plume* of "Warrington" he was the Boston correspondent of the Springfield *Republican* and of other journals. Author of *Warrington's Manual* (1875). D. Mar. 11, 1876.

Robinson's Roads, tp., Montgomery co., Ala. P. 2639.

Rob'ison (John), LL.D., b. at Boghall, Stirlingshire, Scotland, in 1739; graduated at the University of Glasgow 1756; was employed as tutor in the navy; accompanied the expedition to Quebec 1759; became professor of natural philosophy in Glasgow University 1766; went to Russia as secretary to Admiral Sir Charles Knowles 1770; was made inspector of the corps of marine cadets at

Cronstadt, with the rank of lieutenant-colonel, 1772, and was professor of natural philosophy in the University of Edinburgh from 1774 to his death, Jan. 30, 1805. Author of *Lectures on the Elements of Chemistry* (2 vols., 1803), *Elements of Mechanical Philosophy* (1804), and of numerous contributions on natural science to the *Encyclopædia Britannica* (3d ed., 1793–1801), which were edited by Sir David Brewster under the title *A System of Mechanical Philosophy* (4 vols., 1822).

Robison's Springs, tp., Elmore co., Ala. P. 774.

Rob Roy, the popular name of a Scotch outlaw (*Roy* meaning "red" in Scotch), whose true name was ROBERT MACGREGOR, b. in Scotland about 1660; changed his name to CAMPBELL on the outlawry of the clan MacGregor 1693; became a partisan of the Pretender in 1715, and for many years thereafter continued to make depredations, chiefly upon the retainers of the duke of Montrose. D. near Aberfoyle about 1738. His exploits, long traditional in Scotland, formed the basis of a novel by Sir Walter Scott.

Ro'by (HENRY JOHN), b. at Tamworth, England, Aug. 12, 1830; graduated at St. John's College, Cambridge, 1853; became fellow there 1854; was assistant tutor 1855–56, and reappointed 1860; was university examiner in law, classics, and moral sciences 1859–61; member of, and secretary to, the local examination syndicate 1858–59; took a prominent part in urging university reform; was undermaster of Dulwich College Upper School 1861–65; professor of jurisprudence at University College, London, 1866–68; was appointed by the Crown secretary to the schools inquiry commission Dec., 1864, to the endowed schools commission Aug., 1869, and was a member of that body 1872–75. He edited the *Report* of the school commissioners and the numerous volumes of documents thereto appended (Mar., 1868); author of an *Elementary Latin Grammar* (1862) and a valuable *Grammar of the Latin Language, from Plautus to Suetonius* (2 vols., 1871–74).

Roc'ambole [Fr.], the *Allium Scorodoprasum,* a plant of the garlic family, much resembling garlic, but larger and milder. It is cultivated in European kitchen-gardens, and is a native of northern regions.

Roccabian'ca, town of Italy, province of Parma. Its old *rocca* or castle (1460) is still standing and contains some interesting frescoes. After countless changes of ownership this castle has once more returned to the Pallavicino Trivulzio family. P. 5500.

Roccadas'pide, town of Southern Italy, province of Salerno, situated on a hill on the eastern slope of Monte Calimarro. The climate is healthy, and the inhabitants are mostly engaged in raising swine, which are fed in the oak forests of the neighborhood. P. 6000.

Roccasec'ca, town of Southern Italy, province of Caserta, on a high hill N. of Pontecorvo. The episcopal palace, not occupied since Sora became capital of the diocese, is a fine building, and some remains of the old and very strong feudal castle still exist. The adjoining country is famous for rare plants from which the inhabitants make a medicinal powder known as *roccasecca.* This town was the birthplace of the celebrated Thomas Aquinas. P. 5500.—ROCCASECCA is also the name of a village near Rome.

Roccastra'da, town of Italy, province of Grosseto, on a lofty hill about 15 miles N. of the town of Grosseto. Roccastrada is surrounded by castellated walls, and portions of the old feudal stronghold which once sheltered the banished Ghibellines of Siena are still remaining. This half-ruined castle stands on a rugged rock which is commanded by still higher crags in its rear, and which is cut almost vertically down on the front face, thus presenting an aspect of great strength as well as wildness. The buildings in the town are insignificant. P. 8200.

Roccel'la Ionica, town of Southern Italy, province of Reggio di Calabria, near the mouth of the Calamizze, almost upon the sea-shore. It is surrounded by crenated walls, and the adjacent country is of astonishing fertility, abounding in all the richest productions of Southern Italy. The small harbor suffices for the coast-trade. P. 6300.

Rochambeau', de (JEAN BAPTISTE DONATIEN DE **Vimeur**), COUNT, marshal of France, b. at Vendôme, France, July 1, 1725; entered the French army 1742; was distinguished in the campaigns of the Seven Years' war; became field-marshal 1761; was made lieutenant-general Mar. 1, 1780; commanded the French forces in the U. S. during the war of independence 1780–82; took a prominent part in the campaign of Yorktown 1781; became governor of Picardy 1782; was a member of the second "Assembly of Notables" 1788; became marshal 1791; commanded the Army of the North Mar. to June, 1792; was imprisoned during the Reign of Terror, and escaped the guillotine only through the death of Robespierre; was appointed by Napoleon, when First Consul, grand officer of the Legion of Honor (1804). D. at Thoré May 10, 1807. He wrote *Mémoires,* published in 1809 (2 vols.), translated into English by M. W. E. Wright (Paris, 1838).—His son, DONATIEN MARIE JOSEPH, b. in 1750; served in the U. S. 1780–82; took part in the wars of the French Revolution, Consulate and Empire; became lieutenant-general 1792; was governor of Santo Domingo 1796; was taken prisoner there by the English 1803; distinguished himself at the battle of Bautzen, and was killed at that of Leipsic, Oct. 18, 1813.

Roch'dale, town of England, in Lancashire, is built on both sides of the Roch, and has large manufactures of woollen goods, such as baize, flannels, blankets, and kerseys; cotton goods, especially calicoes, and iron and steel ware. In 1844 a co-operative association was founded here by a few flannel-weavers with a capital of £28. In 1870 the association numbered 5560 members, with a capital of £81,232, a library of 7000 volumes, prosperous sick and burial societies, and large investments in cottages for members. P. 44,559.

Rochdale, p.-v., Leicester tp., Worcester co., Mass., on Boston and Albany R. R.

Rochefort', or **Rochefort-sur-Mer** [anc. *Rupifortium*], town, port, and one of the great naval arsenals of France, department of Charente-Inférieure, on the Charente, is surrounded by walls and ramparts planted with trees, and defended by forts at the entrance into the river. Outside is a spacious roadstead protected by the islands of Ré, Oléron, and Aix. Its two harbors are safe and large, able to accommodate the largest ships of war, and lined with extensive wharves, docks, arsenals, ropewalks, cannon-foundries, schools of navigation, magazines, hospitals, and necessary naval establishments of every kind and of excellent description. P. 30,212.

Rochefort (VICTOR HENRI DE ROCHEFORT-LUÇAY), COUNT, b. in Paris, France, Jan. 30, 1830; educated at the college of St. Louis, and at the age of twenty-one began contributing to the Paris press, writing mainly on the drama, art, and society. He became one of the editors of *Figaro,* and was removed from that position by the imperial government because of his liberal opinions. In June, 1868, he founded *La Lanterne,* in which he so bitterly attacked the Empire that in August of the same year the journal was suppressed and its editor condemned to one year's imprisonment and $2000 fine. He fled to Belgium before the sentence was pronounced, and there resumed the publication of *La Lanterne,* which was circulated surreptitiously in France. In Nov., 1869, he was elected a member of the Corps Législatif. Later in the same year he founded a radical journal, *La Marseillaise,* and in Jan., 1870, was sentenced to six months' imprisonment and fined $600 for violent language. He remained in prison until the fall of the Empire at Sedan, when he became a member of the government of national defence and member of the committee on barricades. In Feb., 1871, he founded another journal, *Le Mot d'Ordre,* devoted to sustaining the official policy of M. Gambetta. At the same time he was chosen a member of the National Assembly, when he voted against the proposed basis of peace, and then resigned. He declined to be a member of the Commune, but violently opposed the government. On the entrance of the national troops into Paris he fled toward Belgium, but was arrested, tried for complicity in the acts of the Commune, sentenced to imprisonment for life in a fortress, and sent to the penal settlement of New Caledonia, whence he and several of his associates escaped in the spring of 1874, and returned to Europe by way of the U. S. He has since resided at Geneva. J. B. BISHOP.

Rochefoucauld. See LA ROCHEFOUCAULD.

Rochefoucauld-Liancourt', de la (FRANÇOIS ALEXANDRE FRÉDÉRIC), DUKE, b. in France Jan. 14, 1747; was grand master of the robes to Louis XV. and XVI.; deputy to the States General, where he was one of the leaders of the party of reform; was president of the National Assembly after the taking of the Bastile, July, 1789; sat in the Constituent Assembly; spent the period of the Reign of Terror in travelling in the U. S.; published a *Voyage dans les États Unis* (1795–97) and an *Account of the Prisons of Philadelphia* (1796); established the first savings bank in France; introduced vaccination there, and was twenty-three years inspector-general of the School of Arts and Trades at Chalons. D. at Paris Mar. 27, 1827.

Rochejacquelein. See LA ROCHEJACQUELEIN.

Rochelle, p.-v., Flagg tp., Ogle co., Ill., at intersection of Chicago and Iowa with Omaha line of Chicago and North-western R. R., has 1 newspaper and a thriving trade in grain. P. 1607.

Rochelle', La, town of France, department of Charente-Inférieure, on an inlet of the Atlantic formed by the

two islands Ré and Oléron. It is fortified, well built, with handsome streets and many fine edifices, and has a large, deep, perfectly safe, and commodious harbor, a great arsenal, extensive manufactures of glass, earthenware, cotton twist, sugar, and brandy, and considerable trade in wine, corn, and colonial products. It played a very conspicuous part during the religious wars as a stronghold of the Huguenots. P. 19,506.

Rochelle Salt [first prepared at La Rochelle in 1672], the double tartrate of soda and potassa, an efficient cathartic, considered more palatable than most preparations of the kind. It is chiefly used in preparing seidlitz powders.

Roche′port, p.-v., Boone co., Mo., on Missouri River, has 1 newspaper and a thriving river-trade. P. 823.

Roch′ester, city of England, in the county of Kent, on the Medway, between Chatham and Strood, with which it forms one continuous town. It has a fine cathedral, some trade in coal and hops, and 18,352 inhabitants.

Rochester, p.-v. and tp., Sangamon co., Ill., on Sangamon River and Springfield and Illinois South-eastern R. R. P. 1440.

Rochester, p.-v. and tp., cap. of Fulton co., Ind., 97 miles N. of Indianapolis, near Lake Manitou, has 6 churches, graded schools, 2 banks, and 2 newspapers, ships flour, grain, and produce. P. of v. 1528; of tp. 3726.

J. Major Bitters, Ed. "Union Spy."

Rochester, p.-v. and tp., Cedar co., Ia., on Red Cedar River. P. 174; of tp. 797.

Rochester, p.-v., Butler co., Ky., on Green River. P. 228.

Rochester, p.-v. and tp., Plymouth co., Mass., engaged in farming and lumbering. P. 1024.

Rochester, p.-v., Avon tp., Oakland co., Mich., on Bay City division of Michigan Central R. R.

Rochester, city and tp., cap. of Olmsted co., Minn., on Winona and St. Paul R. R., 50 miles from Mississippi River. Zumbro River flows through the city, affording fine water-power. It has 12 churches, a public library, 3 national banks, 2 weekly newspapers, a handsome court-house, schools, grist and flouring mills, 2 foundries and machine-shops, 3 hotels, and a public hall; in the centre of the best grain-raising county in the State, it ships annually about 1,000,000 bushels. P. of city, 3953; of tp. 591. Blakely & Hillman, Eds. "Record and Union."

Rochester, p.-v. and tp., Andrew co., Mo., on Platte River. P. 218; of tp. 2672.

Rochester, p.-v. and tp., one of the capitals of Strafford co., N. H., on Salmon and Cocheco rivers, at junction of Conway division of Eastern and Maine Central, Dover and Winnipiseogee branch of Boston and Maine, and Portland and Rochester R. Rs., has fine water-power, extensive woollen-factories, and 1 newspaper. P. 4103.

Rochester, city and port of entry, cap. of Monroe co., N. Y., 229 miles W. of Albany; lat. 43° 8′ 17″ N., lon. 77° 51′ W. The first house was erected in 1812; incorporated as the village of Rochesterville 1817, as a city 1834. P. in 1820, 1500; 1830, 10,863; 1840, 20,191; 1850, 36,403; 1860, 48,204; 1876, 82,500. The site is upon a level plain on both banks of Genesee River, 7 miles from and 263 feet above Lake Ontario. In the course of the river through the city there are three falls, of 96 feet, 26 feet, and 83 feet respectively, below the last of which the stream becomes navigable for all lake vessels. From the upper fall, near the centre of the city N., nearly to the lake, the river-banks are of precipitous rock, varying in height from 100 to 210 feet. The immense water-power afforded by these falls is the foundation of the prosperity and rapid growth of the city, the water being thrice used in its course through its limits. The main stem of New York Central R. R. crosses the town at the upper fall, and there are three branches of the road centring here—one to Syracuse *viâ* Auburn, one to Niagara Falls, and one to the mouth of the Genesee. Other railroads having termini here are Genesee Valley, running S. and connecting with the Erie R. R.; Northern Central, running to Baltimore; and Rochester and State Line, completed to Le Roy, and now finishing to Salamanca on Atlantic and Great Western R. R. The Lake Ontario Shore R. R. crosses the river at its mouth, and is to be brought to the city by a branch. Erie Canal crosses the river by a fine stone aqueduct, 848 feet long, on 7 arches, and Genesee Valley Canal, coming from the S., ends here. The city has an average length of 4 miles by about the same breadth. It is laid out in broad streets, generally well paved and lighted, and abounding in fine shade trees. There are also numerous and spacious parks. The dwellings are, to a much greater degree than is usual in cities of its size, detached and stand back from the streets, and are surrounded with lawns and shrubbery. The business portion is notably well built. Among the public buildings, the city hall, court-house, Free Academy, and savings bank form a conspicuous architectural group, while in their immediate neighborhood is Powers's Commercial Fireproof Building, one of the finest in the country, recently erected at an expense of over $1,000,000. The churches are 60 in number, including the Roman Catholic cathedral, a fine edifice of moderate size, but effective and correct in style. Other examples of good taste in architecture are afforded in the First Presbyterian, the Temple street, St. Peter's, and the First Baptist churches. In the matter of education Rochester has for many years been prominent among the cities of the land. The University of Rochester, established 1850, has taken high rank among the colleges of the U. S., and has 10 professors and 160 students. It possesses a spacious building, containing the chapel, cabinet, and recitation-rooms, 100 × 60 feet, constructed of red sandstone, and Sibley Hall, of similar material, costing $125,000, and containing the university library of 13,000 vols., both situated in a campus of 23 acres finely laid out. The endowment (including buildings) is about $600,000. The Theological Seminary (Baptist) is located in a fine four-story brick edifice on East avenue, and was established 1850. It has 8 professors and 77 students, is the largest of that denomination in the U. S., and has besides a German department in a separate building; value of real estate, $100,000; of endowment, $250,000, with a library of 8500 vols. There are 23 public schools, generally of fine size and proportions, divided into primary, intermediate, and grammar schools, and the Free Academy (cost $125,000), which affords instruction in the higher branches; 200 teachers are engaged in these various schools in the tuition of about 10,000 pupils. The value of the buildings and furniture is $500,000. Connected with this system is the Public Library of 8000 vols. It is estimated that 6500 pupils attend the parochial and other private schools. The Athenæum, a literary association, has been in existence some forty years, and possesses a reading-room and a library of 18,000 vols.; and the Law Library, located in the court-house, has 10,000 vols.

There are two hospitals (City and St. Mary's), well located in airy situations, with spacious buildings capable (together) of providing for 500 patients, and each is under the care of a competent corps of physicians. The other benevolent institutions are St. Mary's, St. Patrick's, St. Joseph's, and the Protestant orphan asylums; the Church Home of the Episcopal Church; the Home for the Friendless; the Industrial School, and the Home for Truant Children—all possessing fine buildings. The House of Refuge for juvenile delinquents (a State institution) is located in an enclosure of 42 acres in the N. part of the city. The buildings are 382 feet front, with two large wings at right angles therewith, and several large workshops, etc. in the rear and detached. About 430 boys are confined here, and are instructed in some useful trade. They are sentenced for no fixed period, but are dismissed when by correct behavior and proficiency in work they are deemed by the trustees reformed and capable of earning a support. There has recently been established by the State a department for the correction of female juvenile delinquents, and a large and beautiful building, capable of accommodating 200 inmates, has been erected near the house for males. Both are under the same supervision, and receive prisoners from the central and western parts of the State. The Monroe co. penitentiary, almshouse, and insane asylum, located S. of the city, are a spacious, new, and imposing group of buildings, well constructed with a view to heating and ventilation, and vastly superior in all respects to such institutions in general. The penitentiary receives convicts from many of the counties of Western New York, and is admirably conducted.

Mount Hope Cemetery, one of the oldest of its kind in the U. S., was established 1838, and possesses 200 acres of land on the southern boundary of the city. It is agreeably diversified with hill and dale, and many of the original forest trees have been preserved. The grounds are laid out in a picturesque manner, and are admirably kept and cared for. A tower on the highest summit affords a fine view of the city and vicinity, and there is a substantial granite chapel in the grounds, and a beautiful keeper's lodge at the entrance. The Roman Catholic Cemetery of the Holy Sepulchre, established 1872, is located N. of the city on a fine site of 140 acres, upon which a stone chapel is to be erected. There are 2 gas companies, one on each side of the river, with a total capital of $1,200,000, and with 60 miles of mains. A street railway company operates 7 different routes, radiating from the centre of the city and having 14 miles of track. The 4 savings banks have an aggregate deposit of $13,000,000, and there are 6 banks of discount, with a combined capital and surplus of $1,800,000, and 4 private bankers, all with a total deposit of $3,500,000.

A magnificent system of waterworks has recently been constructed at a cost of $3,250,000, with two sources of supply—one from the river, the water being forced through 8 miles of mains in the business centre by the Holley patent, and is used for suppressing fires and running light machinery; the other is from Hemlock Lake, 29 miles S. and 400 feet above the city. There is a receiving reservoir of 85,000,000 gallons capacity, and a distributing of 45,000,000 gallons, from which the water is sent through 60 miles of mains along all the principal streets. The water is of the first quality for softness and purity, and 10,000,000 gallons can be distributed daily from this source. The two systems can be connected in case of accident to either, and thus a certain supply is guarantied. The pressure on the mains is such as to throw from the hydrants a stream 130 feet perpendicularly, and no city is more perfectly guarded from fire. The nursery business, owing to a singular adaptation of soil and climate, has assumed vast proportions. There are 3500 acres under cultivation in the city and vicinity, yielding an average yearly product of $1,000,000.

The manufacturing interests of the city, owing to its fine waterpower, are both immense and diversified. In earlier years flour was the chief product, and although now dwarfed by other branches it is still of great importance, there being 18 mills, grinding annually, with 75 run of stone, 2,500,000 bushels of wheat. Ready-made clothing is by far the largest manufacture; capital $2,500,000, with 6500 employés, and annual sales of $5,500,000. Boots and shoes rank next—$1,250,000 of capital, annual product of $3,500,000, and 2000 hands. The Leighton Iron Bridge Works employ 300 men and sell $1,000,000 yearly; 18 breweries make nearly 100,000 barrels of beer and ale per year; 5 tobacco-factories produce 1,250,000 pounds, and 70 cigar-makers 9,000,000 cigars; $500,000 is employed in furniture-making, with 1000 hands, annual product $800,000; the Stewart Rubber Co., recently established, with 100 employés makes 1500 pair of shoes daily, and has ordered machinery which will increase this product to 10,000 pair per day. The largest carriage-factory in the U. S. is located here, and has a capacity for 800 hands. Among the other larger branches of manufactures are optical instruments, perfumery, steam-engines, blast furnaces, fruit-canning, glassware, bank locks, agricultural machinery, and two immense establishments for garden and flower seeds.

The city is becoming a great distributing centre for coal, which is loaded from railroads on the banks of the river directly into vessels, which convey it to all points on the lakes in yearly increasing quantities. The business centre of the fertile Genesee Valley, Rochester exhibits a steady growth in wealth and population, which has never been seriously checked since its foundation. It is divided into 16 wards, and its assessed valuation is over $60,000,000.

FRED. A. WHITTLESEY.

Rochester, tp., Ulster co., N. Y. P. 4088.

Rochester, tp., Lorain co., O. (ROCHESTER DÉPÔT P. O.), on Cleveland Columbus Cincinnati and Indianapolis R. R. P. 691.

Rochester, p.-b. and tp., Beaver co., Pa., at the confluence of Beaver with Ohio River, here crossed by a bridge, and at junction of Pittsburg Fort Wayne and Chicago with Cleveland and Pittsburg R. R. P. 2091; of tp. 620.

Rochester, p.-v. and tp., Windsor co., Vt. P. 1444.

Rochester, p.-v. and tp., Racine co., Wis., on Fox River, on Western Union R. R. P. 392; of tp. 876.

Rochester (JOHN **Wilmot**), EARL OF, b. at Ditchley, Oxfordshire, England, Apr. 10, 1648; succeeded to the title 1659; became a favorite at the court of Charles II.; wrote poems in accordance with the prevailing taste; was noted for intemperance and profligacy, and also for his conversion from infidelity on his deathbed. D. July 26, 1680. His *Poems* and *Familiar Letters* were posthumously published. Biographies were written by Bishop Burnet and by Dr. Johnson.

Rochester (LAWRENCE **Hyde**), EARL OF, second son of the earl of Clarendon, the celebrated historian, b. in England about 1635; was carefully educated; entered Parliament for Oxford University 1661; was sent on various diplomatic missions to Poland and Germany; was plenipotentiary at the Congress of Nymwegen 1666; became first lord of the treasury and privy councillor 1679; was made baron of Wootton-Bassett and Viscount Hyde 1681; succeeded to the earldom of Rochester 1682; became lord president of the council 1684, lord treasurer and prime minister on the accession of James II., 1685; was deprived of his offices from unwillingness to become a Roman Catholic 1686; took part in the revolution of 1688; was leader of the High Church party in the reign of Anne, and became president of the council 1710. D. May 2, 1711.

Rochester (NATHANIEL), b. in Westmoreland co., Va., Feb. 21, 1752; served in North Carolina during the war of the Revolution with the rank of major and of commissary-general; became a merchant and manufacturer at Hagerstown, Md.; bought large tracts of land in Genesee Valley 1800, and settled in 1818 in Rochester, N. Y., which had been named after him in 1812. D. there May 17, 1831.

Rochester, University of, a college established in 1850 by the Baptists of Western New York in co-operation with their brethren in other parts of the State, who felt the need of an institution of this nature. Though under the effective control of the Baptist denomination, both the faculty and the board of trustees embrace members of other religious denominations, and about one-half the undergraduates are from other than Baptist families. The university opens to students three courses of study—the classical, the scientific, and the eclectic. In 1876 it had eight professors, 160 students, $212,016.49 in invested funds, and $378,662.27 in real estate, a library, cabinet, and buildings. The geological cabinets of the university (collected by Prof. Ward) have been pronounced by competent judges among the best in the country. The alumni of the university numbered in 1876 about 600, of whom an unusually large proportion had devoted themselves to mercantile pursuits and to journalism. In 1853, Martin B. Anderson assumed the presidency of the university, a position which he still holds. J. H. GILMORE.

Roch'et (*rochettus*), in the Roman Catholic Church costume, a garment of lace or lawn resembling a surplice with tight sleeves. It is worn by bishops and others.

Rochet' (LOUIS), b. at Paris Aug. 24, 1813; studied under David d'Angers, and began to exhibit in 1835, his first statue being a *Boy extracting a Thorn from his Foot.* Among his most prominent works are *Napoléon*, at Brienne (1853); *Madame de Sévigné*, at Grignan (1857); a colossal equestrian statue of Pedro I., at Rio de Janeiro (1861); and a similar statue of Charlemagne (1867).

Rochette' (DESIRÉ RAOUL), b. at St. Amand, department of Cher, France, in 1789; was appointed professor of history at the normal school of Paris in 1815, keeper of the cabinet of metals in 1818, professor in archæology at the Collége de France in 1820. D. at Paris July 5, 1854. His principal works are—*Histoire critique de l'Etablissement des Colonies grecques* (4 vols., 1815), *Monuments inédits d'Antiquité* (1828), *Sur les Antiquités chrétiennes des Catacombes* (1839). His *Letters on Ancient Art* were translated into English by H. M. Westropp (1854).

Rock [Fr. *roche*, "a rock"], in technical language, any considerable aggregation of mineral matter, whether hard and massive like granite, marble, sandstone, etc., or unconsolidated like clay, sand, and gravel. Incoherent mineral aggregates, as sand, clay, etc., only receive this name when they form some definite portion of a geological series. The science which has been formed by the combination of facts observed in regard to rocks is called *lithology*, or sometimes *petrology*. Rocks may be divided into three classes—*igneous*, *sedimentary*, and *metamorphic*. Of these the igneous rocks are such as have derived their distinguishing characters from the action of fire. They form two groups—*volcanic* and *plutonic* rocks—of which the first are the immediate product of volcanic eruption, have generally consolidated under no greater pressure than that of the atmosphere, and are usually porous, cellular, or friable. They include trachyte, lava in its various forms, volcanic tufa, obsidian, pumice, etc. Plutonic rocks are more massive and compact, and are supposed to have cooled from fusion at great depths and under heavy pressure. They include igneous granite, porphyry, igneous diorite, sienite, dolerite, etc. The sedimentary rocks are such as have been deposited from water. They form three groups—viz. *mechanical*, *chemical*, and *organic* rocks. The mechanical sediments are those which are composed of fragments of pre-existing rocks triturated and distributed by aqueous agency. This group includes gravel, sand, and clay, or the same materials consolidated into conglomerate, sandstone, and shale. Organic stratified rocks are such as have been formed through the agency of animal or vegetable life. They are limestones, which are mostly derived from the hard parts of marine animals, Foraminifera and mollusks; diatomaceous earths, composed chiefly of the silicious shields of diatoms; shell-marl, which accumulates at the bottoms of bodies of fresh water; coal and peat, etc. Chemical rocks are those which have been precipitated from chemical solutions, and among these are to be enumerated rock-salt, gypsum, the ores of iron and other metals, vein-stones, travertine, etc. Metamorphic rocks are aqueous sediments which have been changed from their original condition and made

more compact and crystalline by heat—which has baked or vitrified them—by steam, or hot or cold chemical solutions. By these agents shale is converted into slate, sandstone into quartzite, limestone into marble.

The classification of the igneous and metamorphic rocks is yet incomplete and confused, as it has been mainly based on superficial observation and speculation. The composition, relations, and history of the different varieties can only be accurately determined by laborious and patient microscopic and chemical study—an investigation as yet but fairly begun. This subject is, however, now receiving the attention of many eminent mineralogists, and such progress has been already made in it that it is confidently expected not only that the igneous rocks will ultimately be accurately classified, but that by such study much new light will be thrown on the early history of the earth. (See VOLCANO.) The metamorphic rocks are always much disturbed and folded, and compose all mountain-chains (while isolated cones are made up of fused and ejected material), and it is probable that the heat that has changed them has been derived from arrested motion. (See METAMORPHISM.) The formation of sedimentary rocks may be seen in progress in the ocean off any coast. Here we find, as the effect of shore-waves, rain and rivers, frost and sun, the land constantly worn away, and the débris spread over the adjacent sea-bottom. Just along the shore a belt of beach sand or gravel is usually formed; outside of this a belt of fine mechanical sediment (fine sand and clay); still farther out, and beyond the reach of the wash of the land, a calcareous mud or "ooze," derived from the hard parts of marine organisms. When consolidated by solutions of silica or lime, the materials of these belts form respectively sandstone or conglomerate, shale, and limestone. On coasts composed of limestone rock and about coral islands calcareous sands and gravels are formed instead of the more common silicious fragmental rocks. In any submergence of the land and advance inland of the shore-line sheets of these materials would be spread over all the area invaded and for some time occupied by the sea—first, the beach deposit, conglomerate and sandstone, then the off-shore fine mechanical sediments, shale or earthy limestone, and finally, pure limestone. As the sea shallowed and retreated, mixed fine mechanical and organic sediments would be deposited from it, completing a "circle of deposition." Such sequences of sedimentary rocks, formed by advances and retreats of the sea, compose all the great "systems" into which the "geological column" is divided. J. S. NEWBERRY.

Rock, county of Minnesota, at the S. W. angle of the State, adjoining Iowa and Dakota, intersected by Rock and Big Sioux rivers and their tributaries, has a rolling prairie surface, well adapted for stock-raising. Cap. Luverne. Area, 432 sq. m. P. 138.

Rock, county of S. Wisconsin, adjoining Illinois, on Rock River, traversed by Chicago and North-western, Milwaukee and St. Paul, and Western Union R. Rs., consists largely of fertile prairie. Staples, Indian corn, oats, wheat, hay, tobacco, hops, butter, and wool; has large numbers of horses, cattle, sheep, and swine, and numerous manufactories of carriages, agricultural implements, and furniture. Cap. Janesville. Area, 750 sq. m. P. 39,030.

Rock, tp., Mitchell co., Ia. P. 474.

Rock, tp., Jefferson co., Mo. P. 2896.

Rock, tp., Mercer co., West Va. P. 1240.

Rock, tp., Rock co., Wis. P. 1062.

Rock'away, p.-v. and tp., Morris co., N. J., on Rockaway River and Morris Canal, and on Morris and Essex and Hibernia Mine R. Rs., has foundries and rolling-mills, and is in the vicinity of iron-mines. P. 6445.

Rock Bluff, p.-v. and tp., Cass co., Neb. P. 756.

Rock'bridge, county of W. part of Virginia, in the Valley of Virginia, bounded S. E. by the Blue Ridge, intersected by James and North rivers, and crossed in its N. W. corner by Chesapeake and Ohio R. R. The celebrated "Natural Bridge," from which the county derives its name, is on Cedar Creek, near the S. extremity. Staples, wheat, Indian corn, hay, tobacco, wool, and butter. There are 16 flour-mills and several tanneries and manufactories. Cap. Lexington. Area, 700 sq. m. P. 16,058.

Rock'bridge, p.-v. and tp., Richland co., Wis. P. 994.

Rock Cas'tle, county of Central Kentucky, bounded S. E. by Rock Castle River, drained by its branches, intersected by Louisville Nashville and Great Southern R. R., and has a mountainous surface. Staples, Indian corn, tobacco, sorghum-molasses, wool, and butter. Some coal is found. Cap. Mount Vernon. Area, 350 sq. m. P. 7145.

Rock Castle, p.-v., Trigg co., Ky., on Tennessee River. P. 80.

Rock Creek, p.-v. and tp., Carroll co., Ill., on Western Union R. R. P. 2056.

Rock Creek, tp., Hancock co., Ill., on Toledo Peoria and Warsaw and Toledo Wabash and Western R. Rs. P. 1201.

Rock Creek, tp., Hardin co., Ill., on Ohio River. P. 856.

Rock Creek, tp., Bartholomew co., Ind. P. 1203.

Rock Creek, tp., Carroll co., Ind., on Wabash River. P. 1316.

Rock Creek, p.-v. and tp., Huntington co., Ind., on Wabash River. P. 1639.

Rock Creek, tp., Wells co., Ind., on Wabash River. P. 1326.

Rock Creek, tp., Jasper co., Ia. P. 480.

Rock Creek, tp., Cowley co., Kan. P. 441.

Rock Creek, p.-v. and tp., Jefferson co., Kan. P. 441.

Rock Creek, tp., Nemaha co., Kan. P. 740.

Rock Creek, tp., Guilford co., N. C. P. 1082.

Rock Creek, tp., Wilkes co., N. C. P. 960.

Rock Creek, v., Morgan tp., Ashtabula co., O., on Ashtabula Youngstown and Pittsburg R. R. P. 491.

Rock Creek, tp., Dunn co., Wis. P. 267.

Rock-crys'tal, a name for the purest and most transparent forms of quartz. Some of these are of great beauty, and the crystalline forms are often very fine. Rock-crystal is sometimes used for spectacle lenses, for a gem cut like the diamond, etc. It is harder than ordinary glass.

Rock'dale, new county of N. Georgia, on South River, traversed by Georgia R. R.; has a rolling surface and a productive soil. Iron and gold have been found. Cap. Conyers. Area, 200 sq. m.

Rockdale, p.-v., Randolph co., Ala. P. 624.

Rockdale, tp., Crawford co., Pa. P. 1664.

Rockdale, p.-v., Milam co., Tex., on International and Great Northern R. R., 324 miles from Galveston, has 3 banks, 1 newspaper, good schools, machine-shops, and extensive stock-yards. Large numbers of cattle are shipped from this place, and the soil is well adapted for the production of cotton. P. about 500.

McGREGOR & MUIR, EDS. "MESSENGER."

Rock Dell, p.-v. and tp., Olmsted co., Minn. P. 837.

Rock Elm, p.-v. and tp., Pierce co., Wis. P. 554.

Rock'et [It. *rocchetta*], a projectile known from remote antiquity in China and India, but first introduced into Europe about A. D. 900, the distinguishing characteristic of which is that it is set in motion by a force within itself, and therefore combines the functions of gun and projectile. Rockets were employed at first chiefly in fireworks for popular amusement; were subsequently utilized in war for igniting an enemy's citadel; and were also used for signals. About the beginning of the nineteenth century Sir William Congreve gave them greater precision, and prepared them for extended military employment as weapons of offence. They are now falling into disuse.

Rock Falls, p.-v., Whitesides co., Ill., on S. bank of Rock River, 110 miles W. from Chicago and the terminus of Chicago and Rock Falls branch of Chicago Burlington and Quincy R. R., has 1 church, a good public school, 1 bank, 1 newspaper, 2 hotels, 1 paper and 2 flouring mills, 1 machine-shop, 1 planing-mill, 1 table and 1 wagon manufactory, and fine water-power. P. 471.

W. H. CADWELL, ED. "PROGRESS."

Rock'field, p.-v. and tp., Carroll co., Ind., on Toledo Wabash and Western R. R. P. 289.

Rock'fish, a name under which the *Roccus lineatus*, or striped bass of New Jersey, is known along the Atlantic seaboard from Southern New Jersey southward to Virginia. (See STRIPED BASS.)

Rock Fish, tp., Cumberland co., N. C. P. 2982.

Rock Fish, p.-v. and tp., Duplin co., N. C. P. 1380.

Rock'fish, tp., Nelson co., Va. (ROCKFISH DÉPÔT P. O.). P. 3841.

Rock'ford, p.-v., cap. of Coosa co., Ala. P. 1068.

Rockford, city and tp., cap. of Winnebago co., Ill., on Chicago and North-western R. R., and on both sides of Rock River, 92 miles W. of Chicago, the seat of Rockford Female Seminary, an institution closely allied in its origin and history with Beloit College. The city is adorned by rows of natural trees, whence it has received the name of "Forest City." Located in an agricultural district unsurpassed in beauty, in the fertility of its soil, and in the intelligence of its people, possessed of one of the

most extensive water-powers of the West, and blessed with religious and educational advantages of a high order, it is not to be wondered at that there has grown up a city occupying the front rank of the inland cities of the "Prairie" State. Water-mains extend through the principal streets both in East and West Rockford—one pipe crossing the river from the works, the other at the foot of Morgan street, South Rockford, making now about 21 miles of pipe laid throughout the city. The water now used is wholly accumulated from springs, though a large main extends to the river which can be immediately utilized if a larger quantity is needed. The pumping power is the "new pumping engine and automatic pressure regulator." The pumps are 9 inches in diameter and 24 inches stroke, and the four deliver, at one revolution of the engine, 51.4 gallons of water, or 431.76 pounds. This set of machinery will pump 3,000,000 gallons of water in twenty-four hours, when running at the rate of 39 revolutions per minute. The motion of the machinery is put under the control of the pressure of water in the street-mains supplied by it, and the movement is thus increased or diminished in exact ratio to the increase or diminution of the draughts from these mains. The water-pressure regulator is provided with a piston placed within a piston-chamber, and having a rod extending outward, which is connected with a crossbar, having heavy weights attached to prevent a sudden or spasmodic movement. A small pipe connects the piston-chamber with the water-mains, so that any change in the pressure of the water is at once communicated to the piston, causing it to rise or fall as the pressure is increased or diminished. The water-pressure regulator is usually set at a pressure of 45 pounds, and in case of non-action the water safety-valve, at a pressure of 55 pounds, is the next exhaust, the water-regulator being so connected with the steam-power that as the water-pressure rises equal to that of steam, the engine stops. Rockford has a fine museum, containing collections of stuffed birds, rare old coins, precious stones, geological specimens, shells, etc. The manufacturing interests are mainly confined to agricultural implements. In 1844 the Rockford Hydraulic Co. was organized, and built a dam across the river about 800 feet long, the power being under a six-foot head. There are 2 furniture-factories, 1 extensive watch manufactory, 1 woollen and 1 cotton mill, several flour-mills, 2 insurance companies, 5 weekly newspapers, 1 oatmeal-factory, and 8 banks of savings and deposit, with an aggregate capital of over $1,500,000. P. of city, 11,049; of tp. 1383. A. E. Smith, Ed. "Rockford Gazette."

Rockford, p.-v. and tp., Floyd co., Ia., on Shell Rock River and on Burlington Cedar Rapids and Minnesota R. R., has 1 newspaper. P. 732.

Rockford, tp., Pottawattamie co., Ia. P. 623.

Rockford, tp., Sedgwick co., Kan. P. 197.

Rockford, p.-v., Algoma tp., Kent co., Mich., on Grand Rapids and Indiana R. R. P. 582.

Rockford, p.-v. and tp., Wright co., Minn. P. 782.

Rockford, tp., Caldwell co., Mo. P. 870.

Rockford, p.-v., Surry co., N. C. P. 890.

Rock Gap, tp., Morgan co., W. Va. P. 635.

Rock Grove, p.-v. and tp., Stephenson co., Ill. P. 1096.

Rock Grove, tp., Floyd co., Ia. P. 1289.

Rock Hill, tp., Bucks co., Pa., on North Pennsylvania R. R. P. 3363.

Rock Hill, p.-v., York co., S. C., on Charlotte Columbia and Augusta R. R.

Rock Hill, tp., Stafford co., Va. P. 1105.

Rock'ingham, county of S. E. New Hampshire, extending along the Atlantic coast from Maine to Massachusetts, bounded N. E. by Piscataqua River, watered by Squawscot, Lamprey, Cocheco, and other rivers, and traversed by Manchester and Lawrence, Concord and Portsmouth, Boston and Maine, Eastern, and Nashua and Rochester R. Rs., has a broken surface, well adapted to pasturage. Staples, potatoes, hay, wool, butter, and cheese. Manufactories, especially of ironware, of clothing, and of boots and shoes, are very numerous. There are above 20,000 milch cows, many other cattle, and sheep. Caps. Portsmouth and Exeter. Area, 700 sq. m. P. 47,297.

Rockingham, county of North Carolina, adjoining Virginia, intersected by Dan and Haw rivers, and traversed by Richmond and Danville R. R., has a broken surface and a fertile soil. Staples, Indian corn, sweet potatoes, tobacco, honey, and butter. There are several manufactories of chewing tobacco. Cap. Wentworth. Area, 600 sq. m. P. 15,708.

Rockingham, county of N. Virginia, stretching across the great Valley of Virginia from the Shenandoah Mountains on the N. W. to the Blue Ridge on the S. E., intersected by both forks of Shenandoah River, traversed by Winchester Potomac and Harrisonburg division of Baltimore and Ohio R. R., and has a very fertile soil. Staples, wheat, Indian corn, oats, hay, sorghum-molasses, wool, and butter. Horses, cattle, sheep, and swine are numerous. There are 14 flouring-mills. Cap. Harrisonburg. Area, 850 sq. m. P. 23,668.

Rockingham, tp., Scott co., Ia. P. 280.

Rockingham, p.-v., cap. of Richmond co., N. C., on Carolina Central R. R., has 1 weekly newspaper. P. 454.

Rockingham, p.-v. and tp., Windham co., Vt., on Rutland division of Vermont Central R. R. P. 2854.

Rockingham (Charles Watson **Wentworth**), Marquis of, b. in England May 13, 1730; became earl of Malton 1750, and succeeded to the marquisate in December of the same year; became premier in 1765, acquiring popularity in the American colonies on account of the repeal of the Stamp Act Mar., 1766; retired from office July 12, 1766, and again became premier on the resignation of Lord North, Mar. 22, 1782. D. at Wimbledon, Surrey, July 1, 1782.

Rock'ing Stones, or **Logan Stones,** large rocks which are so balanced upon other stones that they can be rocked by the hand. They abound in many parts of the world, and in not a few cases are evidently boulders which have been dropped by glaciers or icebergs.

Rock Island, county of N. W. Illinois, extending along Mississippi River, and intersected by Rock River, traversed by numerous railroads, which centre at Rock Island, has a rolling surface and a fertile soil, and abundant deposits of coal and limestone. Staples, Indian corn, wheat, oats, potatoes, hay, and butter. Manufactories of saddlery and harness, carriages, agricultural implements and other hardware, flouring and saw-mills. Cap. Rock Island. Area, 350 sq. m. P. 29,783.

Rock Island, p.-v., Stanstead co. and tp., Quebec, Canada, adjoining the village of Derby Line, Vt., and on a branch of Massawippi Valley R. R., 20 miles from Island Pond, Vt. Here are 3 large boot and shoe manufactories, a fine hotel, mineral springs, an iron-foundry and machine-shop, and 1 weekly newspaper. P. about 800.

Rock Island, city, cap. of Rock Island co., Ill., on Mississippi River, 180 miles W. of Chicago, is one of the principal railroad centres of the West, and steamboats leave daily for St. Louis and St. Paul during the season of navigation. Rock Island contains 11 churches, St. Augustana College (founded by the Swedish Lutheran denomination), excellent public and private schools, 3 national and 1 private bank, a large public library, and 2 newspaper establishments, issuing daily and weekly editions. It is lighted with gas, and supplied with water from the Mississippi River by means of the Holly pressure system. Among its manufactories are the Rock Island Glass Co., an extensive plough-factory, the Rock Island Co.'s stove-foundry, and several other establishments. There are 3 lumber and 2 flouring mills, 4 sash, door, and blind factories, 1 distillery, machine-shops, etc. The railway and river shipping facilities are excellent, affording wholesale dealers direct communication with all points N., W., and S., while the water-power at Moline, 2 miles distant, and at Milan, 3 miles away, makes it the centre of an extensive manufacturing region. Connected with the city is Rock Island, from which the municipal name was derived. Previous to and during the Black Hawk war a garrison was kept at Fort Armstrong, a series of block houses on this island, and during the civil war many Confederate soldiers were kept in its famous prison. The national government is now building the most extensive armory and arsenal in the country here. Motive-power is to be supplied from the Moline waterworks, which were improved in the most durable manner at government expense, and the right thus acquired to three-fourths of the power. The city is connected with Davenport, Ia., by an iron bridge with a passage for railway trains above and vehicles below. This bridge was built by the government as an approach to Rock Island arsenal, the Chicago Rock Island and Pacific R. R. Co. defraying a portion of the cost of construction. P. 7890. Walter Johnson, Ed. "Daily Union."

Rock Island, p.-v., Troy tp., Perry co., Ind., on Ohio River. P. 241.

Rock'land, county of S. E. New York, bounded E. by Hudson River and S. W. by New Jersey, crossed by Hackensack and Ramapo rivers, and intersected by Erie and Northern New Jersey R. Rs., consists largely of the Highland range of hills skirting the Hudson, has extensive quarries of red sandstone, and manufactures vast quantities of lime and brick. Agriculture is very limited. Cap.

New City (CLARKSTOWN P. O.). Area, 208 sq. m. P. 25,213.

Rockland, city, seaport, and cap. of Knox co., Me., on the western shore of Owl's Head Bay, which forms its harbor, and on Knox and Lincoln R. R., 60 miles E. N. E. from Portland and about the same distance S. S. W. from Bangor. The city was incorporated in 1854, and contains 8 churches, excellent public schools, 1 savings and 2 national banks, besides a bank of discount and deposit, 4 weekly newspapers, and a well-organized fire department. Rockland is supplied with water and gas, and is extensively engaged in the manufacture of lime, producing 1,000,000 casks annually; also in commerce, trade, and to some extent shipbuilding. Its territorial limits embrace about 7000 acres, and it has a water-front of about 4½ miles, affording ample facilities for commerce. P. 7074.

Z. POPE VOSE, ED. "ROCKLAND GAZETTE."

Rockland, p.-v., Plymouth co., Mass., on Hanover branch of Old Colony R. R., 19 miles S. of Boston, has good schools, a savings bank, 1 newspaper, and 1 hotel. The manufacture of boots and shoes forms an extensive industry. P. about 4278.

J. SMITH, ED. "ROCKLAND STANDARD."

Rockland, p.-v. and tp., Ontonagon co., Mich., on Ontonagon River. P. 1479.

Rockland, p.-v. and tp., Sullivan co., N. Y., on New York and Oswego Midland R. R. P. 1946.

Rockland, tp., Berks co., Pa. P. 1451.

Rockland, p.-v. and tp., Venango co., Pa., on Allegheny River and Allegheny Valley R. R. P. 2068.

Rockland, tp., Brown co., Wis. P. 753.

Rockland, tp., Manitowoc co., Wis. P. 889.

Rockland Lake, a beautiful sheet of water 4 miles in circumference, in Clarkstown tp., Rockland co., N. Y., opposite Sing Sing, 36 miles N. of New York, 1 mile W. of Hudson River, and 160 feet above its surface. Here some 200,000 tons of ice are annually cut for market by about 1000 men. The post-village of Rockland Lake extends from the Hudson (Slaughter's Landing) to the lake. It has some manufactures. P. 510.

Rock'lin, p.-v., Placer co., Cal., on Central Pacific R. R., is the location of the machine-shops of that railroad, and has fine quarries of granite. P. 542.

Rock Mart, p.-v., Polk co., Ga., at W. terminus of Cherokee R. R., has 1 newspaper, fine slate-quarries, and a considerable trade in cotton and grain.

Rock Mill, p.-v., Randolph co., Ala. P. 929.

Rock'port, p.-v., cap. Hot Spring co., Ark., on Cairo and Fulton R. R., and on Washita River, which is navigable to this point.

Rockport, p.-v. and tp., cap. of Hanson co., Dak., on W. bank of Dakota River.

Rockport, p.-v., cap. of Spencer co., Ind., on Ohio River and Cincinnati Rockport and South-western R. R., has 7 churches, 3 public-school buildings, 2 newspapers, 1 bank, several mills and manufacturing shops, and 5 hotels. Rockport is surrounded by a fine farming country, abounding in timber and coal. P. 1720.

G. E. BULLOCK, ED. "REPUBLICAN JOURNAL."

Rockport, p.-v., Ohio co., Ky., on Elizabethtown and Paducah R. R. P. 173.

Rockport, p.-v., Camden tp., Knox co., Me., on Penobscot Bay.

Rockport, p.-v. and seaport of Essex co., Mass., 32 miles N. E. of Boston, on Gloucester branch of the Eastern R. R., has 5 churches, a public library, a national and savings bank, a large cotton-mill, 1 newspaper, good schools, 2 hotels, an organ-factory, and 3 isinglass manufactories. Principal business, quarrying granite, fishing, and farming. P. 3904.

L. CLEAVES & CO., EDS. "ROCKPORT GLEANER."

Rockport, p.-v., Tarkio tp., cap. of Atchison co., Mo., 5 miles E. of Rockville, a station on Kansas City St. Joseph and Council Bluffs R. R., has 2 weekly newspapers. P. 490.

Rockport, p.-v. and tp., Cuyahoga co., O., on Rock River. P. 2001.

Rockport, city and seaport, cap. of Aransas co., Tex., on Aransas Bay, in direct communication with New Orleans by water, has 4 churches, an institute, good schools, and 1 newspaper. Rockport is one of the largest cattle-marts of Texas. C. F. BAILEY, ED. "TRANSCRIPT."

Rock Rapids, p.-v., cap. of Lyon co., Ia., on Rock River, 22½ miles W. of St. Paul and Sioux City R. R., has abundant water-power, a rich soil, good schools, 1 newspaper, and 2 hotels. Principal business, farming, trading, and real estate. P. about 200.

MOULUX & DICKINSON, EDS. "ROCK RAPIDS REVIEW."

Rock River rises in Fond du Lac co., Wis., flows through Horicon Lake, receives its W. fork, and traverses Lake Koshkonong; passing southward into Illinois, its course becomes south-westward. After a somewhat rapid course of 350 miles, it reaches the Mississippi 2 miles below Rock Island. It is not navigable except at high water, but affords much water-power. Its valley is picturesque and fertile. Its total fall is 379 feet, and if desirable slack-water navigation might easily be perfected throughout a large part of course.

Rock Roe, tp., Prairie co., Ark. P. 277.

Rock Run, p.-v. and tp., Stephenson co., Ill., includes the village of Rock City on Western Union R. R. P. 2242.

Rock-Salt. See SALT.

Rock'ton, p.-v. and tp., Winnebago co., Ill., at confluence of Rock and Pecatonica rivers and on Western Union R. R. P. 1827.

Rock Vale, p.-v. and tp., Ogle co., Ill. P. 757.

Rock'ville, p.-v., Tolland co., Conn., at the terminus of Rockville branch of Hartford Providence and Fishkill R. R., 15 miles E. of Hartford, contains 6 churches, excellent schools, 2 national and 2 savings banks, 1 newspaper, 2 hotels, a job-printing establishment, 8 woollen-mills, manufactories of warps, sewing silk, stockinet, envelopes, and ginghams. The water-power for these mills is supplied by Hockanum River, which has a fall of 286 feet. It is furnished with water and gas. P. about 5000.

F. H. STICKNEY, ED. "JOURNAL."

Rockville, tp., Kankakee co., Ill. P. 1112.

Rockville, p.-v., Adams tp., cap. of Parke co., Ind., on Logansport Crawfordsville and South-western R. R., in a rich agricultural district, has 2 newspapers. P. 1087.

Rockville, p.-v. and tp., cap. of Montgomery co., Md., on Metropolitan branch of Baltimore and Ohio R. R. P. 660.

Rockville, p.-v. and tp., Stearns co., Minn. P. 403.

Rockville, v., Greene tp., Adams co., O., on Ohio River. P. 937.

Rockville, v., Middle Paxton tp., Dauphin co., Pa. (SUSQUEHANNA P. O.), on Susquehanna River, here crossed by a railroad bridge, on Schuylkill and Susquehanna division of Philadelphia and Reading R. R., and on Pennsylvania R. R. P. 259.

Rockville, tp., Anderson co., S. C. P. 871.

Rockville Centre, p.-v., Queens co., N. Y., 16 miles from Brooklyn, on Southern R. R. of Long Island, has 4 churches, an academy, 1 newspaper, and a planing and moulding mill. It is a summer resort for residents of New York City and Brooklyn.

C. L. WALLACE, ED. "SOUTH SIDE OBSERVER."

Rock'wall, new county in Texas, set off from Kaufman since 1870, is watered by branches of Trinity and Sabine rivers, has a rolling prairie surface and a fertile soil. Cap. Rockwall. Area, about 170 sq. m.

Rockwall, p.-v., cap. Rockwall co., Tex.

Rock'well (JOHN ARNOLD), b. at Norwich, Conn., Aug. 27, 1803; graduated at Yale College 1822; became a lawyer at Norwich; was a member of the State senate 1838–39; judge of the New London co. court 1840; member of Congress 1847–51; was principally instrumental in procuring the establishment of the court of claims at Washington, D. C.; practised much before it, and was author of *The Mexican Law of Mines and Real Estate* (2 vols., 1851–52), a standard work. D. at Washington, D. C., Feb. 10, 1861.

Rockwell (JULIUS), b. at Colebrook, Conn., Apr. 26, 1805; graduated at Yale College 1826; studied law at the New Haven Law School; was admitted to the bar in Litchfield co. 1829; settled at Pittsfield, Mass., 1830; was a member of the Massachusetts legislature 1834–38, being Speaker 1835 and 1838; was bank commissioner 1838–41; member of Congress 1847–51; of the Massachusetts constitutional convention 1853; was U. S. Senator 1854–55, filling the unexpired term of Edward Everett, and was a judge of the Massachusetts superior court 1859–71.

Rock'wood, p.-v., Eramosa tp., Wellington co., Ontario, Canada, on river Speed and on Grand Trunk Railway, 41 miles W. of Toronto, has an academy and important manufactures. P. about 600.

Rocky Bar, p.-v., cap. of Alturas co., Id., on Lewis fork of Columbia River.

Rocky Bayou, tp., Izard co., Ark. P. 720.

Rocky Comfort, p.-v., cap. of Little River co., Ark.

Rocky Fork, tp., Boone co., Mo. P. 1870.

Rocky Gap, p.-v. and tp., Bland co., Va. P. 1000.

Rocky Grove, tp., Orangeburg co., S. C. P. 697.

Rocky Head, tp., Dale co., Ala. P. 800.

Rocky Hill, p.-v. and tp., Hartford co., Conn., on Connecticut River. P. 971.

Rocky Hill, p.-v. and tp., Somerset co., N. J., on Raritan River and Delaware and Raritan Canal, at W. terminus of Rocky Hill R. R.

Rocky Mount, p.-v. and tp., Edgecombe co., N. C., on Tar River, at junction of Wilmington and Weldon R. R. with Tarborough branch of the same road, has 1 newspaper. P. of v. 357; of tp. 2158.

Rocky Mount, p.-v. and tp., cap. of Franklin co., Va., on Richmond and Trans-Alleghany Narrow-gauge R. R. (proposed), has 2 churches, 1 savings bank, 1 newspaper, and 2 hotels. P. 2034.

W. A. AND C. J. GRIFFITH, EDS. "VIRGINIA MONITOR."

Rocky Mountain Locust, the *Caloptenus femur-rubrum.* See LOCUST, by PROF. A. S. PACKARD, JR., M. D.

Rocky Mountains, all the mountains of North America between the great plains and the Pacific Ocean. The term "Stony Mountains" was originally applied, but was finally replaced by the name "Rocky Mountains." This name, which has become fixed by popular usage, is very appropriate. On the mountains and plateaus of the greater part of the region naked rocks are seen to an extent rarely known elsewhere on the globe, as the region is largely destitute of soil and timber. A variety of climatic and geologic causes conspire to this end. Chief among these are extreme aridity and great elevation, the lack of moisture preventing the growth of vegetation, and great elevation promoting rapid denudation of the rock-material disintegrated at the surface. The mountains are composed of crags and peaks of naked rock, and the mountain-streams run at the feet of towering cliffs in deep gorges beset with rocks. The hills, unprotected by vegetation, are swept clean of sands and soil by the winds. The watercourses rarely have flood-plains, and the steep sides of the valleys are strewn with fragments of rock. In the plateau region the streams run in deep cañons, whose walls rise hundreds, or even thousands, of feet above the waters, and the channels below are choked with rocks which tumble from the cliffs. By reason of unequal erosion of the general surface, due to petrologic structure under conditions of great aridity, long lines of cliffs or towering escarpments of rock stand athwart the plateaus. These cliffs are often for scores or even hundreds of miles almost or quite impassable barriers to travel.

In very late geological time the whole region has been the scene of much volcanic activity. Great mountain-ranges have extinct volcanoes on their flanks; high plateaus have dead volcanoes on their backs; broad mesas are covered with sheets of lava; great valleys have been filled with extravasated matter, and scoria and ashes are scattered over the land. Some of this extravasation is so recent that the congealed floods are yet preserved with all their forms of stream and wave, and these naked rocks appear without soil and without even mosses and lichens. The land is well characterized as the Rocky Mountain region. But extreme aridity is not a characteristic of the entire region. Those ranges that are near the Pacific coast N. of the 42d parallel of N. lat. are abundantly supplied with water, and here the indurated beds are greatly masked by dense forests.

This great mountain-system extends through the U. S. from its southern border, through British America and Alaska to the Arctic Ocean, or from the 30th to the 70th parallel of N. lat. Its greatest development in longitude is between the 38th and 42d degrees of N. lat.; here the grand system has a breadth of about 1000 miles. Its highest peak is Mount St. Elias, lat. 60° 20′ 45″ and lon. 141°, which rises to an altitude of 19,500 feet above the level of the sea, as determined by Dall.

In the same grand system may be included the mountains of Mexico and Central America, though the term Rocky Mountains has rarely been applied to them. The mountains of Central America are composed of cordilleras and volcanoes, the geological characteristics of which are yet unknown. The system is separated from the Andes of South America by the narrow Isthmus of Panama, where a pass is found from Atlantic to Pacific waters having its summit not more than 100 feet above the level of the sea. The mountain-region of Central America is separated from the mountain-region of Mexico by the Isthmus of Tehuantepec, where a pass is found from the Gulf of Mexico to the Pacific, its summit not more than 700 feet above the level of the sea. The mountains of Mexico are usually termed by geographers the Mexican Cordilleras, but locally the term "cordilleras" is applied only to certain ranges; the other great mountain-masses, whether their origin be by extravasation or upheaval and degradation, have their special names. Too little is known of the topography, and especially of the geological structure, of the mountains of Mexico to warrant any classification or sub-grouping, and we are not able to separate the more northern mountains of Mexico from the more southern mountains of the U. S.

Passing from Mexico to the U. S., we reach the Rocky Mountains proper; and here the geography and geology of the region have been studied to such an extent as to warrant a partial classification of the grand system into minor groups or systems; but such classification cannot be carried into British America. In the U. S. are the following systems: the Desert Ranges, the Park Ranges, the Plateaus, the Basin Ranges, the Sierra Nevada, the Coast Ranges, the Cascade Mountains, and, provisionally, the Geyser Ranges.

The Desert Ranges extend through Southern California, Southern Arizona, and South-western New Mexico southward into old Mexico; the limits of the group in this direction are unknown. They are bounded on the N. by the Basin Range region and the Plateau region; on the E. by the N. and S. mountains of the Rio Grande; on the N. W. they coalesce with the spurs of the Sierra Nevada and Coast Ranges; and here, at present, no definite line of demarcation can be drawn. Nor do we know with which group the mountains of the peninsula of California should be classed. These mountains have a N. W. trend, varying from 30° to 60° W. of N. So far as their geological structure is known, they are of the Basin Range type—*i. e.* a monoclinal ridge of displacement, or a displacement due to a fault on one side and a flexure on the other, which may otherwise be described as the half of an anticlinal fold. The typical ridge is composed of strata dipping one way, the front or face of the range being the escarped edges of the strata, and the back of the ridge conforming to some extent with the dip of the strata. Very few of the ranges are as simple as the type described, as they are complicated by secondary faults, and flexures transverse, oblique, and sometimes even longitudinal, with the principal structure. Simple anticlinals are rarely found. The ridges described are composed of granites, schists, and Palæozoic sandstones and limestones; but these rocks and the monoclinal structure are often masked by extravasated beds found on the flanks, or sometimes partly burying the ranges, and many of the mountains are chiefly of eruptive origin. Usually, these mountains rise as island ridges from a desert sea of sand, the most inhospitable region of North America, but near their north-eastern limits in Arizona and New Mexico, the general altitude being greater, there is more precipitation of moisture. The Colorado River divides the system. On the E. the mountains are drained by Bill Williams' Fork and the Gila; on the W. there is no living stream tributary to the Colorado, but the ranges that extend to the coast are drained by streams that fall directly into the Pacific. Of the age of the dry land there is no certain knowledge, but the mountain-forms due to upheaval and atmospheric degradation, and also the mountain-forms due to extravasation, are of very late geological origin—much later than the dry land from which they rise.

Principal Mountains of the Desert Range System.

Name.	Range or group.	Height.	Name.	Range or group.	Height.
Authority, Wheeler:			Wah-gu-yhi Pk.,	Grapevine Mts.,	8,528
Ingo Pk.,	Ingo Range,	11,337	Cerro Gordo "	....	9,432
Hahn "	"	11,298	Wancobe "	....	11,267
New York Pk.,	"	10,594	————	Funeral Range,	4,971
Matinaugo Pk.,	Darwin Range,	8,845	————	Bare Mts.,	6,039
Telescope "	Telescope "	10,938			

The Park System extends from Southern Wyoming through Central Colorado into New Mexico, bounded on the N. by the Laramie Plains, on the E. by the Great Plains, and on the W. by the Plateaus; the southern limits cannot yet be defined. There are a great number of ranges in New Mexico on either side of the Rio Grande del Norte having a N. and S. trend, the general structure and geological relations of which are unknown. They may constitute a system or sub-system by themselves, or they may be considered as a part of the Park System. The general trend of the Park Ranges is a few degrees W. of N., but there are exceptions. These mountains are drained by the Platte and Arkansas, which flow into the Mississippi; by the Rio Grande del Norte, which flows into the Gulf of Mexico; and by the Colorado River of the West, which flows into the Gulf of California. The axial ridges of the system—*i. e.* those which separate the Atlantic from the Pacific drainage—constitute a part of the continental divide. The system is composed of ranges and irregular groups which stand as walls about the great parks. In North Park heads the North Platte; in Middle Park heads

the Grand, a tributary of the Colorado; in South Park heads the South Platte, and the Rio Grande del Norte drains the San Luis Park. These parks are broken valleys nearly or completely surrounded by mountains. Besides the larger parks mentioned, there are many of smaller extent, mountain-valleys of great beauty in midsummer, but mantled with snow during many months of the year. Most of the ranges are known to be of the Uinta type—*i. e.* broad plateau-like masses carved from blocks upheaved in part as integers, and in part as bodies of many parts—a structure more fully described below. Many of the park-spaces are zones of diverse displacement. These mountains are composed of granites, schists, Palæozoic, Mesozoic, and Tertiary sediments, and the sedimentary groups are separated by many and well-defined unconformities, giving evidence of alternating periods of dry-land condition and oceanic sway; but the last great orographic movement which upheaved the great masses from which the mountains have been carved began in Tertiary time. The following are the principal ranges and groups of this system in succession from E. to W.: Rising from the plains in full view of Denver is the Colorado Range, which on the N. is nearly continuous with the Medicine Bow Range, and the latter is the eastern wall of North Park. To the S. it trends westward toward Mount Lincoln. W. of the Plains, S. of the South Platte, E. of Trout Creek and the head-waters of the Fountain River, is a low plateau-like range which Dr. Hayden has considered a part of the Colorado Range, and has called them as combined the Colorado or Front Range; but both for geographic and geological reasons it may be better to separate the ranges, and to call the high snowy mountains W. of Denver the Colorado Range, the inferior southern mountains the Front Range. Between North and Middle Parks is the Park View Mountain, the culminating peak of a range with an E. and W. trend, but not well defined. Next in order to the westward is the Park Range, which extends from Buffalo Peaks northward nearly to the junction of the Sweetwater with the North Platte River. This range forms the western wall of South, Middle, and North Parks. The Colorado Range in its western trend toward Mount Lincoln abuts against the Park Range, and thus is formed the southern wall of Middle Park and the northern wall of South Park. From the N. end of this range, W. of North Park and the northern end of Middle Park, long spurs and irregular mountains extend westward to the Plateaus. To the S. of these ranges there is a great mass of mountains without apparent structure as a range; this is the Pike's Peak Group. W. of the S. end of the Park Range is the valley of the Arkansas, and W. of the valley is the Sawatch Range, with the Mount of the Holy Cross as its northern extremity. This range trends 30° W. of N. Still farther W. is the Elk Mountain Group, which consists of a series of short, parallel ranges closely massed, trending in the same direction as the Sawatch Range.

Returning to the border of the Plains, the first range S. of the Arkansas is the Wet Mountain. Its trend is the same as the last. To the W., and parallel with this range, is the Sangre de Cristo, called in one portion of its course the Sierra Blanca. This range trends westward in its southern prolongation, and breaks up near Santa Fé. To the W. of it lies San Luis Park, and beyond the park is the enormous irregular rugged mass known as the San Juan Mountains, and beyond are the Plateaus.

Many spurs and smaller detached masses of this system have received names, and the feats of many adventurous travellers in scaling the towering peaks of these ranges have been chronicled. Everywhere throughout the region the mountain-climber sees a wilderness of crags and peaks, and a scene wild, grand, and desolate, and many a clear, cold, emerald lake embosomed on the mountains.

Principal Mountains of the Park Range System.

Name.	Range or group.	Feet.	Name.	Range or group.	Feet.
Authority, Gannett, U. S. G. G. S.:			Capitol Mt.,	Elk Mountain R.,	13,997
Gray's Peak,	Colorado Range,	14,341	Snowmass Mt.,	"	13,970
Torrey's Peak,	"	14,336	Pyramid Peak,	"	13,885
Mt. Evans,	"	14,330	White Rock Mt.,	"	13,857
Long's Peak,	"	14,271	Italian Peak,	"	13,350
Mt. Guyot,	"	13,565	Treasury Mt.,	"	13,200
Cheyenne Mt.,	Front Range,	9,948	Mt. Daly,	"	13,193
Platte Mt.,	"	9,343	Lopus Peak,	"	12,823
Park View Mt.,	Park View R.,	12,433	Gothic Mt.,	"	12,570
Mt. Lincoln,	Park Range,	14,297	Custer Butte,	"	12,052
Buffalo Peak,	"	13,541	Greenhorn Mt.,	Wet Mountain,	12,230
Mt. Powell,	"	13,398	Garland Peak,	Sangre de Cristo,	14,300
Pike's Peak,	Pike's Peak G.,	14,147	Crestone,	"	14,233
Mt. Harvard,	Sawatch Range,	14,375	Mt. Rito Alta,	"	13,989
Mt. Elbert,	"	14,351	Hunt's Peak,	"	13,423
La Plata Mt.,	"	14,311	Mt. Wilson,	San Juan Mts.,	14,280
Massive Mt.,	"	14,298	Unkarpagri,	"	14,235
Mt. Autoro,	"	14,215	Mt. Sniffels,	"	14,158
Mt. Princeton,	"	14,196	Mt. Eolus,	"	14,054
Mt. Yale,	"	14,187	Handie's Peak,	"	13,997
Holy Cross Mt.,	"	14,176	Rio Grande Py-		
Mt. Shavano,	"	14,093	ramid,	"	13,773
Mt. Ouray,	"	14,043	Mt. Osu,	"	13,640
Grizzly Peak,	"	13,956			
Castle Peak,	Elk Mountain R.,	14,115	Authority, Wheeler:		
Narrow Mt,	"	14,003	Mt. Thomas,	Sierra Blanca,	11,496

The Plateaus.—The great plateaus stretch from Southern Wyoming through Western Colorado and Eastern Utah far down into New Mexico and Arizona. They are bounded on the N. by the Wind River and Sweetwater Mountains, on the E. by the Park Mountains, on the S. by the Desert Range region, and on the W. by the Basin Range region. The region is chiefly drained by the Colorado River of the West; on the S. W. by the Sevier and Virgin rivers, and a small portion on the S. E. by the Rio Grande del Norte. The general elevation is about 7000 feet above the level of the sea. The ascent from the low desert plains on the S. is very abrupt, in many places by a steep and almost impassable escarpment. Geologically, the plateaus are separated into blocks by faults or their homologues, monoclinal flexures—a structure to which the name "Kaibab" has been given, where the blocks are displaced as integers. These geological features serve in part to divide the region into many topographic blocks. The streams which traverse the plateaus have their sources in the Wind River Mountains on the N. and in the Park Mountains on the E., and in their courses through the plateaus they run in profound gorges or cañons, further dividing the area into blocks; and this division is completed by lines of cliffs due to the unequal erosion of harder and softer beds under conditions of aridity. Thus, by faults and monoclinal flexures, by deep cañons, and by lines of cliffs this region is cut into a great number of plateaus. Some of the larger or more important of these plateaus are as follows: The Colorado Plateau, lying S. of the Grand Cañon of the Colorado—general elevation, 7500 feet; Shiwits Plateau, N. of the Grand Cañon, W. of the Grand Wash, E. of the Hurricane Cliffs, and S. of the Vermilion Cliffs—general elevation, 6000 feet; Uinkaret Plateau, N. of the Grand Cañon, E. of the Hurricane Cliffs, W. of Kanab Cañon, and S. of the Vermilion Cliffs—general elevation, 6000 feet; Kaibab Plateau, N. of the Grand Cañon and W. of the Marble Cañon—general elevation, 7500 feet. The three last plateaus extend from Northern Arizona into Utah. Farther to the N., on the W. side of the Sevier River, the Mar-ka-gunt Plateau—general elevation, 8500 feet; on the E. side of the Sevier the Pauns-a-gunt Plateau—general elevation, 8000 feet; the Aquarius Plateau, N. of the Pauns-a-gunt—general elevation, 11,000 feet. S. W. of the Paria River, near the head of Marble Cañon, are the Paria Plateau—general elevation, 6000 feet; the Kai-pai-owits Plateau, N. of the Paria and E. of the Pauns-a-gunt—general elevation, 7500 feet. The Ta-va-puts Plateau is in Eastern Utah, bounded on the N. by the Uinta and White River valleys, and on the S. by the Book Cliffs, and is cut in twain by the Green River—general elevation, 7000 feet. There are many others of the plateaus of nearly equal importance.

On these plateaus stand buttes, lone mountains, and groups of mountains. The buttes are of cameo structure—*i. e.* mountains of circum-denudation, with horizontal strata and escarped sides. The mountains, composed in whole or in part of extravasated matter, exhibit many interesting types of structure. The grand structure-lines of these plateaus have a N. and S. trend, but with important and diverse exceptions. In addition to the plateaus proper, there are many mountains due to upheaval and degradation, some of which are found in zones of diverse displacement, others are of simple anticlinal structure, and still others of the Uinta structure. The more important of these mountains of diverse type is the Zuñi Range, far to the S., and the Uinta Range, far to the N. The Uinta Range is carved from a broad upheaval having an E. and W. axis. On either flank of the upheaval there is a line or zone of maximum displacement, where the upheaval is by flexure or by faulting. Between these zones there is a gentle flexure either way to the axis. Thus, the upheaval is in part by general flexure from the axis as an anticlinal, and in part by faulting and monoclinal flexure, as in the Kaibab structure; thus behaving in part as an integer, and in part as a body of many parts. The Uinta Range, as before mentioned, has been taken as a type of this structure.

The Plateaus have been continuously above the sea since the close of the Cretaceous period, but during earlier Tertiary times the region was an area of lacustrine sedimentation, and during late Mesozoic and early Tertiary time the Basin Province was the dry land that fed the sea and lakes of the Plateau Province. The great displacements by which the region was broken into blocks began in early Tertiary time, and is probably yet in progress. The Plateaus are composed of Tertiary, Mesozoic, and Palæozoic sediments. Crystalline schists and granites are found in some of the deep cañons.

On the next page is presented a table containing the principal mountains of the different ranges, groups, etc., of the Plateaus, giving their name, location, height, and the authority for the measurements:

Principal Mountains of the Plateaus.

		Feet.	
Mt. San Francisco,	Colorado Plat.,	12,052,	Whipple.
Mt. Dellenbough,	Shiwits Plat.,	6,650,	Thompson, U.S.G.G.S.
Mount Trumbull,	Unikaret Plat.,	8,187,	" "
Mount Logan,	"	7,950,	" "
Mount Emma,	"	......	" "
Mount Brian,	Mar-ka-gunt Pl.,	11,178,	" "
Little Creek Peak,	"	9,971,	" "
Bear Valley Peak,	"	9,274,	" "
Monroe Mountain,	Sevier Plateau,	11,240,	" "
Blue Mountain,	"	11,071,	" "
Mount Dalton,	"	10,480,	" "
Marysvale Peak,	"	10,359,	" "
Adam's Head,	"	10,181,	" "
Musinia Peak,	Musinia Plat.,	10,764,	" "
Kaiparowits P'k,	Kaiparowits P.,	9,095,	" "
Mount Ellen,	Henry Group,	11,389,	" "
Mount Pennell,	"	11,335,	" "
Mount Hillers,	"	10,645,	" "
Mount Ellsworth,	"	8,280,	" "
Mount Marvine,	Unkarpagu R'ge,	11,598,	" "
Fish Lake Mountain,	"	11,578,	" "
Mount Hilgard,	"	11,453,	" "
Terrill's Ridge,	"	11,380,	" "
Gilson's Crest,	"	11,000,	" "
Emmons's Peak,	Uinta Mount's,	13,694,	King.
Mount Hodges,	"	13,500,	"
Mt. Tokurwana,	"	13,500,	"
Dawes's Peak,	"	13,300,	"
Gilbert's Peak,	"	13,250,	"
Wilson's Peak,	"	13,235,	"
Barro Peak,	"	12,834,	"
Marsh's Peak,	"	12,410,	"
Leidy's Peak,	"	12,400,	"
Pa-ri-kaiv,	La Sal Group,	12,980,	Gannett, U. S. G. G. S.
Thousand Lake Mountain,	"	11,229,	Thompson, U.S.G.G.S.
Navajo Mountain,	"	10,308,	" "
Escudilla Mountain,	"	10,691,	Wheeler.

Basin Ranges.—These ranges occupy South-eastern Oregon, Southern Idaho, Western Utah, Nevada, and the north-eastern corner of California. The region is bounded on the E. by the great plateaus, on the W. by the Sierra Nevada, and on the S. by the region of the Desert Ranges; their extent to the N. is unknown. They are N. and S. ridges of comparatively low altitude and narrow bases. The desert-valleys separating them are filled with subaërial gravels and sands, completely masking the underlying formations. The general type of structure is that previously mentioned as characteristic of the Desert Ranges, but here the structure is better exemplified, and hence has been called the Basin-Range structure. Such are the characteristics of these mountains so far as they are due to upheaval and atmospheric degradation; but many of the ranges are complicated by extravasated masses that mask the general structure to a greater or less extent. It is probable that this region has been above the level of the sea since Jurassic time, and some portions of it longer, but the great orographic displacement which produced the present ranges is of very late date, and it is probable is yet in progress. One of the characteristics of these ranges is, that they usually rise abruptly from the desert plain without intervening foot-hills, and rarely do the ranges coalesce. The region occupied by these mountains has no drainage to the sea except to a limited extent on the N. side, where some of the mountains stand near the Shoshone River, and on the south-eastern corner, where a few of the ranges are drained by the Virgin River, a tributary of the Colorado River of the West. Some of the streams that head on the mountains find their way into salt lakes, and others disappear in sinks—*i. e.* they are lost in the desert sands, where their waters are evaporated.

Three general basins may be designated: (1) The Salt Lake Basin, in which lies Salt Lake, Utah Lake, and Sevier Lake. During glacial times there was a large expanse of fresh water in this great basin, in which was included the sub-basins of the lakes above mentioned. To this ancient body of water Mr. Gilbert has given the name Lake Bonneville. (See Sevier Lake.) (2) The second great basin is that of the Humboldt, which lies E. of the Sierra Nevada, and is separated from the Salt Lake Basin by the Humboldt Mountains. A number of smaller lakes are included in this general depression. (3) The third is the Amargosa Basin, which lies to the S. of the Humboldt Basin and S. W. of the Salt Lake Basin.

There are about 100 ranges in this group. The highest is the Wasatch Range. In this range are found the principal geological formations of the other ranges of the system, and also some of the sedimentary beds of the Plateau System. The escarpment of the range faces the W., and the highest peak, Mount Nebo, is found at the southern extremity. The streams which are used to fertilize the Great Salt Lake and Utah valleys have their sources in these lofty mountains.

The following table gives the principal mountains of the Basin Range System:

Principal Mountains of the Basin Range System.

Name.	Range or group.	Height.	Name.	Range or group.	Height.
Authority, Wheeler:			Globe Pk.,	Toyabe,	11,237
Mt. Nebo,	Wasatch,	11,992	Mt. Moses,	Fish Creek,	8,725
Authority, King:			Signal Pk.,	Havallah,	9,387
Clayton's Pk.,	Wasatch,	11,889	Mt. Bonpland,	East Humboldt,	11,321
Twin Pks.,	"	11,560	Star Pk.,	West "	9,925
Lone Pk.,	"	11,295	Plavine Mt.,	....	8,217
Lewiston Pk.,	Oquirrh,	10,623			
Toorle "	"	10,396	Authority, Thompson:		
Mt. Bonneville,	Aqui,	11,050	Beaver Dam Mts.,	Virgin Range,	8,100
Pilot Pk.,	Ourbe,	10,900	Virgin Pk.,	"	8,000
Gosi Ute Pk.,	Egan Range,	10,491	Mt. Bangs,	"	7,950
Spruce Mt.,	Peoquap "	10,411	Pine Valley Mt.,	Pine Valley R.,	10.250
Tenabo Pk.,	Cortez,	9,240	Craggy Head,	"	8,250
Dalton "	"	9,232	Mt. Delano,	Tushar Range,	12,159
Shoshoni Pk.,	Shoshoni,	9,760	" Belknap,	"	12,114
Mt. Poston,	Toyabe,	12,143	Midget's Crest,	"	11,414
Bunker Hill,	"	11,735	Mt. Katharine,	Pavant Range,	9,802

The Sierra Nevada is one great range stretching from the 35th parallel of N. lat. to about 41° 35′, where the range topographically terminates at Mount Shasta, or perhaps S. of this, at Lassen's Peak. These mountains are carved from a great plateau more than 400 miles in length and 100 miles in breadth. The axis of the range is near the eastern side, and trends about 30° W. of N. Here the streams head, the greater number running westward into the Pacific, the less number running eastward and rapidly descending into desert valleys, where they are lost in the sands. On the eastern side a bold front rises abruptly from the desert plains, presenting a grand façade of storm-carved rocks. On the western side, though the descent to the Sacramento and San Joaquin rivers is greater, the general slope is more gentle, but is broken by many profound gorges or deep cañons, some of which, according to Whitney, are due to faults; others are cut by streams and fashioned by glaciers. At the southern extremity the range is broken into small subsidiary ranges and spurs. At the northern end, from Lassen's Peak to Mount Shasta, the plateau-like character is much broken by volcanic masses, and here the general topographic characteristics are greatly changed. On the western flank of the range there are many table-mountains covered with sheets of lava. This broad massive range is crowned with peaks which rise to higher altitudes than any other in the U. S.

According to Whitney, the region appeared as dry land in late Jurassic time, but it is probable that the last great orographic movement which under conditions of degradation produced the present mountain-forms began in late Tertiary time, and may yet be in progress.

Principal Peaks of the Sierra Nevada System.

Name.	Height.	Authority.
Mount Whitney..............	14,887,	Whitney.
Mount Shasta..................	14,442,	"
Mount Tyndall................	14,386,	"
Mount Kaweah................	14,000,	Toner's *Dict. of El.*
Mount Brewer.................	13,886,	Whitney.
Mount Dana....................	13,297,	"
Mount Lyell.....................	13,217,	"
Castle Peak.....................	13,000,	Petermann's map.
Mount Silliman................	11,623,	Whitney.
Lassen's Peak..................	10,577,	"
Pilot Peak........................	7,500,	Petermann's map.

The Coast System is composed of the low, narrow ranges near the Pacific Ocean, and separated from the Sierra Nevada by the valleys of the Sacramento and San Joaquin rivers, which, often uniting, burst through the ranges, dividing them into two sub-systems, the Northern and Southern Coast Ranges. To the N., beyond the head-waters of the Sacramento, the Coast Ranges topographically coalesce with the Cascade Mountains, and to the S., beyond the head-waters of the San Joaquin, with the Sierra Nevada; but here the geological separation is plain, as shown by Whitney. The general trend of these ranges is 30° W. of N. The Coast Ranges are composed of more or less closely-appressed folds of strata degraded by rains and rivers; *i. e.* they have the Appalachian structure, but complicated and more or less masked by extravasated matter. The summits or axial planes are in general tipped westward or toward the Pacific. The Appalachian type is not known to occur elsewhere in the Rocky Mountain region. The upheaval of these mountains began in late Tertiary times, and may be yet in progress.

Principal Mountains of the Coast Range System.

Name.	Height.	Authority.
San Carlos Peak..................................	4977,	Whitney.
Mount Hamilton..................................	4440,	"
Mount Diablo......................................	3856,	"
Mariposa Peak.....................................	3700,	"

The Cascade Mountains stretch from Southern Oregon northward far into British America. On the E. they are bounded by the great valley of the Columbia River, and on the W. by the Pacific Ocean. The Columbia River where it bursts through this zone of mountains plunges to the level of the sea in a series of great cascades, and from these the mountains take their name. They cannot be separated topographically, nor have we yet sufficient data to separate

them geologically from the northern extremity of the Coast Ranges and Sierra Nevada. But little is known of their general topography and geology, except that the group is characterized by many lofty volcanoes now extinct. The trend of this zone of mountains is a little W. of N.

Principal Mountains of the Cascade System.

Name.	Height.	Authority.
Mount St. Elias	19,500,	Dall.
Mount Jefferson	15,500,	Humboldt (quoted).
Mount Ranier	14,444,	Coast Survey.
Mount Adams	13,258,	Vansant.
Chuchulum Mountain	11,700,	Petermann's map.
Mount Hood	11,225,	Williamson.
Mount Baker	10,760,	Petermann's map.
Mount St. Helen's	9,750,	" "
Skomekan	8,400,	" "
Shalahum	7,400,	" "
Tchopahk Mountain	7,200,	" "
Checolsum Mountain	5,706,	" "

To the N. of the Park Mountains and great plateaus beyond the Laramie Plains and the head-waters of the Shoshone River, are many mountains drained on the S. by tributaries of the North Platte, on the E. by the Missouri River and its tributaries, and on the W. by the Columbia River and its tributaries. No accurate geographic or geological surveys have been made of these mountains, and they may constitute one or more systems, but at present it is proposed to call them provisionally the Geyser Mountains. An outlying range, known as the Black Hills of Dakota, are of the Uinta structure, as shown by Newton.

Too little is known of the Rocky Mountains of British America and Alaska to warrant any description, though Canadian geographers and geologists are rapidly extending their researches westward into the region.

In the U. S. the Rocky Mountains, together with the Great Plains that stretch westward, constitute the great arid region where irrigation is necessary to agriculture. In Northern California and Western Oregon and Washington the precipitation of moisture from the Pacific currents is very great, and hence this region is not embraced in the arid district. The arid region is nearly one-half of the area embraced in the U. S., excluding Alaska. From actual surveys and careful comparative estimates it is shown that it will not be possible to redeem more than 2 per cent. of the entire region by irrigation when every brook, creek, and river is utilized. About 3 per cent. of the region is forest-clad. These forests are on the sides of the high mountains, and extend over the more elevated plateaus. This does not include large districts of country covered with a scant growth of dwarf cedars and pines which can be used for fuel, but are of no value in mechanical industries. Some portion of this forest-region may eventually be cultivated without irrigation, but only such crops can be raised as may mature in the short summers of a subarctic climate. Over the remaining lands a large portion is covered with grasses and other plants which may be utilized to some extent for pasturage. The land to be cultivated lies along the streams, and is principally confined to the little valleys nestling among the mountains. In these patches grain-fields, vineyards, orchards, and gardens will eventually be planted, and receive most careful and elaborate culture. The mountains, hills, and plains will furnish nutritious but scant pasturage for herds and flocks, but altogether the agricultural resources of the region are very limited. Gold, silver, iron, copper, salt, coal, and many other minerals are found in great abundance, and the region will be chiefly valuable for its great mines. At the present state of rapid progress in mineral discovery it is not safe to generalize on the geographic distribution of the minerals of the region. J. W. POWELL.

Rocky River, tp., Cabarrus co., N. C. P. 1521.

Rocky Run, tp., Hancock co., Ill., on Mississippi River. P. 656.

Rocky Spring, tp., Montgomery co., N. C. P. 320.

Rocky Springs, tp., Lexington co., S. C. P. 458.

Rocky Station, p.-v. and tp., Lee co., Va. P. 2304.

Roco'co, a style of debased and extravagant ornamentation for buildings, interiors, furniture, etc., which has several times prevailed in various parts of Europe.

Rodentia. See APPENDIX.

Rod'eric, the last king of the Visigoths in Spain, ascended the throne in 709 in consequence of a revolution by which King Witiza was overthrown, and fell in the battle of Xeres de la Frontera (July, 711) against the Arabs under Tarik, who then took possession of the southern and central parts of Spain. The Spanish and Arab historians disagree very much both with respect to the events which raised Roderic to the throne, his death, and his character, and with respect to the causes which brought about the Arab invasion; but it seems most probable that an insurrection of the Roman and Celtic elements of the population of Spain took place against Witiza, followed by a rising of the partisans of Witiza against Roderic, and that the Arabs, after conquering Mauritania, would have crossed over to Spain, even if they had received no invitation from any dissatisfied party there.

Rodez', town of France, capital of the department of Aveyron, on the Aveyron, is irregularly built, with narrow and winding streets, but is surrounded by pleasant promenades, and its vicinity is noted for its fertility. Woollen fabrics of different descriptions and excellent cheese are manufactured. P. 11,856.

Rodg'ers (C. RAYMOND P.), b. Nov. 14, 1819, in New York; entered the navy as a midshipman Oct. 5, 1833; became a passed midshipman in 1839, a lieutenant in 1844, a commander in 1861, a captain in 1866, a commodore in 1870, a rear-admiral in 1874; served in "the mosquito fleet" in its operations against the Seminoles, and on the E. coast of Mexico during our war with that country; commanded the Wabash at the battle of Port Royal, and Battery Sigel at the reduction of Fort Pulaski, and acted as Rear-Admiral Du Pont's fleet-captain in the attack on Fort Sumter of Apr. 7, 1863; chief of the bureau of yards and docks from 1871 to 1874, when he became supt. of the Naval Academy, which position he held till July 1, 1878; complimented in official despatches throughout his whole naval career, and thus spoken of by Rear-Admiral Du Pont in his report of Apr. 15, 1863: "On this as on all other occasions I had invaluable assistance from the fleet-captain, Commander C. R. P. Rodgers, who was with me in the pilot-house directing the movements of the squadron. For now over eighteen months in this war this officer has been afloat with me, and, in my opinion, no language could overstate his services to his country, to this fleet, and to myself as its commander-in-chief." Uniting the highest sense of personal honor to great administrative ability, determined will, and a character above reproach, no man has done more to raise the *morale* of the navy than Raymond Rodgers; and his good works in it will be remembered with gratitude long after his body shall have been consigned to the grave. FOXHALL A. PARKER.

Rodgers (GEORGE W.), b. Oct. 30, 1822, in Brooklyn, N. Y.; entered the navy as a midshipman Apr. 30, 1836; became a passed midshipman in 1842, a lieutenant in 1850, a commander in 1862; during the civil war commanded the iron-clad Catskill in various actions with the forts in Charleston harbor, and was killed in battle Aug. 17, 1863; spoken of by Rear-Admiral Du Pont as an officer "of the highest professional capacity and courage," and thus mentioned by Rear-Admiral Dahlgren in his official report of Aug. 18, 1863: "It is but natural that I should feel deeply the loss of Capt. Rodgers. Brave, intelligent, and devoted to his duty and to the flag under which he had passed his life, the country will not, I am sure, omit honor to the memory of one who has not spared his life in her hour of trial." FOXHALL A. PARKER.

Rodg'ers (JOHN), b. in Harford co., Md., in 1771; entered the U. S. navy as a lieutenant Mar. 9, 1798; was executive officer of the frigate Constellation when she captured the French frigate L'Insurgente, Feb. 9, 1799; was thereupon made captain Mar. 5; succeeded Com. Barron in command of the squadron operating against Tripoli and Tunis 1805; commanded the President when that vessel had an encounter with the British man-of-war Little Belt, May 16, 1811; rendered various services during the war of 1812–15, especially in the defence of Baltimore; was president of the board of navy commissioners 1815–24, acting secretary of the navy 1823, and commanded the Mediterranean squadron 1824–27, after which he was again on the board of navy commissioners until 1837. D. at Philadelphia, Pa., Aug. 1, 1838.

Rodgers (JOHN), b. Aug. 8, 1812, in Maryland; entered the navy as a midshipman Apr. 18, 1828; became a passed midshipman in 1834, a lieutenant in 1840, a commander in 1855, a captain in 1862, a commodore in 1863, a rear-admiral in 1869; served in the everglades of Florida during the Seminole war, on the E. coast of Mexico during our war with that country, and as a volunteer aide to Rear-Admiral Du Pont at the battle of Port Royal, Nov. 7, 1861; in 1862 commanded the Galena in the severe battle at Drury's Bluff, and in 1863 the monitor Weehawken in the first Fort Sumter fight, and in the short action with the Confederate iron-clad steamer Atlanta, which resulted in the Atlanta's capture; distinguished for calm, cool courage and superior ability, and regarded by his brother-officers as one of the foremost naval men of the age.

FOXHALL A. PARKER.

Rodi, town of Southern Italy, province of Foggia, situated on a rocky promontory rising above the waters of the Adriatic. The adjoining district is very fertile, and

the sea here abounds in fish. The coasting-trade is considerable. P. 5200.

Rö'diger (Emil), b. at Sangerhausen, Thuringia, Oct. 13, 1801; studied theology and Oriental languages at Halle; was appointed professor of Oriental languages there in 1835, and removed in 1860 to Berlin. D. June 15, 1874. He published an edition of Lockman's *Fables* (1830), a *Syrische Chrestomathie* (1838), *Versuch über die himjaritischen Schriftmonumente* (1841), and after Gesenius's death finished his *Thesaurus Linguæ Hebraicæ* and edited his Hebrew grammar from the 14th to the 20th editions (1845–66).

Rod'man, p.-v. and tp., Jefferson co., N. Y. P. 1604.

Rodman (Isaac Peace), b. at South Kingston, R. I., Aug. 28, 1822; became a merchant and a woollen manufacturer; was in 1861 a member of the Senate and a colonel of militia; resigned his seat to raise a company of volunteers; participated as captain of the 2d Rhode Island Vols. in the battle of Bull Run, and as colonel of the 4th Rhode Island Vols. in the capture of Roanoke Island; was made brigadier-general for gallantry at Newberne Mar. 14, 1862, taking the enemy's works at the point of the bayonet; was in command of Gen. Parke's division at Fredericksburg, and displayed high military genius at South Mountain and Antietam. He was mortally wounded in the latter battle in the terrible conflict for the possession of the stone bridge. D. near Hagerstown, Md., Sept. 29, 1862.

Rodman (Thomas J.), b. in Indiana in 1818; graduated at the U. S. Military Academy and commissioned brevet second lieutenant of ordnance July, 1841. His whole life was devoted to the interests of his profession in experimenting upon iron, gunpowder, and cannon, which produced invaluable results. To him is due the honor of inventing the 15-inch and 20-inch smooth-bore guns, and of the method of *hollow casting*, by which alone their manufacture became practicable, with their projectiles, adopted for our military and naval service; also the improvements made in the mode of manufacture of gunpowder for large cannon. The "mammoth powder" and "perforated cake" were made by him, since adopted by foreign nations for use in their heavy rifle guns. Author of a valuable *Report of Experiments on Metals for Cannon and Cannon Powder* (1861). D. at Rock Island, Ill., June 7, 1871.

Rod'ney, p.-v., Jefferson co., Miss. P. 573.

Rodney (Cæsar), b. at Dover, Del., about 1730; inherited a large landed property; was sheriff of Kent co. 1758; member of the legislature many years, its Speaker 1769–74; delegate to the Stamp Act congress at New York 1765; was chairman of the Delaware popular convention 1774; elected to the Continental Congress Mar., 1775; was soon afterward elected brigadier-general; signed the Declaration of Independence; served under Washington in the New Jersey campaign 1776–77; defended Delaware from British invasion; was made major-general of Delaware militia; was president or executive officer of Delaware 1778–82, and was twice elected to Congress, but did not again take a seat in that body. D. at Dover in 1784.

Rodney (Cæsar Augustus), nephew of Cæsar, b. at Dover, Del., Jan. 4, 1772; graduated at the University of Pennsylvania; studied law; was a prominent member of Congress 1803–07, attorney-general of the U. S. 1807–11; commanded an artillery company 1813; went to South America 1817 as member of a commission to report upon the insurrection against Spain; was a member of Congress 1821–22, U. S. Senator 1822–23, and in the latter year appointed first minister to the Argentine provinces. D. at Buenos Ayres June 10, 1824. He was author, with J. Graham, of *Reports on the Present State of the United Provinces of South America* (1819).

Rodney (George **Brydges**), Baron, b. at Walton-upon-Thames, Surrey, England, Feb. 19, 1718; entered the British navy in childhood; was governor of Newfoundland 1748, member of Parliament 1752, rear-admiral 1761, in which year he captured the French West India Islands; vice-admiral 1762, baronet 1764, master of Greenwich Hospital 1765, commander-in-chief in Jamaica 1771, admiral and commander-in-chief at Barbadoes in Dec., 1779, when he sailed from England with a fleet of 30 vessels; defeated a Spanish squadron off Cape St. Vincent Jan. 16, 1780, and broke through the French fleet near Martinique Apr. 17, 1780, for which achievement he received the thanks of both houses of Parliament and a pension of £2000. In the war against Holland (1781) he captured Dutch Guiana; was made vice-admiral of England, and commander-in-chief of the West India squadron; engaged the French fleet under Count de Grasse Apr. 9, and again Apr. 12, 1782, capturing 7 ships of the line and 2 frigates; thanked and pensioned by Parliament, and created Baron Rodney of Rodney Stoke, Somersetshire, 1782. D. in London May 23, 1792. (See his *Life*, by Gen. G. B. Mundy, 1830.)

Rodos'to, town of European Turkey, on the Sea of Marmora, 77 miles from Constantinople, is surrounded with beautiful gardens and orchards, and sends to the metropolis large quantities of vegetables, fruit, and fish. P. 18,000.

Rodri'guez (Alfonso), b. at Valladolid, Spain, in 1526; graduated at Salamanca 1545; entered the order of Jesuits; taught theology at Salamanca and in the college of Monterey, of which he became rector; acquired great fame as a casuist; wrote a work entitled *Practice of Christian Perfection*, which was translated into many languages; for the last thirty years of his life resided at Valladolid and Montilla, being the most noted Spanish master of novices. D. in Seville Feb. 21, 1616.

Roe (Azel Stevens), b. in New York City in 1798; received an academic education; became a merchant in New York, but failing in business through lending his name to other persons, he retired to Windsor, Conn., about 1848, and has since devoted himself successfully to literature. Author of numerous novels, among which are *James Montjoy* (1850), *To Love and to be Loved* (1852), *A Long Look Ahead* (1855), and *True to the Last* (1859).

Roe (Francis A.), b. Oct. 4, 1823, in New York; entered the navy as a midshipman Oct. 19, 1841; became a passed midshipman in 1847, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1866, a captain in 1872; served as executive officer of the Pensacola at the passage of Forts Jackson and St. Philip and battle of New Orleans, and commanded the Katahdin in numerous battles and skirmishes on the Mississippi; commanded the Sassacus in the action between our squadron of wooden gunboats under Capt. Melanchthon Smith and the Confederate iron-plated ram Albemarle, May 5, 1864; highly commended in the official despatches for "coolness, judgment, and skill." Foxhall A. Parker.

Roe (Sir Thomas), b. at Low Layton, Essex, England, about 1580; educated at Magdalen College, Oxford; was knighted 1604; explored the river Amazonas in Brazil 1609; was sent as envoy to the Great Mogul, Shah Jehan, and penetrated to Delhi 1614–18; entered Parliament for Cirencester 1620; was ambassador to Constantinople 1621–28, to Poland and Sweden, charged with negotiating a peace between those kingdoms, 1629; sat in Parliament for Oxford University 1640; was ambassador to the Diet of Ratisbon 1641, and made chancellor of the order of the Garter and privy councillor the same year. He brought from Constantinople a valuable collection of Oriental MSS., which he presented to the Bodleian Library, and procured the celebrated Alexandrian MS. of the Greek Bible, now in the British Museum. It was by his advice that Gustavus Adolphus intervened in the Thirty Years' war in Germany. D. in England Nov., 1644. Author of *A True and Faithful Relation of what hath lately happened in Constantinople* (1622), and of a *Journal of Voyages to the East Indies, Turkey, Egypt, Palestine, and Persia*, first published posthumously in French 1663, and in English in the same volume with Della Valle's *Travels* (London, 1664). It was proposed in 1730 to publish this work by subscription under the title, *The Negotiations and Embassies of Sir Thomas Roe from 1620 to 1644*, in 5 vols., but only 1 vol., comprising *The Negotiations with the Ottoman Porte* (1740), ever appeared. Roe's *Journal* is reprinted in the collections of Kerr (vol. ix.), Churchill (vol. i.), and Pinkerton (vol. viii.).

Roe'bling (John A.), b. at Mulhausen, Prussia, June 12, 1806; received the degree of C. E. from the Royal Polytechnic School at Berlin, the subject of his graduating thesis being suspension bridges—a subject which was destined to gain for him enduring fame. In 1831 he emigrated to this country, locating near Pittsburg, Pa., and after a brief interval commenced the practice of his profession, his first employment being on the slack-water improvement of the Beaver River, followed by similar engagements in other localities, until called into the service of the State of Pennsylvania to make surveys for a railroad route across the Alleghany Mountains from Harrisburg to Pittsburg. One of the routes located by him is that now followed by the Pennsylvania R. R. In 1844, having previously commenced the manufacture of wire rope, he obtained the contract for replacing the wooden aqueduct of the Pennsylvania canal across Allegheny River by a suspension aqueduct, which was opened in May, 1845. This aqueduct consisted of seven spans, each 162 feet in length, the wooden trunk which held the water being supported by two continuous wire cables 7 inches in diameter. The construction of the Monongahela suspension bridge next followed, and in 1848–50 four suspension aqueducts were completed on the line of Delaware and Hudson Canal. In the mean time, Mr. Roebling had established his works at Trenton, N. J., where he took up his residence. In 1851 the great suspen-

sion bridge at Niagara River was commenced, and in Mar., 1855, the first locomotive crossed, since which no interruption to travel has occurred. (See article BRIDGE; also ELLET, CHARLES.) The work of constructing a bridge over Kentucky River with a span of 1224 feet was commenced in 1851, but, owing to the failure of the company, was not completed. The elegant bridge over the Allegheny at Pittsburg, and that over the Ohio at Cincinnati, were his next works. But his last and grandest undertaking was the bridge across East River, connecting Brooklyn and New York. (See EAST RIVER BRIDGE.) The reports, plans, and specifications for this work were all completed and operations begun when, while directing the work, he was severely injured in the foot; lockjaw succeeded amputation, and he d. in Brooklyn July 22, 1869.—His son, WASHINGTON A. ROEBLING, is the able and worthy successor under whose direction the work is progressing favorably. G. C. SIMMONS.

Roe'buck [Ang.-Sax. *râh*], a small species of the deer family (Cervidæ), representing the genus *Capreolus* (*C. capræa*), found in Europe. It is more nearly related in some respects to the small common deer (*Cariacus*) of the U. S. than to any other of the European forms, agreeing with the former in the structure of the legs. It is characteristic, however, in the antlers being destitute of an anterior basal snag, the first branch arising considerably above the burr, and the tail being very rudimentary or wanting; the muffle is broad and naked; the color in summer is reddish-brown, and in winter olive; there is a large white spot surrounding the anus; the height is about two and a quarter to two and a half feet at or near the shoulder; the length about four feet. The species is generally distributed throughout Europe, and frequents woods and copses. It is very agile in its movements. The species is represented in Central Asia and China by a related species, the *Capreolus pygargus*. THEODORE GILL.

Roebuck (JOHN ARTHUR), b. at Madras, India, in Dec., 1802; resided in Canada during his youth and early manhood 1815–24; was called to the bar in London 1832; entered Parliament the same year as a radical reformer; was London agent for the assembly of Lower Canada 1835; lost his seat 1837, and again in 1847, but was returned in 1841; and for Sheffield in 1849, continuing to represent that borough until 1868, and being once more elected there Feb., 1874. Author of a *Plan for the Government of our English Colonies* (1849) and of a *History of the Whig Ministry of 1830* (2 vols., 1852); was a leader of the parliamentary opposition during the Crimean war; was chairman of a committee appointed on his motion to inquire into the state of the army in the Crimea, and was the prime mover in the Administrative Reform Association, organized in 1856. He lost his seat at Sheffield 1868 in consequence of his denunciation of trades unions, and is noted for the oratorical ability he has frequently displayed, more especially in criticism of Mr. Disraeli.

Roemer (OLE). See RÖMER.

Roermond', town of the Netherlands, province of Limburg, at the influx of the Roer into the Maas, is the seat of a bishop, has a fine cathedral and manufactures of cotton and woollen goods. P. 9000.

Roeville, tp., Henry co., Ala. P. 890.

Roga'tion Days [Lat. *rogare*, to "implore"], the Monday, Tuesday, and Wednesday of Rogation Week, the week which contains Ascension Day. In the Roman Catholic Church the recital of the Litany of the Saints is a special feature of these days, and public processions are held in some countries. The second and third Rogation Days are *feriæ*, and not holy days of obligation. Tuesday is a *feria* of the first, and Wednesday of the second class.

Rog'er, the name of the first two rulers of the Norman dynasty in Sicily. ROGER I., the twelfth son of Tancred of Hauteville, b. in Normandy about 1031; joined in 1058 his elder brother, Robert Guiscard, who had made large conquests in Southern Italy; participated in the conquest of Calabria, and received a part of the country; crossed over to Sicily; took Messina in 1060, Palermo in 1072, and succeeded in expelling the Saracens from the island in 1089, and establishing himself as sovereign under the title of count of Sicily. His other great exploit was the abolition of the Greek Church in Sicily and the introduction of the Roman, for which the pope, Urban II., rewarded him by making him apostolic legate, with permission to appoint bishops, etc. D. at Mileto, Calabria, in 1101.—During the minority of his son, ROGER II., b. about 1095, his widow, Adelaide of Montferrat, carried on the government. In 1127, on the extinction of the elder line, Roger II. became duke of Apulia and Calabria, and in 1130 received the title of king of Sicily, and was crowned at Palermo by his brother-in-law, Anacletus, whom he established in Rome as antipope and sustained against Innocent II. The latter excommunicated him, collected an army, and advanced into his territory in 1139, but was defeated and captured, and only restored to liberty on condition of removing the excommunication. Subsequently, Roger II. made war successfully on the Greek emperor, and on the Saracens in Africa. His internal administration was also successful. Commerce and industry, poetry, art, and science, flourished, and Sicily was one of the richest and happiest states of Europe. D. Feb. 26, 1154.

Roger of Wendover, an early Latin chronicler of English history, of whom little more is known than that he was a monk in the abbey of St. Alban's, where he d. May 6, 1237. Author of *Flores Historiarum*, which was recast under the same title by Matthew Paris.

Rog'ers, tp., Ford co., Ill. P. 593.

Rogers, tp., Presque Isle co., Mich. P. 355.

Rogers (FAIRMAN), b. at Philadelphia, Pa., Nov. 15, 1833; graduated at the University of Pennsylvania 1853; was lecturer on mechanics in the Franklin Institute of Pennsylvania 1854–65, and professor of civil engineering in the University of Pennsylvania 1855–70; served as a volunteer in the cavalry and as an officer of engineers 1861; completed for the U. S. Coast Survey in 1862 the survey of the portion of Potomac River northward from Blakiston Island, and was one of the original members of the National Academy of Sciences 1863. He resigned his professorship in the University of Pennsylvania, and was chosen a trustee of that institution in 1870.

Rogers (HENRY), b. in England about 1810; educated at Highbury College; was for some years pastor of an Independent church; was chosen professor of the English language and literature in University College, London, 1839; was afterward professor of philosophy in Spring Hill Independent College, Birmingham, and became in 1858 president of the Lancashire Independent College at Manchester. Author of *Life and Character of John Howe* (1836), *General Introduction to a Course of Lectures on English Grammar and Composition* (1838), *The Eclipse of Faith, or a Visit to a Religious Skeptic* (1853), *Vindication of Bishop Colenso* (1863), *Reason and Faith* (1866), and two series of *Essays*, reprinted from the *Edinburgh Review* and from *Good Words*, besides various other works.

Rogers (HENRY DARWIN), LL.D., F. R. S. E., brother of J. B. Rogers, b. at Philadelphia, Pa., in 1809; became professor of physical sciences in Dickinson College, Carlisle, 1830; many years professor of geology in the University of Pennsylvania; was employed on the geological survey of New Jersey, of which he published a report and geological map 1836, and the final report 1840; was occupied from 1836 to 1855 as director of the geological survey of Pennsylvania, making five annual reports (1836, 1838, 1839, 1840, 1841), and issued his final report under the title *The Geology of Pennsylvania, a Government Survey, with a General View of the Geology of the U. S., Essays on the Coal Formation and its Fossils, and a Description of the Coal-Fields of North America and Great Britain, with seven Large Maps and numerous Illustrations on Copper and on Wood* (3 vols. 4to, with portfolio of maps, Edinburgh and London, 1859). This magnificent work, one of the most elaborate of its class, was published at the expense of the State of Pennsylvania, the maps and illustrations being executed by the eminent geographer A. Keith Johnston, with whose assistance he also published an *Atlas of the U. S.* (1857; new ed. 1861). In 1858, Prof. Rogers, after residing some years at Boston, Mass., was appointed regius professor of natural history in the University of Glasgow, and was chosen a fellow of the Royal Society of Edinburgh. He prepared other American maps for the atlases of the Messrs. Johnston, published many papers in the *Transactions* of learned societies, and was one of the editors of the Edinburgh *New Philosophical Journal*. D. at Glasgow May 29, 1866.

Rogers (JAMES BLYTHE), M. D., b. at Philadelphia, Pa., Feb. 22, 1803; educated in medicine at the University of Maryland; was professor of chemistry in medical colleges at Baltimore and Cincinnati, in the Franklin Medical School at Philadelphia, and in the University of Pennsylvania; was chemical and geological assistant in the surveys of Virginia and Pennsylvania; contributed many papers to medical and scientific periodicals, and (with his brother, R. E. Rogers), edited Dr. E. Turner's *Elements of Chemistry*. D. at Philadelphia June 15, 1852.

Rogers (JOHN), b. at Deritend, a suburb of Birmingham, England, about 1505; graduated at Pembroke Hall, Cambridge, 1525; was rector of the church of the Holy Trinity, London, 1532–34; subsequently for several years chaplain to the Merchant Adventurers at Antwerp and pastor of a Dutch congregation at Wittenberg, Saxony; embraced

Protestant opinions; became intimate with Tyndal and Coverdale; prepared, by the aid of the former's manuscripts, a revised edition of the English Bible, based on Coverdale's translation, with elaborate marginal notes and an index, which he published under the assumed name of "Thomas Matthew," probably at Hamburg or Lubeck (folio, 1537); translated Melanchthon's *Waying and Considering of the Interim* (1548); returned to England 1548; was presented to the rectory of St. Margaret Moyses and the vicarage of St. Sepulchre's, London, May 10, 1550; was made by Bishop Ridley prebendary of St. Paul's, St. Pancras, and rector of Chigwell Aug. 24, 1551; was soon after appointed divinity reader; preached a sermon at St. Paul's Cross on the Sunday after the entry of Queen Mary into London (Aug. 3, 1553), in which he denounced Romanism and exhorted the people to adhere to the doctrines promulgated under Edward VI.; was cited before the privy council, where he made an able defence; was ordered to remain a prisoner in his own house Aug. 18, 1553; was removed to Newgate prison about Feb., 1554, tried for heresy before Gardiner, bishop of Winchester, condemned to death Jan., 1555, and burnt at the stake at Smithfield, the first of the "Marian martyrs," Feb. 4, 1555. Throughout his protracted imprisonment, at his several examinations, on his trial, and at the stake he comported himself with admirable serenity. His wife, probably a Dutch woman, with her "ten small children and one at the breast," met him on the way to Smithfield—a fact which has been impressed on the memory of millions by the rude illustrations in Foxe's *Book of Martyrs* and in the New England editions of the *Westminster Catechism.* It was formerly supposed that one or more of his great-grandchildren were among the early settlers of New England, this being especially alleged of Rev. Nathaniel Rogers of Ipswich, Mass., through whom his American descendants were believed to be numerous; but the careful researches of Col. Joseph L. Chester, in his biography of Rogers (London, 1861), have shown this statement to be incorrect.—Daniel Rogers, eldest son of the martyr (b. at Wittenberg about 1538; d. 1591), became a learned scholar and an elegant Latin poet, known in Germany as Albimontanus. He assisted Camden in preparing his *Britannia.*

Porter C. Bliss.

Rogers (John), b. in England about 1565; became a Puritan; was vicar of Hemmingham 1592, minister of Haverhill 1603, and afterward minister of Dedham, England, where he d. 1630. Author of *Sixty Memorials of a Godly Life, A Treatise of Love, The Doctrine of Faith,* and *A Godly and Fruitful Exposition upon all the First Epistle of Peter* (folio, 1650)—works which were held in high repute among the English non-conformists. He has been erroneously called a grandson of the Marian martyr.—His son Nathaniel, b. at Haverhill, England, in 1598; educated at Emanuel College, Cambridge; preached at Bocking, Essex, and at Assington, Suffolk; was driven by persecution to New England, where he arrived Nov. 16, 1636; was a member of the synod of 1637, and was settled Feb. 20, 1639, as colleague with Mr. Norton over the church at Ipswich, Mass., where he d. July 3, 1655. Author of a *Letter discovering the Cause of God's Wrath against the Nation* (London, 1644), and left in MS. a Latin *Vindication of Congregational Church Government.* Hubbard, the historian, married his daughter.

Rogers (John), son of Rev. Nathaniel, b. at Coggeshall, England, Jan., 1631; came in childhood to Massachusetts; graduated at Harvard 1649; studied divinity, and aided his father in his pastoral duties at Ipswich; afterward became a physician, and was president of Harvard College from Apr. 10, 1682, to his death, July 2, 1684.

Rogers (John), b. at Salem, Mass., Oct. 30, 1829; left school at the age of sixteen; was two years a commercial clerk at Boston; then made a trip to Spain; commenced the study of civil engineering at Boston, but having strained his eyes, went into a machine-shop at Manchester, N. H., 1848, as an apprentice; worked up through all the branches of the business, including the drafting-room, and was ultimately put in charge of a railroad repair-shop at Hannibal, Mo., 1856. Having amused himself at spare intervals with modelling in clay, he acquired a thirst for art, which led him to make a tour in Europe in 1857, spending some time at Paris and at Rome. On his return he became draftsman in a surveyor's office at Chicago, and soon afterward, learning of a peculiar mode of casting intricate figures, he modelled the groups of the *Checker-Player* and the *Slave Auction,* with which, in Dec., 1859, he came to New York, where they attracted notice. Learning the art of casting from an Italian, he produced in 1861 his *Picket Guard,* followed by a succession of groups of war-subjects, which soon gained popular favor, critical approval, and ultimately brought him decided success in his new industry. Among them were—*Taking the Oath, One More Shot, The Wounded Scout, Union Refugees* (1864), *The Camp-Fire, The Home Guard, The Returned Volunteer, The Country Post-office,* and *The Town Pump.* Mr. Rogers has a studio in New York City, and has recently devoted himself to larger statuary for gardens and lawns, executed in artificial stone. Among his later works are *The Fugitive's Story* (1869), *The Favorite Scholar* (1872), and a series illustrative of Irving's *Legends of Sleepy Hollow* and *Rip Van Winkle* (1868–71).

Rogers (Nathaniel Peabody), b. at Plymouth, N. H., June 3, 1794; graduated at Dartmouth College 1816; became a lawyer, but abandoned the profession in 1838 to establish at Concord, N. H., the *Herald of Freedom,* one of the pioneer anti-slavery papers in the U. S. He also wrote for the New York *Tribune* over the signature "The Old Man of the Mountain." D. at Concord Oct. 16, 1846. A volume of his fugitive pieces appeared at Concord, 1847, with a memoir by Rev. John Pierpont. (See also Bartlett's *Modern Agitators,* and an article by M. J. Motte in the *Christian Examiner,* vol. xliv.)

Rogers (Randolph), b. in the State of New York about 1825; was in early life engaged in mercantile pursuits; became a sculptor at Rome; returned to New York after a few years with the statues of *Nydia, A Boy and Dog,* and others, which procured him a deserved reputation; designed and modelled the bronze doors representing scenes in the life of Columbus, for the eastern entrance to the Capitol extension at Washington (1858); was several years engaged in finishing the designs for the Washington monument at Richmond, Va., including statues of Mason, Nelson, and the two Marshalls; executed a notable statue of John Adams, now in Mount Auburn Cemetery; *The Angel of the Resurrection,* for Col. Colt's monument at Hartford, Conn.; a colossal memorial monument, 50 feet high, for the State of Rhode Island, erected at Providence 1871, and one still larger for Michigan, erected at Detroit 1873, surmounted respectively by statues representing America and Michigan. He executed the colossal bronze statue of Lincoln unveiled at Philadelphia 1871; has made many good busts and attractive ideal figures, among which those of *Isaac* and *Ruth* merit especial notice. He now (1876) resides at Rome.

Rogers (Richard), b. in England about 1550; became a Puritan minister 1575, and preached at different towns of the eastern counties forty-three years, frequently undergoing molestation from the authorities, but acquiring by his pastoral labors and his theological writings a very prominent position among the dissenting divines of England. His *Seven Treatises* (London, folio, 1605; also 1610, 1616, 1627, and 1630) constituted a kind of theological manual much used by the "Brownists," and highly esteemed by Wilson, Hooker, and the early divines of New England. D. at Weathersfield, Essex, Apr. 21, 1618. Calamy and other writers stated that he was a grandson of the Marian martyr, but this assertion is disproved by J. L. Chester's *John Rogers* (1861).

Rogers (Robert), b. at Dunbarton, N. H., about 1730; commanded during the "old French war" (1755–63) the celebrated corps of frontiersmen known as "Rogers' Rangers," distinguishing himself in the campaigns on Lake George, and taking a prominent part in the defence of Detroit against Pontiac; published *A Concise Account of North America* (London, 1765), *Journals of Major Robert Rogers* (1765), and *Ponteach, or the Savages of America* (1766), a tragedy now extremely rare; was appointed governor of Michilimackinac; was soon accused of plotting to deliver that post to the French; was sent in irons to Montreal and tried by court-martial; went to England 1769; was presented to the king, and imprisoned for debt; went to North Africa, where he "fought two battles in Algiers under the dey;" was in Philadelphia 1775, and imprisoned by order of Congress; was paroled, but again arrested by Washington Jan., 1776; was sent to New Hampshire, where he took sides for the Crown, and raised a company of loyalists known as "The Queen's Rangers," of which he became colonel. He went to England about 1777, and his subsequent history is unknown. His *Diary of the Siege of Detroit* was first published by F. B. Hough (Albany, 1860).

Rogers (Robert Empie), M. D., brother of W. B. and H. D. Rogers, b. at Baltimore, Md., in 1814; graduated in medicine at the University of Pennsylvania; was professor of chemistry in the University of Virginia 1844–52; aided his brother, J. B. Rogers, in preparing his edition of Turner's *Chemistry,* and on his death became his successor as professor in the University of Pennsylvania. He has edited the American reprint of C. G. Lehmann's *Physiological Chemistry* (1855), contributed to the *Journal of the Franklin Institute,* taken part with his brothers in the geo-

logical surveys of Virginia and Pennsylvania, and been for many years dean of the faculty of the University of Pennsylvania.

Rogers (SAMUEL), b. at Newington Green, near London, July 30, 1763, son of a London banker, whose counting-house he entered in boyhood; published some poetical trifles in the *Gentleman's Magazine* about 1780, and issued a small volume of verse 1786, but attracted no attention until the appearance of his best poem, *The Pleasures of Memory*, in 1792. Succeeding to his father's large estate 1793, he soon retired from active business, remaining, however, a partner; published another volume of verse 1798, and in 1803 established himself in the house No. 22 St. James's Place, which he made for half a century a kind of head-quarters of London literary society. Though not in any high sense a poet, he was the intimate (and often the useful) friend of nearly all the great names of English literature, and his wealth, liberality, and social qualities gave his productions a vogue to which they intrinsically had no claim. He formed a magnificent collection of pictures, books, and vases, and issued editions of his own works which are much prized for their artistic illustrations. Among them were *The Voyage of Columbus* (1812), *Jacqueline* (1813), *Human Life* (1819), and *Italy* (1822). D. at London Dec. 18, 1855. (See his *Table-Talk* (1856), by Rev. A. Dyce, and *Recollections of Rogers* (1859), by his nephew, William Sharpe.)

Rogers (WILLIAM BARTON), brother of H. D. Rogers, b. at Philadelphia, Pa., in 1805; gave scientific lectures at the Maryland Institute 1827; succeeded his father, Dr. P. K. Rogers, as professor of natural philosophy and chemistry at William and Mary College, Va., 1829; filled a similar post in the University of Virginia 1835–53; organized the Virginia geological survey 1835, and conducted it until its discontinuance in 1842; removed to Boston, Mass., 1853; lectured before the Lowell Institute on the application of science to the arts; aided in founding the Massachusetts Institute of Technology, and was its first president 1862–68, and was president of the American Association for the Advancement of Science 1875–76. Author of *Strength of Materials* (1838), *Elements of Mechanical Philosophy* (1852), and of many scientific papers.

Rogers (WOODES), b. in England about 1660; served many years in the English navy; was entrusted by the merchants of Bristol with the command of an armed expedition to the South Sea in two vessels 1708; took Dampier with him as pilot; arrived in Feb., 1709, at the island of Juan Fernandez, off the coast of Chili, where he found and carried away Alexander Selkirk, the prototype of Defoe's *Robinson Crusoe;* skirted the Spanish settlements as far N. as the coast of California; crossed the Pacific; returned to England by way of the Cape of Good Hope Oct., 1711, and was afterward employed against the pirates of the West Indies. D. in England in 1732.

Rogers City, p.-v., Rogers tp., cap. of Presque Isle co., Mich., on Lake Huron.

Rog′ersville, p.-v. and tp., Lauderdale co., Ala. P. 435; of tp. 1501.

Rogersville, p.-v., cap. of Hawkins co., Tenn., at the head of navigation on Holston River, and on East Tennessee Virginia and Georgia R. R. (Rogersville branch), has 1 newspaper and fine quarries of variegated marble. P. 657.

Roget′ (PETER MARK), M. D., F. R. S., nephew of Sir Samuel Romilly, b. in London, England, Jan. 18, 1779; graduated in medicine at Edinburgh 1798; travelled on the Continent; practised several years at Manchester, where he became physician to the infirmary 1804; became private physician to Lord Lansdowne the same year; settled in London 1808; exerted himself in the establishment of the Northern Dispensary, of which he was long the physician; was an esteemed lecturer in several scientific institutions; was the first Fullerian professor of physiology at the Royal Institution; for twenty years secretary of the Royal Society, 1827–47; became a member of the senate of London University 1826; was president of the Medical and Chirurgical Society 1829–30, and became examiner in physiology to London University 1839. D. at Malvern Sept. 12, 1869. Author of *Animal and Vegetable Physiology* (Bridgewater Treatises, No. v., 1834), *Physiology and Phrenology* (1838), *A Thesaurus of English Words and Phrases* (1854), and other works.

Rohan′-Guémenée′, de (LOUIS RÉNÉ ÉDOUARD), PRINCE, CARDINAL, b. Sept. 25, 1734; was educated for the Church, and sent in 1772 to Vienna as ambassador, but recalled in 1774 on the demand of Marie Theresa on account of the scandalous life he led; was made grand almoner to Louis XV. and bishop of Strasbourg in 1779, and finally cardinal. One of the principal figures in the necklace intrigue (see LAMOTTE), he was arrested in 1785 and arraigned before the tribunal of the Parliament, which, however, considered him a dupe rather than a criminal, and acquitted him. He returned to his diocese, and seems from this moment to have conducted his life on a more serious plan. He was a member of the States General in 1789; refused in 1791 to carry out the new ecclesiastical constitution in his diocese; retired to that part of his bishopric which was situated on the right side of the Rhine and belonged to the Empire; resigned his bishopric in 1801. D. at Ettenheim Feb. 17, 1803.

Rohilcund′, territory of British India, bounded E. by Oude, W. by the Ganges, comprises an area of 11,500 sq. m., with 5,435,550 inhabitants, and forms an independent administrative division. It received its name from the Rohillas, an Afghan tribe, which settled here in the middle of the eighteenth century.

Rohlfs (GERHARD), b. at Vegesack, near Bremen, Apr. 14, 1834; studied medicine at Heidelberg, Würzburg, and Göttingen; served in the foreign legion of the French army in Algeria; went in 1861 to Morocco, which he explored in several directions; joined in 1867 the English expedition against Abyssinia, and made in 1873 an expedition into the Libyan desert with the support of the khedive of Egypt. The results of his travels he has communicated in his *Reise durch Marokko* (1869), *In Abessinien* (1869), *Von Tripolis nach Alexandria* (1871), *Aufenthalt in Marokko* (1873), *Quer durch Afrika* (1874), *Drei Monate im libyschen Wüste* (1875). His *Adventures in Morocco* were edited by Winwood Reade (London, 1874).

Rohtuk, town of British India, in the presidency of Agra, 42 miles N. W. of Delhi, has 13,237 inhabitants.

Rokitans′ky (KARL), b. at Königgrätz, Bohemia, Feb. 19, 1804; studied medicine at Prague and Vienna; was appointed professor of pathological anatomy in the University of Vienna in 1834, and retired in 1874. His *Handbuch der pathologischen Anatomie* (3 vols., 1842–46; 2d revised ed. 1851–61) was translated into English at the expense of the Sydenham Association, and is considered the foundation of the science of pathological anatomy.

Ro′land, the name of one of the principal representatives of mediæval chivalry, but whether he is an entirely fictitious personage, or whether he was one of Charlemagne's paladins and fell at Roncesvalles in 778, is doubtful. His life and exploits form the subject-matter of numerous ballads, epics, romances in prose, rhymed and unrhymed chronicles in French, Spanish, English, Italian, German, and Danish.

Roland′ de la Platière′ (JEAN MARIE), b. at Villefrance, department of Rhone, France, Feb. 18, 1734; was destined and educated for the Church, but felt a decided aversion to an ecclesiastical career: left his father's house when about nineteen years old; traversed France on foot, and found employment at Rouen with a relative of his who was inspector of manufactures. He now began to study the exact sciences; travelled in Switzerland, Italy, and England; became an author on subjects relating to manufactures and the useful arts (see *Letters from Switzerland* (6 vols., 1782), *Dictionnaire des Manufactures et des Arts* (3 vols., 1785)), and was inspector-general of Lyons at the outbreak of the Revolution. In 1780 he married Manon Jeanne Phlipon (b. at Paris Mar. 17, 1754). She had received a careful education, became the partner of all her husband's studies and plans, and spread over his life a lustre of heroism which even the most unfavorable criticism has not succeeded in fully destroying. In 1791 he removed to Paris, having been elected a member of the National Assembly, and the saloon of Madame Roland soon became one of the principal centres of the fermentation of the capital. On Mar. 23, 1792, Roland became minister of the interior in the cabinet of Dumouriez, but offended the king by his straightforwardness and disregard of the usual forms of etiquette, and was dismissed in June. After the fall of the throne (Aug. 10) he re-entered the ministry, whose business proper he administered with admirable insight and promptness, but his intimate connection with the Girondists made him obnoxious to the Jacobins, and on May 31, 1793, he was arrested and confined in his own house. Meanwhile, the somewhat fantastical ideas and undertakings of Madame Roland—which with many another woman would have been considered as resulting from a dangerous lack of discretion, but which assumed a much graver aspect from the positive vigor and energy of her character—had caused her to be arraigned before the Convention. She appeared Dec. 7, 1792, and defended herself so brilliantly that she was acquitted. But after the arrest and escape of her husband she was accused of maintaining treasonous correspondence with the Girondists; was arrested, refused a hearing before the Convention, and guillotined Nov. 9, 1793. When Roland, who had escaped

to Rouen, heard of her execution, he stabbed himself, Nov. 15, 1793. During her imprisonment she wrote her *Mémoires*, which, together with her *Lettres*, were edited by Dauban in 1864 and 1867; he also wrote an interesting *Étude sur Madame Roland et son Temps* (1864).

Rolette′, new county of N. E. Dakota, adjoining British America, consists chiefly of rolling prairies and has several lakes. Area, about 1850 sq. m.

Rolfe, p.-v. and tp., cap. of Pocahontas co., Ia., on Des Moines River, has 1 newspaper, and is a new and thriving settlement.

Rolfe (Robert Monsey). See Cranworth.

Rol′la, p.-v. and tp., cap. Phelps co., Mo., on Atlantic and Pacific R. R., 113 miles from St. Louis, has 5 churches, good schools, 2 weekly newspapers, 1 bank, 2 wagon-factories, 3 hotels, and 2 flouring-mills. P. of v. 1354; tp. 4184. Ulrich Z. Liddy, Ed. "Express."

Rol′land, tp., Isabella co., Mich. P. 210.

Rolles′ton (George), M. D., F. R. S., b. at Maltby, Yorkshire, England, July 30, 1829; educated at Gainsborough Grammar School, Sheffield Collegiate School, and Pembroke College, Oxford, where he was chosen fellow 1851; studied medicine at St. Bartholomew's Hospital, London; was assistant physician to the British Civil Hospital at Smyrna during the Crimean war 1855–56, and to the Children's Hospital, London, 1857; became physician to the Radcliffe Infirmary and Lee's reader in anatomy at Christ Church, Oxford, 1857; Linnæan professor of anatomy and physiology in Oxford University 1860, and fellow of Merton College 1862. Prof. Rolleston is author, among other works, of a profound treatise on the *Forms of Animal Life* (1870), and is reputed one of the ablest modern investigators of comparative physiology.

Rol′lin, p.-v. and tp., Lenawee co., Mich. P. 1515.

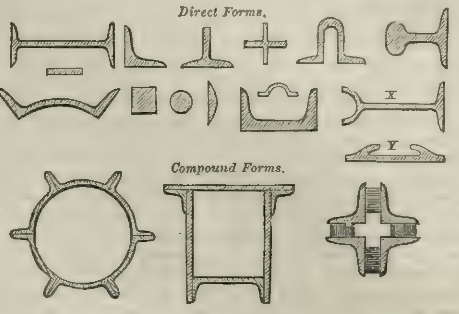
Rollin′ (Charles), b. at Paris Jan. 30, 1661; studied theology at the Sorbonne, but did not take orders; was appointed professor in the Collége de France in 1694; dismissed in 1712 because he was believed to hold Jansenist opinions, but reinstated in 1720. D. Sept. 14, 1741. His *Histoire ancienne* (13 vols., 1730–38) and *Histoire romaine* (9 vols., 1738 *seq.*), continued by Crevier and Lebeau, were intended as handbooks for young readers, and became very popular both in France and England.

Rollin (Ledru). See Ledru-Rollin.

Roll′ing Fork, p.-v. and tp., Pope co., Minn. P. 211.

Roll′ing-Mill. The rolling-mill has, to a greater extent than any other mechanical combination, enlarged the uses and cheapened the production of wrought iron and steel. All the iron bars of commerce, with few exceptions, and a large proportion of the steel bars, are rolled. Nearly all the members of machines and structures for which these materials are suitable—of ships, roofs, boilers, bridges, railways and their rolling stock, and for the purposes of general engineering—are so designed that they can be rolled or compounded of rolled forms, for this method of manufacture is essential to their uniformity and cheapness, and this condition does not seriously embarrass designers, because the great majority of desirable forms *can* be rolled. If the direct products of the rolling-mill, the leading types of which are shown in Fig. 1, are of unsuitable figure or size, endless modifications may be produced by compounding them. It is only necessary in any rolled bar that the

Fig. 1.



cross-section shall be uniform throughout its length, that none of the grooves used in the rolling shall be wider at the bottom than at the top, and that all of them shall open at right angles to the axis of the roll. The chair-bar *Y*, and the form *X* (Fig. 1) could not be rolled directly; the flanges must be folded down by a subsequent operation. In fact, bars of varying width and cross-section can be rolled; and this practice is likely to be largely extended.

It would be interesting to trace the development of rolling-mill machinery, and to observe how one improvement led to another, and how new requirements and their associated difficulties were met. It is possible, however, to glance here only at the general character of these improvements, to consider the more important of them in detail, to refer briefly to the different forms and uses of rolling-mills, and to illustrate the general arrangement of modern mills by the most common and highly organized type—the rail-mill.

The leading features of improvement have been—(1) Increased capacity, due to larger size, better proportions, stronger materials, and notably to better workmanship—notably, because the early mills were made up of rough castings thrown together without any accurate fitting whatever, excepting only on a few wearing parts. They were wasteful of power, costly of maintenance, and noisy beyond endurance, while the best modern mills are as well fitted as marine engines, and as quiet and powerful. (2) The next marked improvement was the arrangement of the rolls so as to work both ways. In a simple two-high mill (Fig. 2) running constantly in one direction, the bar, after passing between the rolls, must be drawn back by hand over the top roll, and entered again for another compression; and thus half the time and a considerable amount of heat are wasted, and unproductive labor is performed. The first remedy was to reverse the motion of the rolls after the bar had passed through, to stop them and start them in the other direction, so that they would draw the bar back again, and in so doing compress it. This plan is still largely used in England, especially for heavy work, such as armor-plates. The reversing is usually effected by gearing and clutches, and sometimes by reversing suddenly a double engine running without a fly-wheel. In any case the reversing machinery is costly to construct and expensive of power and repairs. The three-high mill (Fig. 3) is a much better means of doing work on a bar while moving in both directions. The bar is entered at the front of the train, between the middle and bottom rolls, and at the rear of the train between the middle and top rolls. The engine runs constantly in one direction, thus avoiding the shock and delay of reversing; and the additional labor, as compared with the reversing mill, is the lifting of the bar on the back of the train through the height of the middle roll. In light work, such as rails, which are in any case passed to and fro by the workmen on "hooks" or swinging levers, this additional labor is very small, while heavy work is raised by tables moved by steam-power. The American three-high mill, as arranged for heavy work by the Fritz Brothers, is a remarkable adaptation of means to ends, and it will be examined in detail.

Fig. 2.

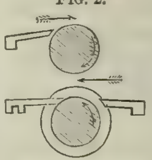
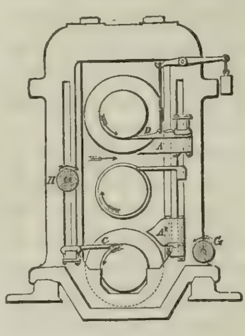
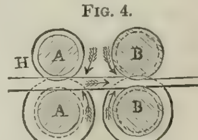


Fig. 3.



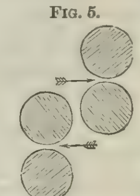
The other notable means of performing work on the bar at both passes is Brown's double mill (Fig. 4), recently introduced in England. It consists of two complete and distinct sets of two-high rolls in double housings, the two sets moving in opposite directions. The bar being entered at H, passes between the rolls A A without touching them, deep grooves being cut in the rolls for the purpose. The bar is caught and reduced by the rolls B B. Before the return pass the bar is moved laterally, and then it is entered in another groove and passes between the rolls B B without touching, and is caught by the rolls A A. Brown's mill avoids the shock of reversing and the necessity of raising the bar. It is, however, very costly, requiring on many kinds of work more aggregate length of rolls and more bearings than the three-high mill in the proportion of $2\frac{2}{3}$ to 1. It also requires more gearing, and more expensive and less convenient housings and minor features.

Fig. 4.



Brown's Patent Mill.

Fig. 5.

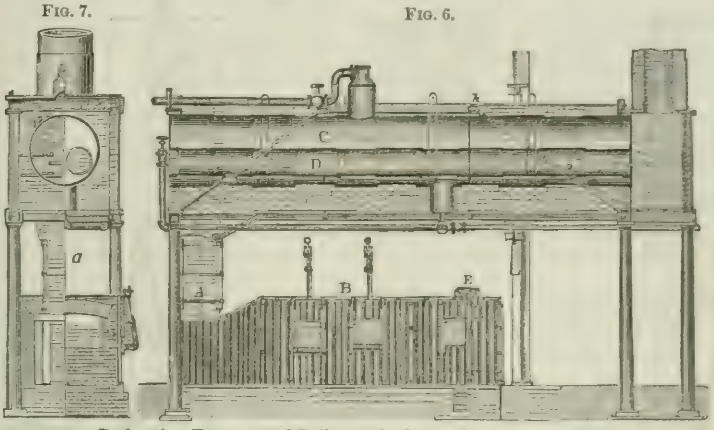


Four-high Mill.

Two other means of making the mill work in both directions have been the subject of experiment. The one was no less a structure than a four-high mill (Fig. 5), the passes being between the two upper rolls and between the two lower rolls, in order to keep the bar constantly the same side up. We shall presently observe the need of this, and how ingeniously the Fritz three-high mill accomplishes it. The other experiment was a three-high mill set on end, with no very obvious advantages and some defects.

The third improvement in rolling-mill practice was the

FIG. 7. FIG. 6.



Re-heating Furnace and Boiler at the Pennsylvania Steel-works.

utilization of the waste heat of the iron-heating furnaces for making steam to drive the machinery. The early mills were mostly driven by streams from charcoal-yielding hills, and when steam was introduced in order to reach mineral coal and wider transportation facilities, iron-makers were a long time in finding out the importance of using waste furnace heat instead of throwing it away, and then burning coal under boilers to supply steam. A plain cylinder boiler, communicating with the chimney-flue of a heating furnace, will furnish steam-power enough to roll all the iron that the furnace will heat. The temperature of steel-heating furnaces is much lower, their object being merely to soften the steel, and not to partially fuse the metal for welding, so that multitubular boilers and the highest economies of steam transmission and application are necessary to furnish the required power.

One of the best forms of boiler-setting in American mills is shown by the Figs. 6 and 7. The reverberatory heating furnace is of such size and form as to receive six or seven rail piles or blooms. The flame from the flue A of the furnace B passes under the boiler C and through the flues D to the chimney, which is placed outside of the building to save space and avoid danger to the roof by fire. This is a 50-inch by 30-foot boiler, with two 17-inch flues. Smaller boilers, without flues, are often employed. Sometimes, however, the chimneys go through the roof in order to better utilize the heat, which then passes underneath the boiler and returns through the flues. The fire-box end E of the furnace is placed next to the wall of the building, and the ash-pit opens out of doors, to avoid dust and cinders inside the mill. A corrugated cast-iron furnace shell yields to expansion by heat without cracking, and is rather lighter than a plain or a perforated shell. The method of supporting the boiler deserves notice. It consists of six light cast-iron columns, and two trusses *h h*, each made of three rails. These support the entire brick-work casing and the bottom plates, and upon four of the posts are placed two cast-iron frames, from which the boiler is suspended by hooks. The earlier mill-boilers were set on the ground behind the furnaces, thus occupying much valuable room and preventing the convenient arrangement of other things. English mill-boilers are generally vertical; and this system presents some economies in space and construction, but the more rapid and dangerous accumulation of sediment on the small bottom end, as compared with the whole lower side of a horizontal boiler, is a serious objection.

The fourth radical improvement, not yet fully appreciated, but rapidly becoming standard—and which is to some extent a substitute for the third, already mentioned—is the twofold improvement of the Siemens gas furnace. (See article FURNACE.) (1) In this the coal, instead of being wastefully burned in each individual furnace, is converted into gas in a system of "producers." The gas is led to the furnace, and there properly mixed with air and perfectly burned. (2) The waste heat of the furnaces is employed in regenerators, to heat the air and gas before they mingle in the furnace, and it is thus fully utilized: 300 pounds of coal will by this means heat a ton of ingots or rail piles, while 800 pounds of coal are used for the same work in the best practice with an ordinary furnace. A serious drawback to this economy of the Siemens furnace is the fact that steam-power must be furnished by separate firing under boilers, because the heat from the waste gases is entirely absorbed by the regenerators. With good engines, however, the gas-furnace still effects an important saving in fuel, and it must be credited with still greater economy —viz. the reduction of oxidation, and the consequent saving of metal while heating. This is due to the practicability of maintaining a neutral or carburizing flame during the heating in a gas-furnace, while much free air will work through the fire in the ordinary furnace.

The fifth grand improvement in rolling-mill arrangements was the application of independent and direct-acting steam-engines, not only to the different trains of rolls, but also to the other machines, such as saws, punches, and shears. For these smaller engines the necessity of carrying steam-pipes all over the mill involves the difficulty of excessive condensation in the pipes; but a more serious objection to the old practice of driving everything by a single engine is the costly maintenance of long lines of belts and shafting. Another objection is the expense of running all this shafting and a large engine in order to drive a single machine if the other machines are not working. Some modern iron rail-mills have eleven distinct steam-engines, one for each of the following machines: puddle-train, top and bottom and scrap train, rail-train, saws, two straightening presses, two punches, blower, boiler-feed, and general water-supply. The driving of the separate roll-trains by independent engines is an immense improvement for these and other similar reasons. In the old practice, still standard in some parts of England, and not entirely abandoned here, a ponderous, slow-moving engine is connected by large and complicated spur-gearing, pinions, and shafting to two, four, and sometimes even to six, trains of rolls, and to all their supplementary machines. The strains and shocks due to multiplying speed, and to the inevitable looseness of the numerous connections, induce breakdowns and heavy repairs. This whole system of gearing must be run at maximum speed to drive properly even a single machine, and in case of a disaster to any one part the whole mill is stopped. In the modern system the engine-shaft is coupled directly to the roll-train. The fewest parts are then needed; there is the least lost motion and the greatest smoothness of running; and there is also the highest economy of room, especially when the vertical engine is employed. Then, when a particular train is lying still its engine and all its connections are also at rest for cleaning or for any needed attention. But this is not all. Steamship men were long enough in finding out—and rolling-mill men were longer—*that high speed of piston* is a grand element in steam-engine economy. Just as the heavy and wasteful paddle-engine of former times has given place to the compact, high-speed screw-engine of the present day, so has the rolling-mill practice been changed. Instead of 6-foot stroke, 25 revolutions, and 300 feet per minute piston-speed in an engine, we now see 4-foot stroke, 80 revolutions, and 640 feet per minute; and even 180 to 250 revolutions are made by the direct engines of small merchant-bar trains.

A common and successful variety of American rolling-mill engine, the Fritz engine, is shown by Figs. 8 and 9, as used in the Bethlehem Iron Co.'s rail-mill at Bethlehem, Pa. The cylinder is 48 inches diameter, the stroke 48 inches, the fly-wheel 26 feet, weighing 55 tons, for a 24-inch three-high train. The framing is low and very steady, and all the wearing parts have the ample area of surface which is required to ensure durability.

In addition to these principal changes, many valuable improvements have been made in shaping the roll-grooves to do a greater variety and better quality of work. Improvements have also been made in devices for feeding the bar into the mill, in guides and guards for promoting the smooth delivery of the bar out of the mill, and in the arrangements of these and their associated parts, which will be further referred to.

Let us now analyze the chief machine of a rolling-mill—viz. the roll-train—considering first, and in its simplest form, a two-high mill with plain rolls for making plates, as shown by Figs. 10 and 11. There are first laid down two bed-pieces or shoes for supporting the housings. These are bolted to masonry foundations, a strip of oak being laid beneath them to give a close continuous bearing, and to provide a slight but most helpful elasticity. A

FIG. 8.

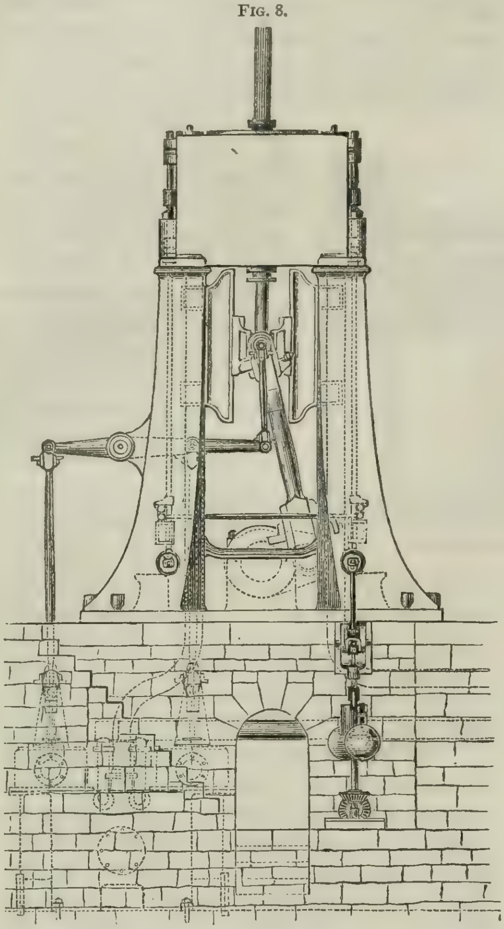
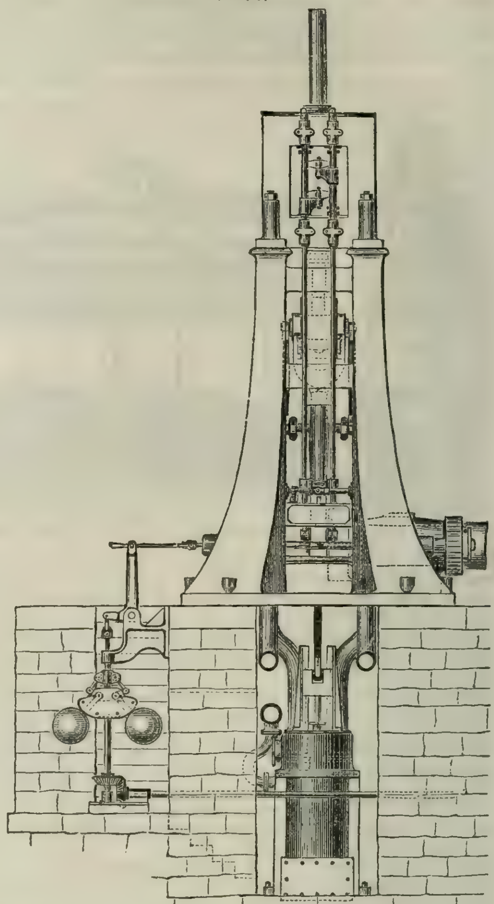
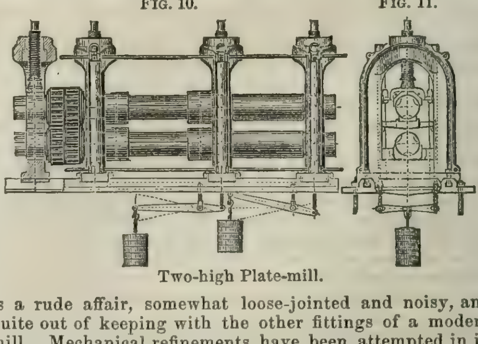


FIG. 9.



stratum of oakum $\frac{3}{4}$ inch thick, driven between the shoe and the masonry, is sometimes used, and it makes a better fit and is more durable. In the old practice the housings were set directly on timber or masonry, and were ill-adjusted and unstable. In the new practice the shoes and housings are accurately planed together. The proper arrangement and proportioning of housings has required years of experimenting. In the older forms the top was removable, to facilitate the changing of the rolls, but this prevented the needful strength and solidity. The housings must be of sufficient height and width to permit changing rolls from front or rear; they must be accurately fitted to the movable bolsters that hold the rolls, and must give them firm lateral support; they must be furnished with the screws to receive the thrust of the top-roll and to vary the distance between the rolls; they must sustain the various guiding and feeding machinery; and, while they give room for all these parts and their functions, they must be strong enough to resist all strains and the heavy shocks of rolling. If the top-roll is subject to constant vertical adjustment, as in the gradual reduction of boiler-plates from thick slabs, it must be counterweighted, as shown, so that it may be held up in contact with the screws. When one roll only is coupled to the engine, the other is turned by the friction of the bar passing between the two. This, however, is practicable only for planishing or finishing rolls, where the work is extremely light. In reducing all ordinary shapes the resistance of the uncoupled roll bends the bar and interferes with smooth working; and for this reason the two pinions, one of which is coupled to the engine, are interposed between the engine and the rolls to impart to them a perfectly uniform rotation. The coupling between a pinion and a roll, or between two stands of rolls—seven or eight stands of rolls being often coupled end to end from one set of pinions—is a form of clutch, consisting of a cast-iron spindle and two cast-iron rings or boxes, fitting partly over the spindle and partly over the roll-necks. Internal projections on the boxes fit into corresponding grooves in the spindle and necks, and the whole is usually so proportioned that a box will break in case an unusual and dangerous strain is brought upon the rolls. It has been customary to lighten the breaking-block or some easily replaced part, so that it will burst and let the roll rise instead of breaking. In the best practice, however, all parts of the train are made so strong that the engine will stop if it cannot reduce the bar. The train is made to stand, and not to break under any circumstances. The coupling

FIG. 10. FIG. 11.



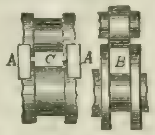
Two-high Plate-mill.

is a rude affair, somewhat loose-jointed and noisy, and quite out of keeping with the other fittings of a modern mill. Mechanical refinements have been attempted in it, but great simplicity is required to permit rapid disconnection, and to allow the rolls to rise and fall, and thus the old crude coupling has been retained. This is one of the few cases in which refinements cost more than they save.

Having now considered the principal features of all roll-trains, let us examine some further details and other types. Fig. 3 is an end view of a three-high mill, the general operation of which has been described; and in this the rolls are held at fixed distances apart. In form-

ing a bar it is often necessary to compress one side more than the other, and this and some other causes tend to bend the bar laterally as it leaves the rolls. The side-guards A are employed to bend it back and deliver it straight. The side-guard A′ enters the bar properly, and there are similar guards on the back side of the rolls. They are all rigidly fastened to heavy bars extending between the housings, and are adjustable laterally to suit grooves of different widths. In the plate-mill, the rolls being of uniform diameter, the same part of the rolls may be used for all the passes, the reduction in thickness being produced simply by decreasing the space between the rolls vertically at each pass, and the edges of the plate are not finished at all. In rolling bars, however, it is necessary to preserve a uniform width and a smooth finish on the sides or edges of the bar, and hence the work must be done in grooves. An open groove, like C (Fig. 12), would allow the metal to squeeze out laterally and form fins. In order to prevent this by fully closing the pass, one roll has a deep groove B (Fig. 13), while the second or companion roll has a collar projecting into the groove of the first. The friction of the sides of this groove is so great, the bar being crowded and spread out into it by the whole force of the engine, that it would not release the bar, but would wind it round and round the roll unless a remedy were provided. That remedy is the guide C (Fig. 3), which is a sharp iron chisel lying in the top of the groove and peeling the bar out of it and off from the roll. The guide D performs the same function for the top roll, and it is held up in contact with the roll by means of a lever and weight. This apparently insignificant system of guides, which would hardly be noticed by an ordinary observer, is, in its various adaptations, one of the most highly-refined features of the rolling-mill, and light bars of complex section could not be produced at all without it. When a guide breaks—in a rail-mill, for instance—the bar instantly winds round the roll until something gives way and stops the train; and millmen consider themselves fortunate if in such a case they escape serious breakage of the rolls.

FIGS. 12, 13.



We have now arrived at a point where we are prepared to examine the most notable feature of the American three-high mill, and its advantage over the English three-high mill. We have seen the necessity of the closed pass formed by a single groove with a lid or collar fitting into it, and of the guide for peeling the bar out of the groove; but even the closed pass is not enough to prevent the formation of a fin. The collar on the opposite roll, which projects into the groove, will wear, and the hot metal will squeeze out by the side of it. Hence the position of this collar must be changed with each pass, so that the incipient fin formed in one groove will be smoothed down in the solid body of the roll in the next groove. Fig. 14 is a section of the American three-high rail rolls at the last three passes. In Pass No. 1 a fin can squeeze out toward the middle roll. In No. 2 this fin is smoothed down in the solid-bottomed groove of the top roll, and another fin may form at the bottom edge of the rail-flange. The position of the fin is again reversed at Pass No. 3, for if it were not, the fin would so increase from one pass to another as to prevent the entrance of the bar, bend it, and spoil its finish. In the English three-high mill (Fig. 15) the opening for the fin is reversed at each pass, but so is the rail. In Pass No. 1 the rail-flange is on the left, in Pass No. 2 on the right, and in No. 3 on the left again. The bar must thus be turned over at every pass, at a considerable expense of time and labor, and the rolls are longer than the American rolls and have more complex collars. Why this difference? It will be noticed that the rolling grooves of the English mill are all in the bottom and middle rolls, while those of the American mill are all in the bottom and top rolls. The English grooves all open upward, and the American grooves alternately upward and downward. But why is this? The English middle roll (Fig. 16) is grooved, simply to allow the old-fashioned guide to lie in it by its own weight and peel out the bar. The guide would of course drop out of any groove in the top roll, and so the top roll, it was supposed, could not be grooved. But by counterbalancing the guide, so that it will stay up, the top roll instead of the middle roll may be grooved, and all the advantages of the alternating fin, the unturned bar, and the short roll, may be gained. The American rail-finishing rolls, as shown in elevation in Fig. 17, have seven grooves in the same length that five occupy in the English rolls, as shown in Fig. 18.

FIG. 14.

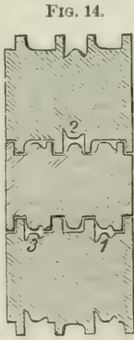


FIG. 15.

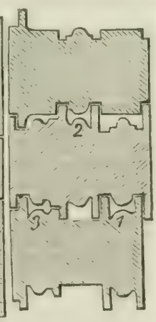


FIG. 16.

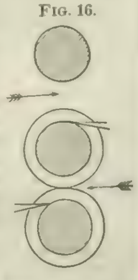
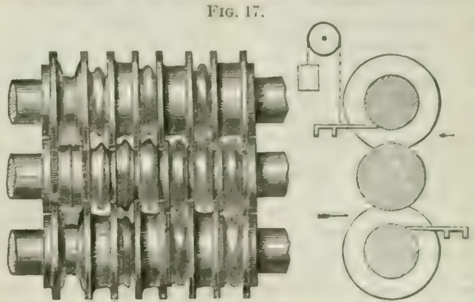
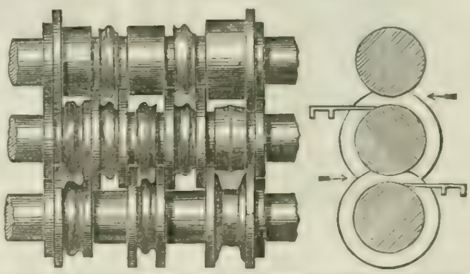


FIG. 17.



Three-high Rail-finishing Train (grooves in top and bottom rolls).

FIG. 18.



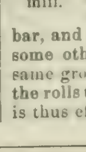
Three-high Rail-finishing train (grooves in middle and bottom rolls).

Another important improvement is the carrying roller or carrier G (Fig. 3), for feeding the bar into the rolls. To move a rail-bloom weighing 700 pounds or more, especially a pile for a beam or a 2000-pound ingot for three rails,—to push and pry this mass into a mill so that the rolls will catch it requires much labor and time. The carrier G is run constantly in the direction of the bottom roll, and the carrier H in the direction of the middle roll, by means of a belt from some suitably revolving part of the train. It is only necessary to drop the end of the bar upon the carrier, for it will at once be pulled forward and entered by friction.

The simplest form of plate mill (Fig. 19) is a pair of plain rolls, one of which is adjustable vertically by means of a screw, so that the pile may be reduced definitely in thickness at each pass. This mill wastes time and heat, as we have previously observed, by requiring the plate to be drawn over the top roll after each pass, without receiving any work. A very ingenious means of reducing the plate at both passes is Lauth's system, in which a small roll (Fig. 20) is interposed between the top and bottom rolls. This roll requires no pinion, because it is powerfully driven by the friction of the roll against which it bears, while the plate passes alternately under and over it. It requires no transverse strength, for that is provided by the large roll, against which it bears from end to end. It may thus be of small diameter, and the plate need only be lifted through its diameter, instead of through the diameter of the large top roll.

FIG. 19.

FIG. 20.

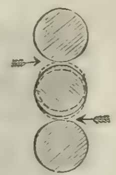


Lauth's Three-high Plate-mill.

We have now examined two distinct systems of rolling—the fixed roll with closed grooves, one for each pass, and the plain rolls screwed together at each pass. For some kinds of work these systems may be combined. In the rail-finishing trains (Figs. 17 and 18) the rolls must be rigidly fixed at a definite distance apart, for to screw them together would change only the thickness of the bar, and not its outline. In rolling blooms, however, and some other rectangular or nearly rectangular forms, the same groove may be used over and over again by screwing the rolls together, and a considerable economy in machinery is thus effected. The groove C, for instance (Fig. 12), of a

two-high mill, is 12 inches wide and 11 high. By screwing the rolls together until the groove is but 8 inches high, a 12-inch ingot can be reduced in four passes to 8 by 12 inches. Another groove, 8 inches wide and 11 high, will in like manner reduce it to 8 by 8 inches. Now, if the rolls were held a fixed distance apart, a separate groove would be needed for each pass, and the eight grooves would require four distinct sets of rolls of a given length and transverse strength, with their housings and couplings, instead of one set of rolls where the passes are used over and over. But this two-high mill with a vertically-moving roll involves the loss of passing the ingot over the top roll after each pass, so that a three-high mill with fixed distances between the rolls, and separate grooves for each pass, would, on the whole, be cheaper for heavy work.

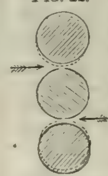
FIG. 21.



Three-high Mill (middle roll movable).

A three-high mill with vertically-moving instead of fixed rolls for this class of work and for plate rolling has long been wanted, but the difficulties have appeared so serious that mill-owners have but lately begun to cope with them. The first machine of this class, with fixed top and bottom rolls, and a middle roll raised and lowered by screws (Fig. 21), was erected at the Bessemer steel-works in Troy, N. Y., in 1870, and has since run constantly with entire success. Another form (Fig. 22), with a fixed middle roll and vertically-moving top and bottom rolls, was erected shortly afterward at the Cambria steel-works at Johnstown, Pa., and has since run day and night with equal success.

FIG. 22.



Three-high Mill (top and bottom rolls movable).

Having observed the principal types of the rolling-mill, and the general features common to all of them, let us now examine the details of the three-high adjustable mill just referred to, and more especially the labor-saving improvements which are applicable to other types of mill, and which promise to largely decrease the cost of manufacture and to increase the production of heavy work. The bolster *a* (Figs. 23–25) that holds the middle roll is a heavy iron casting fitted with an adjustable brass box, and held vertically by two 6-inch steel screws. A shoulder near the top of each screw bears upward, through a removable wearing-piece, against the top of the housing, and the foot of each screw rests on the bottom of the housing. The four screws, two

FIG. 23.

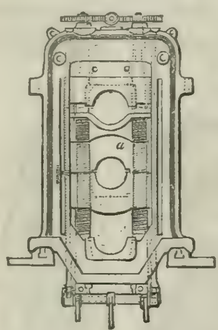


FIG. 24.

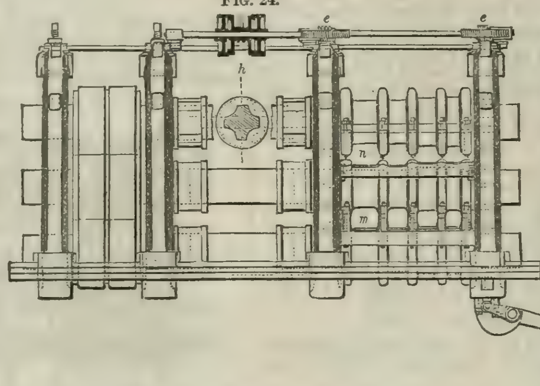
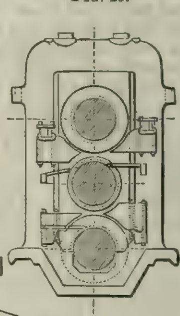


FIG. 25.



Blooming Train at the Troy Steel-works.

in each housing, thus form four posts, which take the upward and downward thrust of the middle roll. By revolving all the screws in one direction, the bolsters which form the nuts climb up on the screw, carrying the roll with them, and *vice versâ*. The guides and guards of the middle roll are attached to the bolsters, and rise and fall with the roll, which is an important feature. The screws are revolved simultaneously and at equal speeds by means of four right and left hand worm wheels *e*, and by two worms on a common shaft. Two loose pulleys *h* on this shaft are driven in opposite directions by belts from the engine. A friction-clutch between the pulleys is fast on the shaft, and by moving the clutch into contact with one of the pulleys the shaft and screws are revolved and the roll raised, while its contact with the other pulley lowers the roll. The first lower groove in the rolls *m* is 12 inches wide. The screwman raises the middle roll until the groove is 11¼ inches deep, which he observes accurately by means of a pointer on the bolster and a scale on the housing. A 12-inch ingot may then be passed through and reduced to 12 by 11¼ inches. The middle roll is now lowered until the first upper groove *n* is 10½ inches deep, when the ingot is passed through the other way and reduced to 10½ by 12 inches. In this manner it is reduced to 9 by 9 inches in the second set; then to 9 by 6 inches in the third set, and to 6 by 6 inches in the fourth, thus receiving, in

FIG. 26.

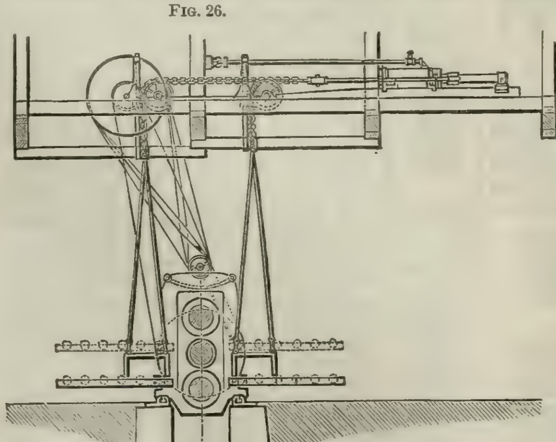
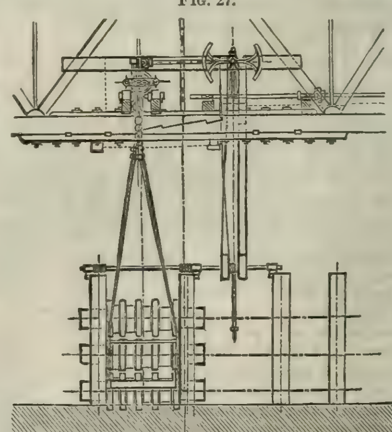


FIG. 27.



Rolling-mill at the Troy Steel-works.

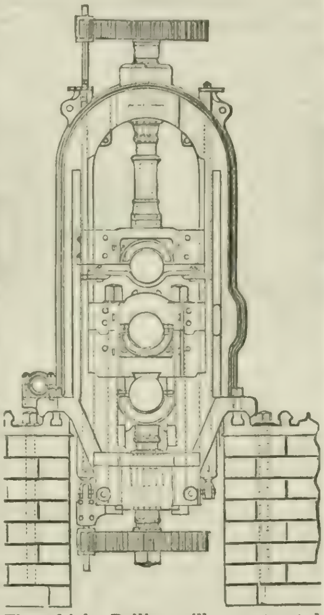
all, sixteen passes through eight grooves. The number and reduction of the passes may be varied indefinitely to suit the size, heat, and hardness of the steel, and an ingot weighing 2000 pounds is thus reduced to one-fourth its original area and drawn out to nearly four times its original length in three to three and a half minutes. Such a mill is capable of rolling 200 tons of steel ingots for rails in twenty-four hours.

The compression of a 2000-pound ingot is chiefly a question of the strength of parts, but the handling of the ingot so that the rolls can get hold of it, and the quick adjustment of the middle roll after each pass, involve some

new and complex combinations. In Figs. 26 and 27 are shown two elevations of the Troy mill as first arranged, with the lifting and adjusting machinery in its simplest form.

A brief mention only can be made of the other improvements in the three-high mill recently worked out by Mr. John Fritz in the splendid establishment at Bethlehem, Pa. The principal roll-train is 125 feet long, and consists of eight stands of 24-inch rolls, with a vertical condensing engine at each end. It is intended to roll beams and heavy merchant shapes up to 900 pounds per yard, and rails and smaller bars up to 100 feet long, and in it the bars are all raised and lowered by a feeding carriage. In the ordinary three-high mill the bearings or necks of the top roll rest on those of the middle roll, and these again rest on those of the bottom roll, so that the lower necks have the constant weight of all the rolls. All the necks are thus under pressure at every pass, and the distance between the rolls is not adjustable while working. In the mill shown in Fig. 28 the bearing-box of the middle roll is securely fastened in the housing. The top roll bears against the upper screw, and the lower roll against a bottom screw, so that the rolls may be adjusted while running, and the same grooves used over and over again; and also so that each neck sustains only the weight and strain on its own roll. There is also an ingenious system of counterbalancing all these rolls; and for changing them an hydraulic crane travels back and forth on the shoes. This will probably be the most perfect mill in the world for heavy miscellaneous work.

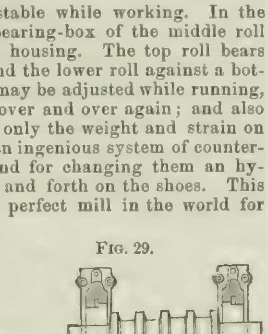
Fig. 28.



Three-high Rolling-mill, constructed from the designs of Mr. John Fritz.

Fig. 29 shows the arrangement of the feeding rollers *a a a* on the blooming-mill lifting-tables, as recently fitted at the Troy steel-works. Each roller has a bevel gear *b* on the end of the spindle, which is driven by the gear *c* on the side shaft *e*, which is attached to the table. This shaft *e* rises with the table, but is driven from the fixed shaft *f* through the intermediate idler gear *g*; the whole system of table-rollers receiving their motion by this means from the engine *h*. The shafts *e* and *f*, and the idler gear *g*, are shown more fully in Fig. 30.

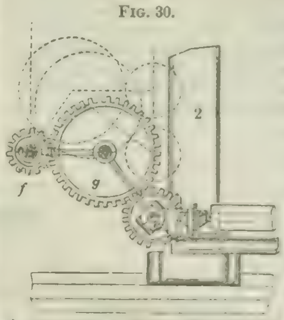
Fig. 29.



Mr. Ramsbottom's blooming-mill is shown in Figs. 31, 32, and 33. It consists of a pair of reciprocating cams or segments of rolls, and the operation will be readily observed from the engraving. The blooms must be short unless the mill is excessively large, and the continuous rotary mill would appear to be the more economical machine.

The universal mill is a comparatively new development of great promise for special kinds of work. It consists of an ordinary two-high mill standing horizontally, and another two-high mill standing vertically, so that the four rolls press the bar on all four sides at once. In some cases there are two vertical sets of rolls—one at the front and the other at the rear of the horizontal rolls. This mill is very useful for making uncommon sizes of flat and square bars, for which it would not pay to make special grooved rolls. The details of the universal mill, of the tire rolling-mill, and of several other special adaptations of rolling machinery, can hardly be considered at all in the present paper.

Fig. 30.



f, Reversing-engine attached to this shaft; 2, housing.

Having now examined the more important details of the rolling-mill, it remains to observe their grouping in a consistent whole. This depends, of course, largely upon the locality, the available space, and the direction in which raw materials arrive and finished products depart. These conditions, however, should rarely prevent a good internal arrangement. The grand feature to be observed is economy in *handling* the materials used; but in many mills, especially those rambling structures which have grown up little by little, and in which no provision was made for future enlargement, the materials are rehandled three or four times when once should suffice. Another point is to leave room enough for each operation without embarrassing any other. These are very important elements, and they are often too little considered. A frequent and very bad method of designing rolling-mills is to lay down simply the general outline of the walls, the position of the furnaces, train, and engine, and to allow about so much room for the rest. When the mill is done some of the doors are found to be in the wrong place; the cranes do not reach anything; the saws will not take extra long bars; the presses and punches interfere with the hot and cold beds; things are in the way of each other, and there is not quite room enough for anything. The only reasonable and proper way is to lay down everything on paper, and after getting it just right, to make the plan a little larger in those places where additional operations seem likely to be carried on. In a well-arranged mill all materials should be received and all the heating done at one end, the rolling machinery should be near the middle, and the finishing and shipping should take place at the other end; the product thus passing as nearly as possible in a direct line. The all-important point to be observed is that in designing works provision can be made for the minimum amount of rehandling and manual labor only by going over all the operations by means of a drawing on paper, by different arrangements again and again, and not by trusting to general ideas to be worked out when it is too late to move perhaps a building that may prove to be in the way.

Fig. 33. Fig. 32.

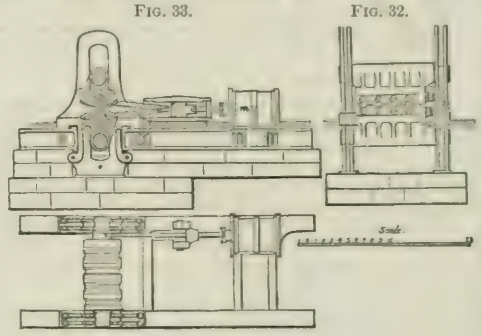


Fig. 31.

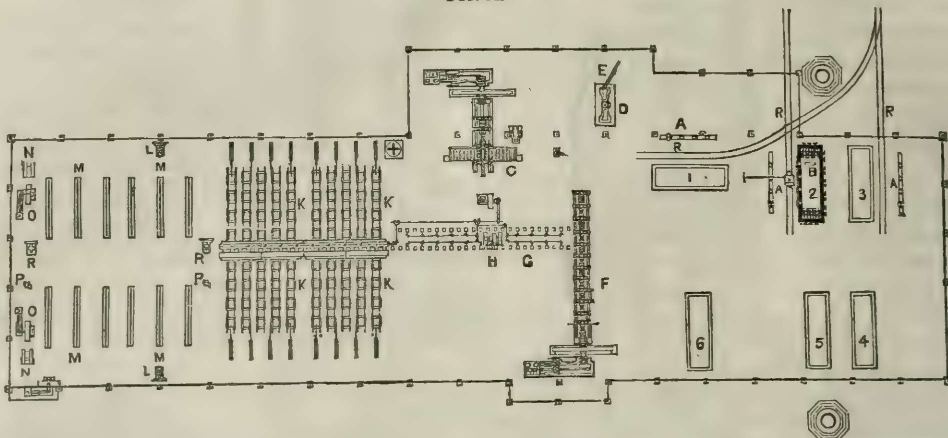
Ramsbottom's Blooming-mill.

Fig. 34 shows the rail-mill at the Edgar Thomson Steel Co.'s works near Pittsburg, Pa. This was completed in 1875, and it has proved to be a well-arranged mill. The building is 100 feet wide and 380 feet long, and in it six Siemens gas-furnaces (1, 2, 3, 4, 5, 6) are placed near one end. The steel ingots are brought to three of them on a 30-inch gauge railroad track R R R from the converting works. These furnaces (1, 2, 3) are fitted with hydraulic gear A for pushing in the ingots B, and for drawing them out after they have been heated. The other furnaces (4, 5, 6) have a lighter gear for handling the blooms only.

From the furnaces 1, 2, 3 the ingots are taken to the blooming-mill C, in which they are rolled in eighteen passes from 14 inches square to 7 inches square, their length being proportionately increased. The ingot is

then cut into two pieces or "blooms" (each being long enough to make two rails) under the steam-hammer D, and by it also the slight cracks that sometimes appear on the surface are chipped out. The blooms are then picked up by the crane E and taken on a wagon to the furnaces 4, 5, 6, in which they are reheated, and from which they go to the rail-train F. In this each bloom is rolled into a rail in thirteen passes, and it issues from the last groove directly upon a line of moving rollers G G in front of the hot saw H. By this saw the 60-foot piece is cut in two in the middle, and the man who controls the saw sends the pieces along by the rollers G and I to the hot bed K K. Here the rail, while lying upon the rollers, is curved between a set of moving arms and fixed stops, and is pushed out on either side to cool. The amount of curvature given to the hot rail is such that when it has become entirely cold the longer continued cooling and contraction of the thick head shall not have caused that face of the rail to become con-

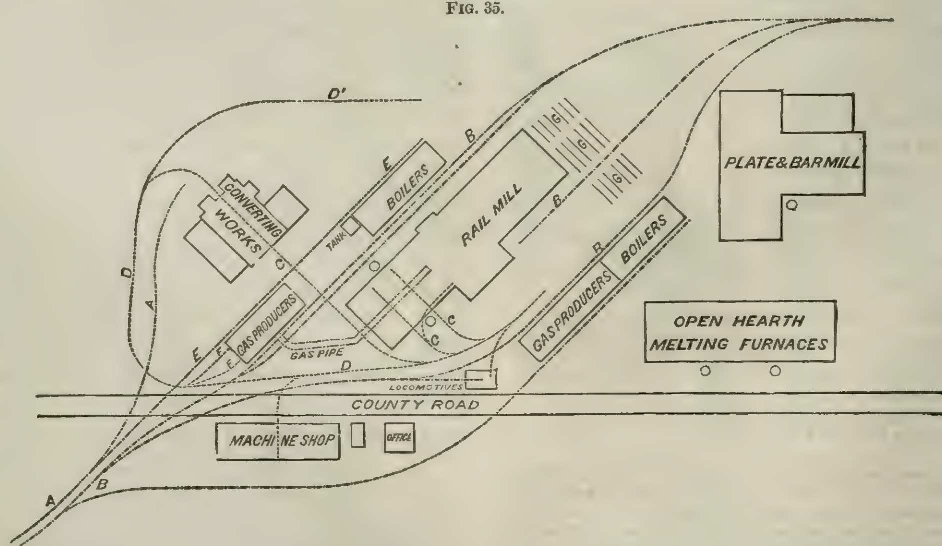
FIG. 34.



cave, but so that it shall be left as straight as possible. The cold rail is then passed through a press L L for an exact and final straightening, and is laid on the cold bed M M. One ragged end still remains to be cut off, however, and for this purpose cold saws N N are used, running at 2000 revolutions per minute, and by them the rails are brought to an exact length. These saws are plain iron disks without any teeth, driven by the high-speed engines O O, and by their rapid rotation the steel is quickly abraded, and thus the end is cut off. The holes for the fish-plate bolts are then drilled or punched in the machines P P or R R, which, with the straightening presses, are run by the engine. The rails are then run outside of the mill and piled on the stock-beds for inspection.

It is evident that in this mill there is ample room for rolling pieces even more than 60 feet long, while at the same time the furnaces, being placed at the sides of the mill, may stand quite near to the train without interfering at all with the passing of the shorter pieces through the roughing rolls. The fixtures for curving the rails are placed in the centre of the mill, between the two hot beds, so that the rails may be pushed out toward either of the two straightening presses. It is also evident that all the finishing tools, the presses, the punches, and the drills, can be at work at the same moment on either long or short rails, and that no interference can occur between them, as the rails move wholly in a direction parallel to the length of the building, excepting as they are pushed across the hot or cold beds. It has been fully proved that by thus placing the finishing machinery at one end of the mill, with the furnaces at the other end, and the rolling machinery across the mill in the centre, the whole is most advantageously located for both efficiency and economy of operation. This establishment, and rolling-mills generally, have elevated tanks or some other ample water-supply, with a sufficient head for filling the boilers after they may have been blown out, for the feed-pumps, and for various other purposes.

FIG. 35.



The great rail and beam mill at Dowlais in Wales was not long since considered the model English mill. In it two large and three small trains and all the sawing machinery are driven by one immense double engine by means of a complex and ponderous system of gearing. There are no less than seventeen bevel and spur wheels, not counting the train pinions, and 200 feet of ponderous shafting. The engine and first countershaft fixtures alone occupy a ground space of 40 by 75 feet. Some of the furnaces are a very great distance from the rolls; some of them are in the finishing end of the mill; and the trains and furnaces generally are not conveniently arranged, simply in order to keep them out of the way of the engine. By using independent engines each train could have been put just where it was wanted, without reference to anything but the convenience of that particular train and its furnaces, and in case of a breakdown in the engine department the delay would be local and not general.

Fig. 35 shows the general arrangement of the works of the Edgar Thomson Co., and from it may be seen the position of the rail-mill referred to, with reference to the convenient delivery to it of the steel ingots. The coke and pig iron, as the raw materials for the manufacture of the steel, are brought in on the high-level track A to the yard in front of the converting-house, and the coal for the supply of the gas-producers and for the boilers on the high-level track E, so that all these supplies are dropped at the most convenient possible point for their use, and repeated handlings thereby rendered unnecessary. The ingots are carried from the converting-house by the 30-inch low-level track C C to the heating furnaces in the rail-mill. The rails are loaded upon cars at B B on the common-gauge, low-level tracks directly from the mill or from the stock-beds G G, as may be required. Additional tracks are provided, giving ample standing-room for cars if they are waiting to be loaded. The narrow-gauge system of tracks is extended into the machine-shop, into the ash-pits F F, at the gas-producers, and along the edge of a bank at D′ for unloading débris of all kinds. From the producers the gas is led toward the furnaces in the rail-mill by a pipe which is carried under ground into the mill, and from which it is distributed to the furnaces as required. From the boiler-house the steam for supplying all the engines is led in suitable pipes to the different parts of the works, and the water-supply is in the same way distributed from the water-tank. The tracks A and B B connect directly with the Pennsylvania R. R., which lies on one side of the works, and also with the Baltimore and Ohio R. R., lying on the other side. The open-hearth melting-plant, with the plate and bar mill, is shown as a part of the plan for the future extension of the works.

In reference to the construction of large and costly works like these, it may be said that the history of the iron manufacture shows that the perfection and the new adaptations of machinery are the last resort among the older establishments when all other sources of profit fail, when fuel becomes costly, and when rival works spring up in better mineral regions and in better markets. Two features are found to be of vital importance: (1) Iron and steel making machinery must be thoroughly strong, well built, and trustworthy, and in some parts even duplicated, so that it will stand crowding to the utmost limit of endurance. (2) In order to save manual labor in handling the materials—for this is the trying element in nearly all manufacturing—an establishment must be large enough to keep the maximum amount of steam-power employed. Hydraulic feeding-tables and other similar machines, steam-hoists and locomotive engines, and all kindred appliances must be kept at work in order to be profitable; and this can be done only in extensive works.

The subject of quality of product as affected by treatment in different kinds of mills and by hammers is worthy of brief attention. It is found that certain kinds of iron cannot be successfully rolled in a two-high mill which revolves constantly in one direction. The pile will tend to split apart or to crack and splinter in some places as it leaves the rolls. This splitting becomes increased at each pass, and is sometimes so great that the end of the pile will not enter a second time in the same direction. In the three-high mill, however, and in the reversing mill, the entering end of the pile is changed at each pass, and the end split by the first does not enter at the second, the difficulty being thus constantly corrected. The splintering at one pass is smoothed down rather than increased by the next.

It has been supposed that soft structural steel is improved by hammering. This impression is founded on the fact that iron is improved by hammering, and that the highest-priced steel, such as tool steel, is hammered rather than rolled. It is true that the pressure of the hammer is greater and more concentrated than that of the light rolls usually employed, and that the hammer may expel more cinder in the early stages of the iron manufacture. The real reason why the hammer is used in iron mills, however, is because it will work large and hard puddle-balls and piles, for which there is no adequate rolling machinery at hand. That rolls are preferred to hammers, even for iron, in the most improved practice, is shown by the introduction of very heavy squeezers instead of hammers for reducing the large puddle-balls of the Danks furnace. The hammer certainly increases the density of an iron or a steel bar as compared with rolling. The rolls crowd the fibres back, as well as toward the centre; the action of the hammer is exclusively toward the centre. This is conspicuously shown in treating large steel ingots. The velocity of the hammer is greater than that of the periphery of the roll; hence the effect of its impact is greater on the surface of the ingot, while that of the rolls is more distributed throughout the thickness of the ingot. It would therefore be supposed that the hammer would draw the surface of the ingot so much as to leave concavities in its ends. The fact is precisely the reverse; the rolled bloom is cup-ended, although it is more uniformly condensed than the hammered bloom. The result of this must be, and the fact is, that the rolled ingot is less dense; it weighs less per cubic inch, but at the same time it is more uniform in structure.

It may occur to persons who have not frequented rolling-mills that there is nothing very remarkable in the machinery thus described—that the automatic operations of machines for working textile fabrics and the complex functions even of wood-working and machine tools indicate a higher order of engineering construction. The reply to this is, that more money has probably been sunk in iron-making machinery that would not work than in any other branch of mechanical engineering. The problem is an exceedingly difficult one, for ingenuity alone will not suffice, but it must be supplemented by extensive observation and experience. It is comparatively easy to make a complex machine perform its functions under a uniform load in a constant and ordinary temperature, and in a room protected even from the dust of the street. The work of a rolling-mill, however, is a series of tremendous shocks. It deals with red-hot metal in large masses, and must adjust itself to constantly-varying expansion by heat. These masses from their unequal temperature, structure, and compression really seem constantly trying to go wrong and to get into trouble, and the manner in which they are compelled to tumble about from roll to table, and from table back to roll again, is wholly destructive to second-class machinery. In addition to all this there are showers of dust and slag flying into places where they are not wanted, and many other embarrassments have to be provided for simply because they cannot be avoided. At the same time, the product must be of accurate size and finish, and also large in amount and constant, in order to yield a profitable return. A. L. HOLLEY.

Rolling Prairie, p.-v., La Porte co., Ind., on Lake Shore and Michigan Southern R. R.

Rolling Prairie, p.-v. and tp., Dodge co., Wis., on Northern division of Milwaukee and St. Paul R. R.

Rolling Stone, p.-v. and tp., Winona co., Minn. P. 595.

Rollins (ALPHONSO), b. in Hallowell, Me., Nov. 3, 1816; graduated at Wesleyan University, Conn., 1844; became a preacher of the Methodist Episcopal Church and principal of the high school at Sheffield, Mass.; was principal of Hempstead Seminary, N. Y., 1845–49, and afterward professor of languages in Delaware College, Newark, Del.; was zealous in the cause of education, a man of singular simplicity and purity of character, and an exemplary Christian. D. May 29, 1854.

Rol′linsburg, p.-v., Monroe co., West Va.

Rol′linsford, tp., Strafford co., N. H. P. 1500.

Rollo, or **Rolf.** See NORMANS, by E. MUNROE SMITH.

Rolls, Master of. See MASTER OF THE ROLLS.

Romagno′si (GIAN DOMENICO), b. at Salso Maggiore, near Piacenza, Dec. 13, 1761; in 1786 took his legal degree at Pavia; at thirty years of age published his *La Genesi del Diritto Penale*, which was not less applauded in Germany than in Italy. In 1791 he occupied important civil offices in Trent, where he continued to practise as an advocate; in 1802 was appointed professor of law at Parma, a position which he retained till 1806, when he was called to Milan to assist in digesting a code of penal procedure, which was afterward adopted. Later a chair was expressly created for him in Milan. Upon the fall of the Bonaparte kingdom of Italy he had to endure poverty and imprisonment. Being set at liberty, he continued his labors under great privations, supporting himself by private lessons. Cattaneo, Ferrari, Maestri, and other eminent Lombards visited and venerated him as their master. D. at Milan June 8, 1835. An edition of the works of Romagnosi in 19 vols. 8vo was published in Florence between 1832 and 1840; other editions have since appeared.

Roma′ic, a name sometimes applied to the language of the modern Greeks. (See GREEK LANGUAGE, MODERN, by PROF. A. N. ARNOLD, S. T. D.)

Roma′na, de la (PEDRO **Caro y Sureda**), MARQUIS, b. in Palma, island of Majorca, Spain, in 1761; served in the Spanish navy; participated in the defence of Gibraltar 1782; entered the army during the war with France 1792; became lieutenant-general 1795, captain-general of Catalonia 1800, and soon afterward member of the supreme council of war; was sent in 1807 to Pomerania in command of the force of 15,000 Spanish auxiliaries furnished to Napoleon, and withdrew these troops, by embarking them on the English fleet at the island of Fünen, Aug. 17–

20, 1808, on learning the treacherous imprisonment of his sovereign by Napoleon, and co-operated with the English in their operations in Denmark. In the Peninsular war he rendered efficient service as commander-in-chief in Northern Spain 1809–10 by organizing the guerilla warfare. D. at Cartaxo, Portugal, Jan. 23, 1811. His *Diary and Letters* were published at Paris (1825).

Ro′man Archæol′ogy. The Development of Art in Rome.—I. *The Pre-Hellenic Period.*—Before the establishment of the Greek colonies in Southern Italy the site of Rome was occupied by a Latin settlement in a very low state of culture. This is evinced by the fragments of vases and objects in bronze that have been found upon the Esquiline in the lowest stratum of earth yet examined, and in part under the portion of the Servian city-wall which defended that hill. The vases of Latian clay found in this stratum, which may be considered with certainty as products of native industry, are roughly moulded by the hand without the use of the wheel, are badly burned, and entirely without ornamentation. Of similar style also are the vessels found in the grove of the *Dea Dia*, which were employed by the Arvales in their sacred ceremonies, and in which, even if the existing examples belong to a later time, the Roman *ritus* certainly maintained the type in use at the institution of the worship of the Dea Dia. On the contrary, other vessels, fragments of which were found under the Servian city-wall, show an advanced process of manufacture, since they are made of a fine foreign clay, turned on the wheel, and painted on the light clay-colored ground with brownish or blackish stripes. The difference between these and the native pottery, together with the fact that similar vessels have been found in the eastern portions of the Old World, on the island of Cyprus, and in Nineveh, lead to the conclusion that these manufactures were imported from the East into Italy, probably by means of the Phœnicians. The few objects in bronze discovered in the same stratum also show a primitive Asiatic character; the most remarkable of these are large *fibulæ* from which little bells were suspended.

II. *The Period of the Hellenic and Hellenico-Etruscan Influences.*—Roman culture first received a higher impulse when the colonies from Magna Græcia began to extend their civilizing influence toward Latium and Etruria. This was felt by Rome, partly in a direct and partly in an indirect way, through the coast-towns of Southern Etruria, where in early times a rich industrial art, inspired by Greek models, had been developed. That the Latians had learned much from the Greeks in the development of their architecture in stone is evident, since many of the Latin words relating to materials and implements belonging to this art are derived from the Greek. Thus, *cal(e)x*, "mortar," is from χάλιξ; *machina* from μηχανή: *gnoma*, the "rule," from γνώμων, γνῶμα. It was also the Hellenic form of temple, modified by Etruscan influence, that was adopted by the Romans. The Etruscan temple, the *templum Tuscanicum*, followed, as far as our knowledge extends, the Doric type. The ground-plan, however, approached more to a square, the pediments were higher, the intercolumniations wider, and the building rested upon a high, oblong terrace, up to the front of which led an open flight of steps. The oldest temple in Rome, the temple of Jupiter upon the Capitol, built by Tarquinius Priscus, was in the Tuscan style. Also, the clay image of the god placed in the temple, and the *quadriga* of the same material over the pediment, were works by an Etruscan artist. The statue held the thunderbolt in its right hand, and in its left probably a sceptre. The flesh was painted red, and the color was renewed from time to time. The costume of the figure consisted of a removable wreath, probably of gold, and of the *toga palmata*, a garment decorated with Asiatic designs, in which the statue was draped on festal occasions. On the other hand, the wooden image of Diana placed in the temple dedicated to this goddess by Servius Tullius, on the Aventine Hill, appears to have been a Greek work, or at least a copy of one, for it exactly resembled an idol that the Phocæans had brought with them to *Massilia* (Marseilles).

Only a few examples of building in stone remain to us from this ancient period. First among these is the Servian city-wall, built of colossal blocks of tufa, without cement—a work in which the tendency of the aspiring Roman spirit to construct everything not provisionally, but for all time, finds a remarkable monumental expression; then the reservoir (*Tullianum*), at the foot of the Capitol, the covering of which is formed with layers of stone placed over each other, gradually projecting inward as they rise—a mode of construction that precedes the development of the true arch, and appears in Greece in the treasuries of Orchomenus and Mycenæ, as also in Etruria in tombs at Cære, Alsion, and Orvieto (*Volsinii?*); and finally in the Cloaca Maxima, built by Tarquinius Priscus in order to collect the subterranean springs that percolated through the Roman soil, as well as to drain and dry the morasses of the Velabrum and Forum. The original form, however, of this gigantic work has been greatly modified by later restorations.

Of the first centuries of the republic several evidences remain, showing an increase of the direct Greek influence. When it was decided to decorate the temple of Ceres (dedicated 485 B. C.) near the Circus Maximus, two Greeks, Damophilus and Gorgasus, distinguished both as modellers in clay (*plastæ*) and as painters, were called to Rome. The types of the Roman copper coinage (which begins under the Decemvirs, 451–449 B. C.) are formed after Greek patterns. The statue erected upon the Comitium to the interpreter of the Decemvirs, the Ephesian Hermodorus, appears also to have been the work of a Greek hand.

Especially indicative of the physiognomy of Rome, as it appeared in the fifth, fourth, and in some quarters of the city also during the two following centuries, is the known fact of the employment of Damophilus and Gorgasus as architects. The manner of ornamentation employed by these artists was that of a polychrome, terra-cotta style, early abandoned in Greece, but which, on the contrary, remained long in vogue in Latium and Etruria. The walls, whether of brick or of timber, were incrusted with plates of terra-cotta, upon which were painted ornamental, and sometimes also figurative, representations. At the eaves of the roofs were *antefixæ* of terra-cotta, in the field of which was introduced in high relief the head of a Silenus, a satyr, or of a woman, and around it ornaments in low relief, the whole painted in brilliant colors. Polychrome figures in terra-cotta adorned the pediments of the temples. Fragments of stucco decorations made in this manner have been found as well in the Etruscan cities as in Rome upon the Esquiline. They show the vast extension, and, since they represent a succession of different stages of style following each other, the long duration as well, of this method of ornamentation.

The picture that presents itself to our fancy, if we imagine the façades of a series of buildings decorated in this style, is far removed from poverty; on the contrary, it is exuberant with plastic and pictorial motives. A restful contrast to this gay variety was offered by the dark gray blocks of peperino, of which the substructions of the temples and of the public buildings generally were formed, although there is every probability that even of these the most prominent architectural members were rendered more conspicuous by the addition of color or of metallic incrustations.

A fact of much significance, in reference to the diffusion of Hellenic views of art among the Romans, occurs at the end of this period. In the year 301 B. C. a Roman patrician, C. Fabius, executed with his own hand paintings in the temple of Salus; and the branch of this distinguished family that descended from him received the surname of "the painters" (*Pictores*). The forms of the designs, however, assumed in many respects a peculiarly Italic character—a different stamp from the true Greek art. The ornamentation upon the peperino sarcophagus of Cornelius Scipio Barbatus (beginning of the third century before Christ—Vatican) consists of motives from the Doric style. Yet its *ordonnance*, which produces a calm and dignified impression, is due to the Roman artist. The group upon the cover of the celebrated Ficoronian *cista* in the Kircherian Museum, executed by Novius Plautius in Rome, represents Dionysus (Bacchus) supported by two satyrs. It thus introduces figures of Grecian mythology, and is very probably moulded after a Greek model. The forms, on the other hand, are completely Italic, and suggest involuntarily the Etruscan influences that had so thoroughly wrought themselves into the earliest phases of Roman development.

The Hellenic Period.—The extension of the Roman dominion over Magna Græcia, Sicily, and finally over Greece itself, was productive of most important results. By this means the Romans were brought into intimate relation with Grecian culture. The taking of Syracuse by M. Marcellus (B. C. 212), and the wars waged against Macedonia and Greece, successfully terminating in the conquest of Corinth (B. C. 146), opened the way for the transportation of numerous works of Greek art to Rome. First the public squares and buildings, then the town and country-houses of prominent Romans, were adorned with these treasures of Greek sculpture and painting. Moreover, this new capital of the world offered a better opportunity for remunerative labor than the declining cities of Greece proper and the hopelessly-shattered empires of Alexander's successors, and consequently there began at this time an extensive immigration of Greek artists to Rome. As early as the middle of the second century we find some of them engaged upon important public works. After the

triumph of Q. Metellus over Macedonia (B. C. 146), Hermodorus of Salamis erected a portico which bore the name of that general, and the same architect was commissioned ten years later, by Brutus, to build the temple of Mars lying in the vicinity of the Circus Flaminius. The temples connected with the portico of Metellus were adorned with sculpture by the Greek artists Polycles, Dionysius, Timocles, and Timarchides. Thus, Rome became gradually the centre of activity for Greek art. In comparison with the high degree of development attained in art in former times, there was now clearly a decline in the creative power; still, Greek art had enough of vitality, even upon Roman ground, to bring to maturity a beautiful after-growth. As at this period Roman civilization became, as a whole, more thoroughly Hellenized, as the literature almost universally assimilated itself to the Grecian type, so also in the realm of the fine arts Greece had almost completely crowded the Italic element out of the field. We have here, in fact, the spectacle of essentially pure Greek art carrying out on Italic soil the same tendency in its exercise which had prevailed in Greece and in the Hellenic East in the third and second centuries before Christ. Its course of development had not changed, but only the scene of its activity.

Architecture and Architectural Ornamentation.—In architecture the Romans seem to have better preserved their originality against Greek influence. This is easily to be understood, since that exact knowledge and that practical insight which are the fundamental requirements of architecture were precisely those features of national character for which the Romans were most conspicuous. Of this period comparatively few sculptors and painters with Roman names are known, and these few are by no means of great importance. But we have strong evidence that even in Greece the merit of Roman architects was acknowledged, in the remarkable fact that when the Syrian king, Antiochus Epiphanes (B. C. 176–169), determined to finish the temple of the Olympian Jupiter at Athens, he entrusted the direction of this undertaking to the Roman knight Cassutius. On the other hand, however, it is difficult to decide how far in architecture the Romans were really creative in the highest sense—how far they invented new elements in construction and ornamentation. There is a hiatus in the history of art for this period which renders impossible the satisfactory investigation of this interesting question. No period of Greek development was better adapted to influence the Romans, either as to architecture or in other directions, than that of the Diadochi (*i. e.* successors of Alexander), which was nearest to them in point of time and best suited to their views and requirements. Cities like Alexandria in Egypt, Antioch on the Orontes, Seleucia on the Tigris, founded with the direct object of establishing great centres of intercourse and commerce, must certainly have furnished the Romans with the most suitable models for the reconstruction of their own capital in a manner adapted to its newly-attained position of power. But, unfortunately, we know very little concerning the architecture of these Hellenic cities. It cannot, therefore, be positively decided whether the Romans acted independently in the construction of the arch, the vaulted roof, and the dome, which were favorite elements in their architecture, or whether they followed Greek models. The arch particularly became a conspicuous feature in the construction of gigantic aqueducts. These were not, as in former times, wholly subterranean, but by a succession of arches the water was carried above ground wherever the character of the surface required it, especially in the vicinity of the city. Thus, the Marcian aqueduct (built B. C. 142) was a subterranean structure for a distance of 528 Roman paces, while 6935 paces of its length rested on arches. The double purpose of use and ornament was served by the arch and vaulted roof in the construction of the *fornices*, or covered archways, which stood at certain important points as monuments to mark the direction of the main avenues of intercourse. From the time of the Republic are known to us the two *fornices* erected by L. Stertinius (B. C. 196), one on the Forum Boarium, and one in the Circus Maximus; a third was erected by Scipio Africanus (B. C. 190) on the Capitoline Hill; and besides these the Fornix Calpurnius on the slope of the same hill, and the Fornix Fabianus in the Forum. The motive of these structures was Hellenic. A passage-way of this kind existed at Antioch as far back as the time of the Seleucidæ. But at the beginning of the time of the emperors this originally Hellenic idea underwent a peculiar ornamental change. It was an old Roman custom on festal occasions to decorate temporarily the façades of the buildings, sometimes even the *fornices*, near where festivals were to be celebrated. Traces of this custom may be found in Italy on church-festivals even at the present day. For such decoration paintings on linen were made use of, which represented scenes appropriate to the festival. These were arranged in suitable places on the buildings to be adorned. During the time of the emperors art gave this temporary decoration a monumental character by substituting relief for painting. In this manner, out of the fornices, decked in their festive attire, grew the triumphal arches of the imperial age. The reliefs upon these clearly show, in their pictorial effects, a relation to the sister art of painting—a relation which becomes all the more apparent when our imagination supplies the polychromy, of which many traces still remain. The Tabularium, a building used for the state archives (finished B. C. 78), is a most majestic combination of the vaulted roof and the arch. This building was situated on the W. side of the Forum, directly upon the ashlar walls which surrounded the Capitoline Hill. It rested on a fivefold row of vaults, the outermost of which, still visible, faced the Forum as an open corridor with half columns of the Doric order. The main feature in the construction of the theatre and amphitheatre was likewise the arch and vault. It would not have been well to provide so impatient and restless a public as that of ancient Rome with no other opportunity of ingress and egress than a few doors; and consequently the whole lower wall of these structures was composed of a series of vaulted entrances. The upper stories were a repetition of the lower one, for the sake of harmony in the architectural effect, although openings for windows would have been all that was absolutely required. Engaged columns, entablatures, and attics served as a frame for the arches, these simple forms producing an impressive effect by their manifold repetition. Of the most ancient stone theatre in Rome, that of Pompey (built B. C. 55), all that is left is a portion of the substructure and the direction of the semicircular plan of the building, followed by the modern street S. Maria di Grote. Of the theatre of Marcellus, which Augustus completed B. C. 13, and which was named from his nephew, the son of Octavia, there are still magnificent remains of the exterior, showing the Doric order in the lower and the Ionic in the upper stories. Of this style of building the grandest structure is the Colosseum, built A. D. 80 under the reign of Titus, and capable of holding 87,000 spectators. In fact, the pilgrims of the Middle Ages saw in it the most emphatic monument of Roman greatness. The building is four stories in height. The three lower stories are composed of arcades, the piers of which are ornamented with engaged columns—on the first story of the Doric, on the second of the Ionic, and on the third of the Corinthian order. In the fourth story the wall is pierced by windows, between which are Corinthian pilasters. The architectural arrangement being so very simple, variety was secured by means of statues, which originally stood within the arches of the second and third stories.

Among the buildings with domes, the Pantheon (erected B. C. 27) stands foremost as probably the most beautiful, and certainly the best preserved, structure of ancient Rome. It is a circular building surmounted by a dome, and has a height equal to its diameter. A portico, with sixteen granite columns crowned by splendid Corinthian capitals, adorns the front. In order to form an idea of the original aspect of the exterior, it is necessary to suppose the absence of the tasteless belfries erected by Bernini; we must fancy the adjacent level much lower than it now is, as anciently five steps led up to the portico. On the pediment should be imagined a relief with statues at the summit and side angles, while the brick of which the circular portion of the edifice was constructed was faced with marble and painted stucco. The roof should be supposed to be covered with tiles of gilded bronze, which were carried off to Constantinople by the emperor Constans II. (A. D. 655). The original form of the interior is in many respects a matter of uncertainty. Under several of the later emperors, especially Septimius Severus and Caracalla, the building underwent restorations and alterations, while the popes introduced further modification by the construction of chapels. In spite, however, of all this maltreatment and of the removal from the ceiling of the bronze plates, which must have produced a wonderful effect of color, the mighty rotunda, flooded with light pouring down from a great circular opening in the centre of the dome, still produced a most powerful impression. The domed roof was also especially employed in the construction of the vast swimming-halls in the baths of ancient Rome. It is noticeable that in the construction of the Roman temples the massive substructure and the steps leading up to the front, which were characteristics of the Tuscan temple, were retained. The architectural and ornamental parts of the temple proper, on the other hand, were thoroughly Greek, although very variously, and not always appropriately, modified. In the construction of the more ancient peperino or travertine buildings the Greek forms were simplified. This arose clearly from the

character of the material, which did not admit of delicate ornamental finish. But in the marble structures of a later period these Greek forms were loaded with excessive ornament and intermingled one with another, the ornate Corinthian taking the precedence over the simpler Doric and Ionic orders. Still greater richness was thought to be attained by adding to the acanthus-leaf ornament of the Corinthian the spiral volutes and the egg-and-bead mouldings of the Ionic capital.

It is impossible to form an adequate conception of the innumerable public edifices, vying with one another in magnificence, which sprang, as it were, out of the ground, from the time of the first Cæsar down to that of Hadrian. The quarries of Luni (Carrara), from which marble began to be taken in the last century of the Republic, furnished a choice material for this purpose. But both before and after this time, blocks and columns of marble were imported from Greece. Augustus, even in his time, could boast that he found Rome a city of brick and left it one of marble.

From the time that Rome became the metropolis of the world it was evident that the old Forum was not adequate to the demands of public intercourse. The older Cato, in order to attract the public to the N. side, erected there the Basilica of Portia (B. C. 184); the Basilicas of Æmilia (B. C. 179) and that of Sempronia (B. C. 169) soon followed. Cæsar carried out the task most energetically, and erected on the S. side of the Forum the Basilica Julia, consisting of five aisles, but of this building little more than the pavement and the bases of several piers remain. On the N. side the Forum Julium was erected. Adjoining this stood the Forum of Augustus. The ruins of the enclosing wall, and the three beautiful Corinthian marble columns of the temple of Mars Ultor, forming the centre of the Forum, are striking proofs of the majestic grandeur of this structure. The imperial forums had, however, strictly speaking, nothing in common with those of the time of the Republic except their name. The latter were characterized by an open space in the centre, where it was customary for the people to assemble. The imperial forums, on the contrary, were a collection of public buildings, chiefly temples and basilicas, connected by walls or porticoes. The basilicas served not only as places for public intercourse, but also for judicial and administrative purposes. At this period the Campus Martius was adorned with a number of magnificent buildings, among which is worthy of notice the marble Septa, commenced by Cæsar and finished by Agrippa, and which was intended for the use of the *comitia tributa*.

A vast deal was done under Augustus to supply the city with water, and that in a most sumptuous manner. The Aqua Virgo and the Aqua Alsietina were led into the city, and the volume of the Aqua Marcia was increased. Agrippa during his ædileship constructed in a single year (B. C. 33) 700 basins, 500 fountains, 130 reservoirs, and employed in the decoration of these works 400 marble columns and 300 bronze and marble statues. The Palatine, on which Augustus had dwelt, was adorned on the S. side with the palace of Tiberius, of which hardly more than the foundations remain. Caligula extended the work in the direction of the Forum, and constructed a bridge to the Capitoline Hill, in order to have the readiest access to the Capitoline Jupiter, whose vicar on earth he considered himself. As is evident from the remains still existing, the hill was enlarged by extensive substructions in order to obtain a larger area for the imperial buildings. Farther to the W. the Flavian emperors erected their palace, the ruins of which, still standing, witness to the simple grandeur of the work.

Meanwhile, the terrible conflagration under Nero (A. D. 64?) had occurred. Of the fourteen city precincts, three were entirely, and seven wellnigh entirely, destroyed. A countless number of Roman monuments venerable for age, as well as many masterpieces of Greek art, were sacrificed. And yet this misfortune was not without its advantage to the city; for after the city was burned by the Gauls (B. C. 390), it had been reconstructed in a hasty manner. Consequently, the parts of the city dating from that period were built irregularly, and the streets were narrow and crooked. But the government in rebuilding the city after the conflagration in Nero's time took measures to remedy these defects. In consequence of the destruction of entire quarters of the city, room was obtained for the erection of large public buildings. Nero's Golden House, on the S. side of the Esquiline Hill, with its surrounding houses and parks extending into the valley between the Esquiline and Cœlian hills, requires only a passing notice as an illustration of the vicissitudes of earthly grandeur; for immediately after the emperor's death (A. D. 68), the whole establishment, with all its luxurious appointments, fell into decay. On the site of the artificial lake within the gardens of the Golden House, Vespasian began to build the Colosseum. The palace itself was made use of by Titus, in part, as a foundation for his baths. Of the Forum Transitorium, on the E. side of the Forum of Augustus, which was erected by Domitian, the last of the Flavian emperors, and finished by Nerva, there are still left remains of the wall of enclosure and two Corinthian columns with an entablature adorned with reliefs.

Architecture received a new impulse under Trajan, who employed an excellent Greek architect, Apollodorus of Damascus. Under the direction of this artist the Forum of Trajan was erected to the N. of that of Augustus, an extensive cut having been made between the Capitoline and Quirinal hills in order to obtain a sufficient area for that purpose. The principal building of the Forum of Trajan was the Basilica Ulpia, having five aisles, the central one being uncovered. This edifice has recently been partially excavated. Trajan's Column, with its gilded reliefs on a colored ground, was embraced within this gigantic structure, and enclosed in a court, as it were, formed by two wings projecting from the basilica. The constructive activity of the emperor Hadrian is exemplified in the double temple of Venus and Roma on the Velia, the plan of which the emperor designed with his own hand (A. D. 135). It was composed of two temples, having a single roof covered with tiles of gilded bronze. The cellæ of the two temples adjoined each other, and the whole was surrounded by a double portico of granite columns. All that remains, besides a number of shattered columns, is a portion of the immense foundations, the ramp, and fragments of the brickwork of the two cellæ. The imperfection of the brick, however, makes it improbable that this latter was a part of the original building, but rather leads to the conclusion that it was a restoration after a fire, by Maxentius (A. D. 307). The Mausoleum of Hadrian (Castle of St. Angelo), begun by that emperor and completed (A. D. 140) by Antoninus Pius, consisted of a square substruction, upon which stood a terrace-like superstructure covered with marble and adorned with statues. The substructure is buried in débris, and only portions of the terrace-like interior mass or core of travertine have stood the wear of the centuries. From the time of the Antonines, besides the column in honor of M. Aurelius, we have only the temple of the elder Faustina (erected A. D. 141), on the N. side of the Forum, and which was afterward likewise dedicated to the memory of Antoninus Pius. The portico, with its ten columns of costly Eubœan (cipollino) marble, left unfluted, is still standing, besides a portion of the cella, which is, however, wellnigh robbed of its marble facing. The back part of the cella has been turned into the church of St. Lorenzo in Miranda. After the Antonines, even at the time when the downfall of the Empire was becoming more and more evident, many sumptuous buildings were erected in Rome. Caracalla strove to surpass all his predecessors in the colossal baths, capable of holding 1600 bathers, which he commenced on the S. E. side of the Aventine Hill, near the Via Appia, but which were not completed until the time of Alexander Severus. These were incrusted with costly stones and peopled with an army of statues. This magnificence has all disappeared, leaving only the brick walls which formed the main body of the building. The city-wall of Aurelian presents itself to us—a *memento mori*, as it were, of the following period. It was constructed in view of the constantly-increasing danger from the encroachments of the barbarians. The Baths of Diocletian, on the Viminal, were still more extensive than those of Caracalla, and, it is said, were capable of accommodating 3000 bathers. Two large dome-covered halls, which once formed a portion of the Baths of Diocletian, are now included in the churches of St. Bernardo and St. Maria degli Angeli. The basilica on the Velian, with its three aisles, was built by Maxentius, and remodelled by his successful rival, Constantine. Three of the arches still stand, though robbed of their original ornamentation. They are of an enormous span, and have served as models to many architects of modern times. Constantine presented the city of Rome with baths which were situated on the Quirinal; but, as was to be expected, the architectural energy of that emperor was mainly expended upon his new capitol in the East.

A close inspection of the above series of buildings proves that architecture, down to a very late period, preserved the indications of a strong feeling for grandeur in plan and in the arrangement of the interior, as well as of masterly mechanical skill. These valuable features were transmitted by declining paganism to the Christian architecture of the East and West. On the other hand, the decline in art showed itself especially in two directions. The first of these was the loss of a feeling for the significance of the component parts of the architectural whole. The column was no longer used in its appropriate office as a support to

the building, but chiefly for the sake of its pleasing effect. The Corinthian columns, for example, in the Basilica of Maxentius, placed against the main piers, served only apparently to support the building, and therefore the eye scarcely perceives that they are now lacking. The other direction in which the decline manifested itself was in the treatment of the ornamentation. The passion for costly material worked most disastrously in this respect. The first traces of this taste may be found as early as the time of the Julian emperors. In still later times the custom prevailed of using brittle kinds of stone, such as porphyry and jasper, in which any delicate treatment of the ornamentation was impossible. Thus, the contractor and polisher came in time to be of more importance than the designer. This taste could not fail to exercise, also, a most pernicious influence upon works in marble, for the artist naturally strove to supply (by an excess of ornament) the color and brilliancy which were lacking in his material. The same causes and consequences are alike apparent in the ornamentation of the interior and the exterior of buildings. In the earlier stages of the period under consideration the decoration of interiors was chiefly fresco, and in private houses the Greek manner of the time of Alexander's successors was, for the most part, followed. During this period the spoliation of the Grecian republics, partly by plunder and partly by purchase, brought into the possession of the conquerors a considerable collection of panel-paintings, and the custom was then introduced of using these pictures as the central ornament of the wall. Not every one, however, was able to obtain a sufficient number even to meet the demands of a moderately-sized dwelling. It was necessary, then, to call in the aid of the fresco-painter, who supplied the lack of the actual panels by imitations executed on the stucco of the walls. This mode of decoration, originating on the eastern shores of the Mediterranean, was imitated by the Romans even in the third century before Christ, and continued among the less opulent down to the period of the decline of classical culture. We are supplied with abundant material for becoming familiar with this mode of decoration by the excavations of Rome and Pompeii. The pictures which occupy the centre of the walls are clearly imitations of panel-paintings, as may be seen from the simulated frames which surround them. Where more extensive compositions were to be represented, the imitation of panel-paintings would have given a heavy, cumbersome effect; to avoid this, they resorted to the ingenious device of representing the walls with imaginary openings, so that they resembled the scenes of a modern theatre, the pictures appearing as if seen through these openings. The painting now no longer burdens the wall, but appears entirely distinct, and as something seen through a window or door. In this manner, for instance, the pictures of Io and Galatea on the Palatine Hill were treated. More extensive spaces, such as corridors, courts, and garden-porticoes, were sometimes decorated in fresco with imaginary outlooks upon parks, grounds, and seaports. In this style of painting, which is also traceable to a Greek origin, a certain Ludius in the time of Augustus became distinguished. The unpoetical but forcible representation of a park on the basement wall of the Villa Livia, situated on the Via Flaminia, is most probably to be ascribed to that artist.

Fresco-decoration, however, in the houses of the wealthy, soon found a rival in the practice of encrusting the walls with costly stone. In this, too, the Romans followed in the footsteps of the Greeks of the time immediately succeeding Alexander, carrying the original idea still farther, and that to excess. Marble facings for walls were first introduced by Mamurra in his house on the Cœlian Hill in the time of Cæsar. Under Claudius and Nero, as we learn from Seneca, the practice of adorning walls with facings of parti-colored stones had become not unfrequent in Rome. Costly marbles finely cut and polished, varying in color in the different architectural divisions, shone in the state apartments of the emperors and of the Roman aristocracy. The ceiling as well, in order to harmonize with the walls, was made brilliant with gold and enamel, and the floors with mosaics. In the time of Claudius the covering of the divisions of the walls with one simple marble was thought too plain; whereupon it became customary to cut out portions of the marble slabs, and then to insert stones of a different color. In this way ornaments, and even figures, came to be represented in stone intarsia. Variously-colored glass, adorned with ornaments and figures, was frequently used for these mural incrustations, and for the same purpose metallic plates were also sometimes employed. In Nero's Golden House these ornaments were composed of gold inlaid with precious stones and mother-of-pearl. Very little of this luxurious mural ornament has come down to us, since later generations have carried off all that was of value. In the triclinium of the palace of the Flavian emperors on the Palatine Hill, in several places pieces of the parti-colored incrustation that covered the walls still remain. From these, by the aid of the imagination, we are able to form a faint idea of the former magnificence of the two halls. Two fragments of mural incrustation were discovered on the Palatine Hill which explain the methods invented during the time of Claudius. They show rich ornamental forms produced by the combining and inlaying of many-colored marbles collected from the various parts of the ancient world. The innumerable fragments of diversely figured and cut glass with which the surface of Rome is literally strewn witness to the extent to which this material was used for incrusting the walls. From the third century red porphyry became the favorite material, the destructive influence of which we have already discussed.

IV. *Sculpture and Mural Decoration.*—In the Roman sculpture of this period two tendencies, the idealistic and the realistic, may be distinguished. The first occupies itself specially with the mythological department, but also sometimes takes to the portrait and to the representation of scenes from daily life. It does not work *originally*, in the highest sense of the word, but is limited, in a greater or less degree, to models from the preceding Greek development. This already shows itself among the artists employed in the service of Metellus Macedonicus. (See above.) Several evidences lead to the conclusion that these artists sometimes re-treated archaic Greek types in the spirit of free art. The statue of Athene, by Timocles and Timarchides, held a shield copied from the Athene Parthenos of Phidias. Through a series of works that have been preserved we are made acquainted with a group of Athenian artists who lived in the last century before Christ. The most distinguished among these are—Apollonius, son of Nestor, the sculptor of the Hercules torso in the Vatican (probably identical with that Apollonius who, after the burning of the Capitoline Jupiter in the time of Sulla, executed the statue of the god designed for the new building); Cleomenes, son of Apollodorus, the artist of the Medicean Venus; Cleomenes, son of Cleomenes, author of the fine portrait-statue in the Louvre mistakenly called Germanicus. This last statue repeats the motive of an archaic type of Hermes. The Medicean Venus belongs to those figures which through a series of intermediate stages are gradually derived from the Cnidian Aphrodite of Praxiteles. Glykon, one of the latest artists of the group referred to, in the execution of his statue of Herakles (Farnesian Hercules, Naples) followed a type probably designed by the second Attic school in the fourth century B. C. The naturalistic treatment and the exaggerated expression of physical strength belong only to the artists of the imperial times. The reliefs on marble vases by two other sculptors belonging to this group, Sosibius (Louvre) and Salpion (Naples), are derived throughout from earlier motives. Since the dependence of these *New Attics*, as they are generally called, upon older productions is clearly recognizable in nearly all their known works, the few sculptures respecting which—as, for example, the Hercules torso of Apollonius—our imperfect sources of information authorize no such conclusion, prove little to the contrary. We may, then, with entire certainty formulate our judgment concerning these artists, that for the conception they were substantially dependent upon ancient works, but that in the execution they showed independence, and thus lent a new charm to the motives reproduced.

A peculiar direction was taken by the school of Pasiteles, himself a versatile and also literary artist of the last century before Christ. We know the statue of an Ephebus, with an inscription (Villa Albani), executed by a scholar of Pasiteles, Stephanus; also a marble group (Villa Ludovisi) generally considered to represent the meeting of Orestes and Electra, and shown by the inscription to be the work of Menelaus, a pupil of Stephanus. Both sculptures are eclectic works, in which the artists aimed to unite the excellencies of different epochs of style. Stephanus has placed an archaic type at the foundation, but treats the nude with the fine naturalism to which the chisel in his day had attained. Menelaus, who was inspired by a motive from the flourishing period of Greece, added to it heterogeneous elements of every kind, and treated the whole with the elegant finish of his time. Eclecticism, then, which presupposes, in all cases, a dependence upon earlier works, must be considered the essential characteristic of the school of Pasiteles, while the kind and degree of that dependence may in some instances be disputable. The manner of treatment, however, remains as the unquestioned merits of these artists. The same is true of Arcesilaus, who wrought the statue of the goddess for the temple of Venus Genetrix, dedicated by Cæsar in 46 B. C. No mention is anywhere made of the ideal purport of his works, but Varro dwells with great praise upon the care-

ful treatment of his models. In the creation of a marble group representing a lioness surrounded by sporting Cupids, and of the statues of centaurs bearing nymphs, the artist seems to have transferred to sculpture motives originating with the Greek painting of the Diadochi period.

In other works of art also, belonging to the epoch under consideration, the authors of which are unknown, recent investigations have shown the same dependence upon ancient models. The well-known group representing Venus and Mars, and probably connected with a work placed in the temple consecrated by Augustus to Mars Ultor (2 B. C.), is strictly derived from two types of the earlier development. One is the well-known figure of Aphrodite holding a shield; the artist of the imperial period, omitting the shield, made the arms of the goddess rest upon the shoulders of Mars, who stands before her; this last figure probably originating in a Peloponnesian school. From the same type, the shield-bearing Aphrodite, is derived the Victory writing upon a shield, of which we have examples in an excellent statue in Brescia and in the reliefs of the Column of Trajan. The celebrated statue of the Nile (Vatican) is the reproduction of an original from the Ptolemaic period. We come to a similar conclusion from the investigation of the portrait-statues, of which the early imperial period presents several very prominent examples, as for instance, that of Augustus from the Villa ad Gallinas (Vatican), that of the older Agrippina (Capitol), etc. From a considerable series of these portrait-statues it is evident that the clearly thought-out and beautifully-expressed motives of the figures belong, in fact, to the earlier development of art which took place on Greek soil. The merit of these portrait-sculptors of the imperial period is essentially limited to the skill with which they managed to impress the personal likeness upon the heads.

In view of these facts we are justified in saying that the plastic art of this period was rather reproductive than original—that when called to poetic creation in the higher sense, it found itself incapable, and fell back upon older productions. On the other hand, it possessed to the fullest extent the power of delicately seizing and reproducing with artistic correctness the forms presented by nature. A considerable decline in this power is first perceptible in the time of Hadrian. Under this emperor arises a peculiarly dry and smooth modelling of forms, and also the custom of brilliantly polishing the surface of the marble—a treatment which compares very disadvantageously with the less elegant but far more lifelike characteristics of the preceding development. To this early stage of decline belongs the last important type to be seen in the history of classic art, the type of the favorite of the emperor Hadrian, the Bithynian Antinous, with whose statues and busts the museums are filled. Since, in the immediately preceding and contemporaneous development, this type stands as completely unique, we may conclude with certainty that the creative merit of art in its formation is to be estimated as very small. Antinous must have been one of those gifted beings in whom Nature herself presented, as it were, an ideal of physical perfection. Art had, in fact, only to enlarge the wondrous form into the colossal, and represent it in the attitudes and with the attributes of the traditional types of the divinities. Were the artistic power here exhibited truly creative, why should this power have manifested itself only in the Antinous, and in no other instance?

After the age of the Antonines the decline in plastic art was most precipitous, at least, in so far as it dealt with ideal themes. An eloquent proof of this is the anonymousness which covers with silence almost the whole art of the third and fourth centuries. So far as our positive knowledge of the monuments extends, there exists of this period no representation of any god from the classic Olympus worthy of mention. On the other hand, the statues of Mithras, of the shocking Æone, the repulsive figures of the Ephesian Artemis, are everywhere prevalent. A most pernicious influence was exerted by the richness of the material, since the costliness of this came to be considered the principal thing, and the artistic treatment was regarded as only secondary. For important and enduring monuments the kinds of stone selected offered, from their very hardness, insuperable obstacles to the development of true form. In the hard, unyielding red porphyry, for example, from which the sarcophagus of Helena, the mother of Constantine, and that of Constantia, the sister of the emperor (Vatican), are wrought, it would have been impossible even for a skilful artist familiar with anatomy to bring the human form to any seeming of organic development. Colossal dimension, as well as richness of material, was a great object of admiration. Alexander Severus caused a multitude of gigantic statues to be erected in Rome. A bronze figure, representing the emperor Gallienus as the Sun-god, measured about 240 feet, and the marble statues of the emperor Tacitus and his brother Florianus at Terni, about 30 feet. It is evident that the defects in an art which cannot come up to its task in the small must show themselves much more conspicuously in the colossal.

The most pleasing, comparatively, and certainly for the history of art the most interesting, productions of this age of decline are the sarcophagi, adorned with figures in relief, which came into vogue from Hadrian's time. The reliefs, mostly mythological subjects, scenes from the story of Bacchus, the myths of Meleager, Hippolytus, etc., repeat motives from the older Greek art, especially from that development of painting which began in the time of Alexander. It would seem that the stonecutters had at hand books of designs from which they compiled these motives as occasion required. In this way many mistakes may have occurred, the representation may have almost always violated the rules of relief, and often been overloaded or confused; still, these sarcophagi show, at least in some of the figures or groups, a reflection, however feeble, of the prominent works of Greek art; and since the originals, especially the paintings, are irrevocably lost, they are of the greatest importance to us in the history of art.

The realistic tendency, which was fostered together with the ideal one of which we have spoken, does not appear at all in the foreground during the last century before and the first after Christ, but remains secondary and limited to a lower sphere, at least as far as regards portrait and *genre* representations. The realistic portrait of this period is distinguishable from the ideal by certain mechanical methods of producing expression. In the latter, the eyelids are elaborated with a strong feeling for style, and there is no intimation of the eyebrows; the realistic school makes the edges of the lids rest upon the eye, as is the case in nature, and marks the form of the brow. Sometimes the pupils are indicated by grooved outlines, a practice which first became general in the third century after Christ. Traces of a similar tendency in portraiture are already perceptible in the time of Alexander the Great and of the Diadochi. While, however, judging from the few monuments remaining, art at that time reproduced the elements offered by Nature with a certain reserve, and distinguished between that which she intended and that which was accidental, the Roman tendency was to copy faces exactly as they appeared to the eye, impressing upon the stone every accidental imperfection, every wrinkle of the skin, and every wart. This confirms the supposition that this unreserved realism was encouraged by the Roman custom of fabricating waxen images of their ancestors (*imagines majorum*), in which usage, as well as the material, demanded a precise copy of nature. Still, the portrait-statues, especially those made in the capital during the first century of the imperial time, adhere, as a whole, to the principle of ideality, and during this period the exclusively realistic manner was limited to an inferior style of art—namely, to the busts wrought in high relief for Roman funeral monuments. It was not till a later time, when the reaction toward the smooth, academic manner of the Hadrianic period began, that it assumed its place as an equal of the ideal, and preserved its vital force even longer. During the whole of the third century this school produced admirable works, as is proved, among others, by the busts of Caracalla which represent in a masterly manner the brutal nature of this emperor. The same phenomenon appears in the province of *genre* representation. In the earlier portion of this period we encounter a realistic tendency only in the reliefs on the monument of the baker Eurysaces of the time of Sulla—a work of very plain, not to say coarse, execution, representing the various processes in the preparation of bread.

Unlimited, on the other hand, is the sway of the realistic tendency in the historical representations with which triumphal arches and other similar monuments were adorned in the imperial ages. Already, during the period of Alexander the Great and of the Diadochi, may be seen in the representations of contemporary events—battles, festal processions, hunts, etc.—an endeavor to portray characteristic scenes from real life. Yet in so doing they, with correct feeling, made special use of painting, and while they proceeded to represent the facts offered by the real, they at the same time sifted and refined them, brought the best into prominence, and arranged the composition according to æsthetic rules. The historical reliefs of the imperial times appear as a further development of these works—a development in which the endeavor to be true to the real emancipates itself more and more from artistic fetters. The band of figures winding up the triumphal columns narrates, chronicle-wise, the principal events of the campaign according to the imperial bulletins, and can be compared to nothing more analogous than to a parchment roll upon which is inscribed an abridgment from the Roman general-staff records. It was clearly impossible to portray complete compositions in this manner. Then follows

another peculiarly picturesque mode of treatment, explained by the fact that the historical relief of the imperial times stands in close relation to a preceding development of painting, and was, in fact, used for decorative purposes in much the same way as the sister art has since been employed. (See above.) By the multiplication of the planes of relief an attempt was made to obtain an effect corresponding to perspective in painting. Bold foreshortenings, intimations of landscape detail, and other means of expression properly belonging to the pictorial art, became, with the advance of this development, more and more frequent, and more prejudicial to the plastic clearness of the representation. On the other hand, as late as under Trajan it continues to be characterized by a freshness and energy which reconcile us, in a certain degree, to the violation of the rules of plastic composition that frequently occurs in these monuments. As Trajan was the last emperor who with a strong hand secured and strengthened the Roman dominion both within and without, so the historical representations describing his achievements received an upward impulse which justifies us in regarding the age of Trajan as the last brilliant period of classic art. After his time there is a rapid decline even in this form of art. The defects, which in the Trajan monuments appear in isolated cases and without exaggeration, are now multiplied. The reliefs of the Arch of Septimius Severus show a multitude of planes piled one above another, and upon each of these a crowd of figures which completely confuse the eye. Under these circumstances we must be grateful to the Roman senate, which, when the arch in honor of Constantine was to be erected, assigned a subordinate place to the inferior sculptures of his time, and borrowed the chief ornaments for the new structure from a monument of the age of Trajan.

The pictorial art shows, in every respect, a development analogous to that of the plastic. It is true that the writers preserved to us make very little mention of the painting of this period. We are told that in the last century of the Republic the portrait-works of Sopolis, Dionysius, and of a female painter named Ia or Laia, were esteemed—that in the same period a certain Avellius painted goddesses with the features of his mistresses. In the Augustan age we hear of the decorator Ludius or S. Tadius. (See above.) Under Vespasian, Cornelius Pinus and Attius Priscus decorated with paintings the temple of Honos and of Virtus, the restoration of which was then completed. Moreover, in writers of the first imperial century passages are extant which speak very disparagingly of the state of contemporaneous painting. Petronius, the best art-connoisseur among the Roman authors whose works are preserved, and who probably lived under Nero, says in plain terms that painting was entirely a thing of the past, and Pliny characterizes it as a "dying art." These individual statements are supplemented and corrected by an examination of the wall-paintings found in Rome and in the Campanian cities that were buried under the eruptions of Vesuvius. These place us at once in a position to estimate rightly the severity of the contemporaneous criticisms. The execution of the frescoes, however hastily sketched they may have been, is on the whole excellent. In accordance with the conditions required in fresco-painting, they represent only the essential, but this they do with great energy and freshness. Since, then, the execution of decorative fresco maintained itself at so considerable an elevation, we have a right to suppose the same to be true in a greater degree of the contemporaneous pictorial panel-painting. Thus, the condemnatory verdict of competent contemporaries does not refer so much to the execution, of which there was no reason to complain, as to the conception; and this supposition is strikingly confirmed by an investigation of the originals reproduced by the mural painters. The compositions occurring in these frescoes, representing scenes from Grecian mythology and from ancient daily life ideally depicted, are by no means conceptions of the imperial period, but rather creations of true Greek art, reproduced here with more or less freedom. Some of these compositions have been traced back with certainty, or at least probability, to known Greek masters. A series of frescoes representing Io guarded by Argos (Rome, Palatine—Pompeii), and another series showing Perseus leading the released Andromeda down the rock to which she had been chained (Pompeii), are probably reproductions of two celebrated paintings by Nikias, a master who flourished in the time of Alexander the Great and of the first Ptolemy. The wall-paintings representing Danaë with the boy Perseus upon the shore of Seriphos (Pompeii) seem to be traceable to an original by Artemon, a contemporary of Demetrius Poliorcetes. And, finally, those representing Medea about to kill her children, yet still restrained by the conflict between the passions of maternal love and jealousy (Herculaneum, Pompeii), repeat a grand composition by Timomachus, an artist probably of the Diadochi period. We can easily understand that the selection of the compositions to be reproduced in fresco should fall especially upon those of the Greek school, beginning at the Alexandrian period; for this development lay nearest the Romans in respect to time, and exercised also in other directions a manifold influence upon their civilization. Very few wall-paintings can, with any probability, be traced to originals earlier than the time of Alexander. Among the examples found in Rome we may only reckon as properly belonging to these the Nozze Aldobrandini (Vatican Library), the composition and forms of which do not show the artistic principle which was brought to full development in the time of the Macedonian hero. On the other hand, the art of the Alexandrian and Diadochi age occupied itself less with grand subjects of a monumental character (megalographia) than with those suited for cabinet pictures intended for private enjoyment. As these cabinet pictures were not rich in figures, and were of proportionally small dimensions, and as they did not so much attempt powerfully to strike the spectator by the grandeur of the subject as to impress him agreeably by graceful representations of situations easily understood, they were excellently well adapted for reproduction in Roman mural painting. In Roman dwellings these pictures, being placed in the centres of walls generally very limited as to space, satisfied all the demands which could reasonably be made upon such a style of decoration, and afforded an agreeable resting-point for the eye, without absorbing the attention. The subject of the scenes represented, and the sentiments associated with them, whether of an idyllic character (as, for example, in the frescoes representing Paris upon Ida surrounded by his flocks), or sentimental (as, for example, in the pictures of Ariadne forsaken upon Naxos), or of a sensual, wanton nature, were as perfectly comprehensible to the Roman, even if he did not understand the Greek language, as to the Greek of the Diadochi period; for the Latin poetry of the Augustan age had borrowed its themes from the Alexandrian poetry which had inspired these very pictorial compositions, and they treated the same subjects as their predecessors had done, and in the same spirit.

In Roman fresco-painting an important place is occupied by the landscape, a province of art which also came into independent development during the age of the successors of Alexander. The most beautiful extant paintings of this kind are the landscapes discovered on the Esquiline, with scenes from the *Odyssey* (Vatican Library). As Vitruvius mentions landscapes with such staffage (*Ulixis errationes*, etc.) as among the motives of the wall-decorations of the "ancients," and as it is evident from the connection of the passage that these "ancients" were none other than the Alexandrian Greeks, it is therefore certain that the Esquiline pictures are taken from originals of the Diadochi period. The observer must expect in these landscapes no peculiarly harmonious representation of atmospheric effects, in the expression of which modern landscape-painting is so brilliantly successful. The poetry of such scenes is brought out in a far less degree in ancient than in modern art, nor did the limited means of decorative fresco-painting permit it to be made very intelligible. The essential merit of the artist who originated the Odyssean pictures lies in the plastic development of the landscape, in the clear arrangement of the planes, the harmony of the proportions, and the nobility of form in the figures introduced.

An exclusively realistic tendency manifests itself only in the mural painting of a very inferior kind. In Pompeii this class of pictures are almost entirely confined to houses of a very poor, or even of a decidedly questionable, character. They depict the manners and habits of artisans and wagoners, who are drinking or making merry with dissolute women, and other scenes from the daily life of the provincial towns of Campania, always represented with a low, sometimes even brutal, feeling, and almost without exception of very coarse execution. After the year 79 A. D., in which the Campanian towns were buried by the unexpected eruption of Vesuvius, and which also cost the life of Pliny, to whom we are indebted for most of our information upon ancient painting, we can no longer follow with any certainty the history of this art. However, the few frescoes of later date which are preserved to us show that then, as before, they repeated the traditional mythological motives transmitted from the earlier antiquity, but that at the same time the execution deteriorated from generation to generation. The paintings of a tomb on the Via Latina, belonging to the Hadrian period, show already a considerable decline, as far as the freshness and energy of the work are concerned, when we compare them with the average of the mythological pictures of Pompeii. The rise of Christianity did not tend to arrest this decline, but rather hastened its downward course. It is true that the Chris-

tian Church—since sculpture not only answered very imperfectly to its needs, but also retained for a long time a suspicion of heathenism—had a decided preference for painting, and assigned to it, or to the intermediate art of *relief*, the task of proclaiming artistically the new creed. In the first place, unlike paganism, which in all times had permitted a high degree of independence in the treatment of the forms of the gods and of all mythological subjects, the Church kept art closely hampered by the bands of an orthodox discipline, which could not but be detrimental to it. In the second place, the *Ecclesia triumphans*, when it entered upon the inheritance of heathenism, adopted also the pernicious use of rich material. The programme of the Christian faith was especially announced by means of dazzling mosaic, a species of art which makes any individual rendering of the outlines difficult, but which answered admirably the purpose of the Church, to bring before the eye sacred forms and histories under orthodox types and clothed with great external brilliancy.

W. Helbig.

Results of Recent Excavations.—The works for the extension and embellishment of the city of Rome executed during the last five years have been the occasion of a great number of archæological discoveries, which we propose to describe as briefly as possible in order to show what immense progress our knowledge of the history and topography of the ancient metropolis of the world has recently made. Properly, our description should classify the new monuments according as they belong to architecture, to painting, to sculpture, to epigraphy, but as most of the discoveries relating to the three latter classes must necessarily be mentioned in connection with the edifice to which they belong, our object may be obtained more simply by giving a topographic description of the architectural monuments.

(*a*) *Fortifications.*—Rome has been defended at three different periods by three different walls—that attributed to Romulus, which surrounds the Palatine; that of Servius Tullius, which encircles the Seven Hills; that of Aurelian, which forms the enclosure of the city at the present day. Four fragments of the wall of the Palatine have been discovered, as well as the site of the gates Mugonia and Romanula. As to the wall of Servius Tullius, it may be traced to-day at forty-two different points, the most considerable remains being those discovered in the Villa Torlonia, upon the Aventine, near the railway-station. The site of the gates Ratumena (1865), Fontinalis (Nov., 1875), Sangualis, Collina (1873), Viminalis, Esquilina, and Capena (Mar., 1871) has also been recognized. In Dec., 1875, were discovered some vestiges of the citadel, or *arx*, which occupied the N. E. summit of the Capitoline, and which seems to have been defended by a double enclosure, the one contemporary with the wall of Romulus, the other with that of Servius.

(*b*) *Temples.*—The number of temples, either standing or uncovered, which in 1870 was twenty-one, has now risen to thirty. Among those recently discovered we should mention—the temple of Cybele, discovered in 1870 on the Palatine, with the statue of the goddess; the temple of the Flavians, discovered 1872 in laying the foundations of the new ministry of finance, with a colossal head of Titus; the temple of the Dea Dia (Ceres), discovered in 1868 outside the Porta Portese, at the station of the Magliana, with 1750 lines of the *Acta Fratrum Arvalium* engraved on marble; the temple of the Fortuna Primigenia, discovered in 1873 between the Baths of Diocletian and the Prætorian Camp, with many inscriptions and a statue representing the Roman lady Claudia Fusta, with the attributes of the goddess; the temple of Julius Cæsar, discovered in 1873 at the S. extremity of the Forum, with many fragments of the *Fasti Consulares et Triumphales*, which were engraved on the basement wall; the temple of Jupiter Capitolinus (1865–76), on the W. summit of the Capitoline; the temple of the Palmyrene Sun (1857), outside the Porta Portese; and, finally, the temples of Bellona and of Honor and Virtue, discovered in 1873 in the foundations of the ministry of finance. Also, the temples of Castor and Pollux, of Jupiter Victor et Stator, of Trajan, of Venus, and of Rome, already in great part known, have lately been entirely uncovered.

(*c*) *Basilicas.*—The whole of the surface covered by the Basilica Julia, which occupied the entire W. side of the Forum, has been completely laid open. The pavement, enlivened by polychrome marbles, is tolerably well preserved, but the triple range of porticoes which surrounded it has almost completely disappeared.

(*d*) *Theatres.*—In Jan., 1876, in the course of some restorations of the palace Savelli-Orsini, which occupies the site of the theatre of Marcellus, there was discovered a considerable portion of the lower portico, filled with architectural fragments of every kind. An imperfect imperial inscription, found in the same place, mentions a restoration of the stage of the theatre by Antoninus Pius.

(*e*) *Amphitheatres.*—During the whole of the year 1874 excavations were making in the interior of the Colosseum. Thus, we have been able to study the system employed for raising and lowering the cages of the wild animals; we have found the small cells in which they were kept before the commencement of the games; in short, all the details of the service of the amphitheatre have been revealed with the greatest minuteness. Almost all the architectural fragments found in these excavations belong to a portico or gallery which crowned the interior of the edifice. Some inscriptions have also been found indicating the place reserved at the games for personages of the court and for the higher order of magistrates.

(*f*) *Circuses, Stadia.*—The palace of Augustus on the Palatine was separated from the palace and the Septizonium of Septimius Severus by a stadium built by Domitian and restored by Hadrian. This stadium was mostly uncovered in 1872; the portico which surrounds it is composed of columns of brick cased with marble, but the imperial tribune was decorated with surprising richness, if we may judge by the shattered columns of Oriental marble, the fragments of sculptured frieze, and other ornamentation found in the excavations.

(*g*) *Thermæ.*—Rome in the period of her splendor counted eleven large thermæ, some of which could receive as many as 2000 bathers at a time, and 856 baths of an inferior order, for the use of the lower classes. These last have almost totally disappeared, but many of the thermæ still exist, and several of them have been explored since 1870. M. Scellier de Gisors, a French architect, has made excavations in the Baths of Titus, bringing to light certain details of the plan hitherto unknown. The Baths of Antoninus Caracalla have been cleared under the direction of the government. The superb mosaic pavements of the halls are nearly all preserved, as well as many fragments of architectural decoration. In the *cella tepidaria* several pieces of columns in porphyry and other stone have been found. The first are three feet in diameter, the others five. Several capitals adorned with representations of divinities have also been found, as well as three mutilated statues whose perfection is worthy of the place from which they were taken—the Farnese Bull, the Hercules, and the Flora. In the piazza of S. Eustachio and in the neighborhood of the Pantheon several halls and chambers of the Baths of Agrippa, filled with fragments of columns, entablatures, and bas-reliefs, have been discovered. The open space paved with travertine in front of the Pantheon has been uncovered to an extent of 120 square mètres. In the Aldobrandini and Rospigliosi gardens, on the Quirinal, some considerable remains of the Baths of Constantine have just been brought to light—the theatre, or *hexedra*, and the rooms which formed the S. E. angle of the baths. The pavements here are composed of very rare marbles, but the circumstance most worthy of observation is, that all the foundations of these baths are constructed from the spoils of older monuments, such as columns, capitals, broken statues, friezes, marble roofings, etc. Among the baths which have just been discovered, the existence of which was before almost unknown, we shall mention two—those of Neratius Cerialis, on the Piazza di Santa Maria Maggiore, in which have been found many statues and inscriptions of exceptional value; those of Heliogabalus, between the Palatine and the temple of Venus and Rome. These last had been used in the seventh century as Christian chapels.

(*h*) *Forums.*—The exploration of the Roman Forum may now be considered as complete. It has the form of the trapezium, and is bounded on the E., W., and S. by streets, on the N. by the Rostra. The pavement is composed of blocks of travertine. Along the W. side—that is, in front of the Basilica Julia—may be seen seven pedestals of honorary columns; the S. side, facing the temple of Cæsar, was shut in by a line of shops, the destruction of which is unfortunate, because among the materials employed in their construction were some interesting inscriptions. In the centre of the Forum may still be seen the pedestal of the equestrian statue of Domitian described by Statius; and farther to the N. the two *plutei*, or parapets, discovered in Jan., 1873, the sculptures of which are regarded as the most perfect that have been found in this locality. These *plutei* indicated the place where all the citizens on their way to the elections were to go and present their *tesseræ*, or tickets of admission. The bas-reliefs on the two interior sides represent the *suovetaurilia*, or sacrifice of a pig, a sheep, and a bull—a sacrifice which was celebrated exclusively on occasion of the census. One of the exterior bas-reliefs represents the institution of the gratuitous education of children (*pueri et puellæ alimentarii*) established by Trajan; the other represents the destruction, by the command of the same emperor, of the fiscal registers in

which were recorded all the arrears due from the taxpayers of the empire. Very recently—that is, in Feb., 1876—while carrying on the excavations of the Forum on the side of the temple of Faustina, were found two bases of statues restored (according to the inscription) by Gabinius Probianus, prefect of the city, after they had been overthrown by an earthquake. The pavement of the Forum Olitorium has been uncovered for an extent of 360 feet between the Theatre of Marcellus (Piazza Montanara) and the Temple of Piety (San Nicolà in Carcere). While continuing the excavations on the S. side, we were able to trace the whole length of the *via* (*triumphalis?*) which connected the Forum Olitorium with the Forum Boarium.

The excavations consequent upon the building of the new quarters upon the Esquiline have led to the discovery of the Forum Esquilinum, and of the public markets (Macellum Liviæ) which surrounded it. In the centre of the square lay the pedestal of a statue, with an inscription relating to the embellishments of the forum executed by order of Flavius Epitynkanus, prefect of the city, in the fifth century. Some of the market-shops preserved traces of their original destination; as, for example, in one was found a collection of mineral colors; in another, a number of small bottles for perfumery; in a third, some wine-measures, and amphoræ once containing the produce of the vines of Chios. The centre of the market was occupied by a large fountain, converted, during the barbarous ages, into a lime-kiln, and still half filled with statues and marbles calcined by fire.

(*i*) *Honorary Monuments.—Triumphal Arches.*—The narratives of the sixteenth century had preserved the memory of a triumphal arch erected in honor of Gordian the Pious at the entrance of the Prætorian Camp, and demolished by Bramante in order to use the material in constructing the palace Della Cancellaria. Some very important remains of this arch were discovered in 1872 in digging a drain in the Via Gaeta. These remains comprise, especially, portions of the entablature, as well as fragments of the inscriptions relating to restorations made by Diocletian. *Columns.*—We have already mentioned the seven pedestals of honorary columns found on the W. side of the Roman Forum. We should add that three of these columns have also been discovered. They measure 26 feet in length, and, judging from the deep holes with which the shafts are pierced, they must have been covered with plates of bronze ornamented with historical reliefs. *Obelisks.*—Among the ruins of the temples of Isis and Serapis, which we know stood near the church Della Minerva, had already been found the obelisks erected afterward in the open squares of the Pantheon, of the Minerva, and in the grounds of the Villa Mattei. Recent excavations in the same place have given us fragments of a *fourth* obelisk, entirely covered with hieroglyphics.

(*k*) *Military Establishments* (*Castra*).—The military garrison of Rome comprised the corps of the *prætorians* and of the *urbani;* the seven battalions of the *vigiles,* who exercised the police of the city; also several battalions of less importance, such as the marine infantry (*misenates, ravenarates*), the imperial guard of honor (*equites singulares*), etc. Their barracks were sumptuous edifices, built, or rather rebuilt, by Septimius Severus, except that of the prætorians, which dates from the reign of Tiberius, and which was restored under the Gordians. Of this latter it was already known that three sides were incorporated into the city-walls by Aurelian. The fourth—that is, the W. side—has just been discovered in consequence of the works in the new quarter of the Viminal (*Castro Prætorio*). It contains 78 small chambers, each capable of lodging six or eight soldiers. A little beyond was found a small apartment, reserved perhaps for the superior officers, the pavement of which was in mosaic representing scenes of combat, the names of the warriors or the gladiators being marked by the side of each figure. The site of the Castra Equitum Singularium—that is, of the barracks of the imperial horse-guards—has been made known by the discovery of a monument erected to Sylvanus at the expense of certain soldiers. The images of Sylvanus generally marked the entrance of every edifice; consequently, we now know that the access to the cantonments of the singulares corresponded with the Via Merulana, near the church of Sts. Peter and Marcellinus. The seven battalions of the vigiles, or policemen, were distributed through the city in such a way that each one occupied the boundary-line between two *regions.* Recent discoveries established the fact that the barrack of the first cohort (or battalion) was situated below the Palace Savorelli, on the boundary between the VII. (Via Lata) and IX. (Circus Flaminius) *regions.* That of the second has been found on the Esquiline, very near the Arch of Gallienus; that of the third at the S. E. angle of the Baths of Diocletian; that of the fifth in the Villa Mattei, by the church of the Navicella; that of the seventh (which is the best preserved) in the Piazza Monte de' Fiori, in the Transtevere. The site of the stations IV. and VI. is still unknown.

(*l*) *Palaces and Houses.*—In a *résumé* so limited as ours it would be impossible to describe the topography of the Palace of the Cæsars on the Palatine as it has been determined by the latest excavations. Let it suffice to say that the imperial palace has no unity of plan or of decoration, but that it is composed of a suite of palaces, the one differing from the other, built at different epochs, and separated by streets and squares always accessible to the public. The most ancient portion is the House of Augustus, situated on the side of the Circus Maximus. Then follow the House of Tiberius, at the N. W. angle of the hill, on the Velabrum; the House of Caligula, at the N. E. angle upon the Forum; the House of Nero, at the S. E. corner, toward the Colosseum; the House of Vespasian, which occupies the very centre of the hill; and finally, the House of Septimius Severus, at the S. W. angle, toward the Porta Capena. Although the condition of these remains is in general very ruinous, yet every room, so to say, preserves sufficient traces to enable us to decide or to divine what was its decoration and its primitive destination; and the whole plan of the entire group has been reconstructed with as much precision as can be obtained in a house of Pompeii. Among the palaces and private houses of which the position or new details have been discovered should be mentioned—the Palace of the Laterans, considerable portions of which have been explored, especially in the garden of the Hospital of St. John, where fragments of an imperial statue in porphyry and several mosaic pavements have been found; the House of Germanicus, on the Palatine, in perfect preservation, the pictures which decorate the walls being considered as the best among those thus far found at Rome; the House of Asinius Pollio, discovered in the Vigna Guidi, at the S. E. angle of the Baths of Caracalla; the House of Q. Fabius Cilo, the site of which is occupied by the church and convent of S. Balbina, and where have been found two superb busts of Caius and Lucius, nephews of Augustus; the house of the Cornelii, discovered in 1873 under the new ministry of finance. In the House of Avidius Quietus, governor of Galatia under Domitian, discovered Mar., 1876, near S. Antonio all' Esquilino, bronze tablets have been found on which are engraved the decrees in honor of Quietus awarded by the cities of the province which he had administered. On one of the walls of the vestibule of the House of Memmius Vitrasius Orfitus, a consul of the fourth century, are found certain inscriptions dedicated to their master by the officers of his house. This building was also discovered near the railway-station. Similar inscriptions preserved on the spot have determined the position of the palace of Neratius Cerialis, prefect of the city in the fourth century, on the piazza of Santa Maria Maggiore; of Numicius Pica Cæsianus, quæstor under Trajan, on the Via Strozzi; and finally of the senator Q. Octavius Felix, near the church of S. Bibiana.

(*m*) *Villas and Gardens.*—The gardens of Mæcenas, on the Esquiline, have been in a great measure excavated, from the church of S. Eusebio as far as the Via Merulana. The most interesting monument as yet found is a magnificent conservatory in the form of a small oblong theatre, the walls of which are decorated with beautiful landscapes. In the neighborhood of this conservatory have been found six caryatides of Pentelican marble, as well as three *hermes* of fauns, which were generally placed at the intersections of garden avenues; two fountains, one of which is in the form of a rhyton, or drinking-horn, marvellously sculptured by Pontios of Athens; three busts of philosophers; and several other fragments of sculpture of a beauty fully worthy of the age of Augustus and of the artistic taste of Mæcenas. Still more important are the discoveries made on the site of the Horti Lamiani, which adjoined those of Mæcenas, occupying the whole of the rectangle comprised between Viæ Labicana, Merulana, S. Croce, and S. Matteo. In the very centre of these gardens the remains of a palace have been found, the E. and W. sides of which were adorned by porticoes with columns of *giallo antico.* On the two other sides—that is, on the N. and S. of the rectangle—were found bath-rooms of extraordinary splendor. The floors were paved with slabs of precious marble, such as *occhio di pavone,* fleece alabaster (*a pecorelle*), jasper, agate, etc. Some of the walls were covered with slate ornamented with arabesques in gold; others were encrusted with *opus sectile marmoreum,* or what is now called "Florentine mosaic." It was in one of these rooms that on Dec. 24, 1874—a day memorable in the annals of art and science—there was discovered in the space of a few minutes the group of sculptures which forms the principal ornament of the New Museum of the Capitol. This group comprises a statue of Venus, a Greek work anterior to the type of that goddess

created by Praxiteles; two statues of the Muses Terpsichore and Polymnia; two figures of tritons, unique types and of remarkable beauty; a bust of Commodus, represented as the Roman Hercules, perhaps the most perfect work of the kind which antiquity has bequeathed to us; a statue of Faunus bearing a basket of grapes on his shoulders; a head of Diana, another of the young Commodus, and twenty-four fragments of other statues. In the same room was found an inscription relating to the improvement of the gardens and the reconstruction of the palace by the emperor Alexander Severus—that is, by the same who restored the gardens of Sallust, as is proved by another inscription found Apr. 2, 1876, in the Villa Spithöver on the Quirinal.

Recent researches also show that almost the whole surface of the Esquiline was occupied by gardens, which, laid out at first for private use, had fallen by degrees into the hands of the emperors, who opened them to the public; so that Rome became perhaps as rich in parks and delightful promenades as is London or Paris to-day. Among the gardens recently discovered we should mention those of Vettius Agorius Prætextatus, the site of which is very near the Porta San Lorenzo. Nearly all the foundations of the buildings belonging to these gardens are composed of fragments of statues. A single one of these walls, scarcely 100 feet in length, has given us 2500 pieces of sculpture, which, united with infinite patience, have already furnished the Museum of the Capitol with seventeen statues and two sculptured vases. It is enough to say that the single statue of a Hercules carrying off the mares of Diomed has been recomposed out of nearly 250 fragments.

(*n*) *Tombs.*—The burial-place of the ancient inhabitants of Rome was not confined to the borders of the great consular highways, but outside every gate were found vast necropolises called *campi*, which took their name from the gate nearest them. Thus, we know already the Campi Viminalis, Esquilinus, Cælimontanus, Aventinensis, etc.; another is found between the Viæ Aurelia and Campana in the present enclosure of the Villa Pamphily Doria; still another between the Viæ Appia and Latina, in which are the celebrated *columbaria* of Hylas and Vitaline, as well as the *hypogæum* of the Scipios. Our space would not permit even a simple enumeration of the tombs discovered during these last years. We must therefore confine ourselves to the principal, and especially to those laid open in the Aventine necropolis. These may be divided into two groups—the one contemporary with the first centuries of Rome, the other belonging to the age of the emperors. The first occupy the whole of the space included between the churches of S. Antonio, S. Eusebio, and S. Vito; the most ancient of the tombs are excavated in the rock according to Etruscan usage; the disposition of the bodies is also Etruscan, each being placed on the funeral couch with the feet toward the entrance of the sepulchre; the manufacture of the objects found in these tombs, such as household utensils, vases, personal ornaments, etc., is also Etruscan. All these details carry us back to the first three centuries of Rome. The second system of burial, which dates from the beginning of the fourth century, is that of sarcophagi and cinerary urns in volcanic stone; several hundreds of these have been found, with a large quantity of objects, the manufacture of which, departing from the Etruscan type, begins to show the progress of the native art of Latium. The third method is that of sepulchral chambers, either isolated or united in groups, built of square blocks of stone, without cement, but already possessing inscriptions and pictures. One of these inscriptions says that the tomb belonged to the college of flute-players (*tibicines*); another is described as the property of the family Æbutia. Among the frescoes discovered in this cemetery two are especially interesting: the first represents the scourging and execution of a criminal performed by six lictors under the orders of the prætor; the other relates to the history of the 300 Fabii and their glorious defeat in the war against Veii. On the opposite side of the Esquiline—that is, in the neighborhood of Porta Maggiore—fourteen columbaria of the first century of the Empire have been discovered. The most important contains 150 inscriptions referring to the domestics of Statilia Messalina, the wife of Nero. From the others more than 400 inscriptions have been taken.

In conclusion, we may announce the discovery of a Rome anterior to the Rome of history. Her existence has been revealed to us not by constructions public or private, but by objects in stone, such as arrow-heads of silex, axes of bluish jadéite, knife-handles of deer-horn, necklaces of burnt clay, pottery made by hand, etc. All these palæo-ethnological objects belong to the Neolithic period, or the age of polished stone. In comparing these discoveries with those which are being carried on at the same time on the Alban Hills, where a pre-historic town or village has just been exhumed from beneath three volcanic layers produced by eruptions from the crater of Monte Cavo, our knowledge of the origin of the most celebrated city of the world may be completely established. But as it is only a few months since men of science have occupied themselves with this interesting subject, it will be a long time before we shall be able to propose theories likely to be accepted with confidence by the scientific world. While we write, an important publication on archæological discoveries just made has issued from the press—*Pitture e Sepolcri scoperti nell' Esquilino dalla Compagnia Fondiaria Italiana, nell' anno 1875* (Romæ, 1876, 4to, illustrations). R. Lanciani.

Roman Architecture. See Architecture and Roman Archæology.

Ro′man Arith′metic is a system in which numbers are represented by letters, which do not vary in value with their position. The Hindoo-Arabic system uses 1 equally for 1, 10, 100, according to its position; the Roman system (see Notation) employs I, *one*, V, *five*, X, *ten*, L, *fifty*, C, *hundred*, D (originally IↃ), *five hundred*, M (originally CIↃ), *thousand*, to which several expedients were added for higher numbers. Here I and X, or X and I, represent eleven; forty-nine must have the awkward extension of XXXXVIIII; and should a form like XLIX occur in an operation, it must be read as (L) fifty, (I) one, and (XX) twenty, or seventy-one, as in the following example of addition:

	X		
VIIII	XX		VII
I	XX	I	III
X	L	I	X = LXXI.

It is evident that much confusion would arise if IX could be read as *nine*, or IV as *four*.

Conforming to modern mechanical arrangements, we proceed to show how operations may be performed with the Roman figures. We first multiply XXII by XVII, adding the modern equivalents:

X X II	10 + 10 + 2 = 22
X VII	10 + 7 = 17
LXX LXX XIIII	70 + 70 + 14 = 154
C C XX	100 + 100 + 20 = 220
CCCLXXIIII	170 + 170 + 34 = 374

In the next place we divide 2660 by 7:

VII) M M DCLX (CC	7) 2660 (200
	1400
VII) CCC CCC DCLX (C	7) 1260 (100
	700
VII) D LX (LXX	7) 560 (70
	490
VII) X LX (X	7) 70 (10
	70
CCCLXXX	380

Here we say, the seventh of (M) ten hundred is (C) one hundred, which we set to the right as quotient, and (CCC) three hundred remains, which we set in a new line: we repeat this for the second M, when we bring the undivided part of the first line (DCLX) into the second as part of a second dividend. Here we observe seven (C's) hundreds, a seventh of which gives the second quotient. Bringing down the remainder (DLX) for a third dividend, we count the (D) five hundred as fifty tens, the seventh of which gives the third quotient of (LXX) seven tens and a (X) ten over to be carried down (it stands under D), with the remainder of the third dividend, to form the fourth. Here we have two tens and (L) five tens, the seventh part of which is (X) ten of the fourth quotient.

In this system cancellation can be more extensively used than in the ordinary methods. It occurs in the following example of the subtraction of 263 from 342, where, in the first statement, CC and X of both numbers are omitted in the second statement as cancelled:

CCCXXXXII	300 + 40 + 2
CCLXIII	200 + 50 + 13
C XXXII	100 + 30 + 2
L III	50 + 3
L VIIXXII	50 + 27 + 2
= LXXVIIII	= 79

As these numeral characters have the same value in all positions, the solution may be commenced at the left, the interior or the right of the lines or aggregates of the numbers. This system should have a place in educational treatises; it would give enlarged views of the nature of numbers and processes; it would correct false ideas of notation, as when a figure is written and spoken of as (3) three in the ordinary notation, but appears as III, XXX, CCC, or MMM in the other; and it would show that certain curiosities of numbers (see Nines) disappear when the process is represented in a different notation. The Roman adaptations of high numbers being awkward, they may be replaced in

modern practice by the addition of small letters, as in ˣM for 10,000, ᶜM for 100,000, and ᴹM for 1,000,000.

S. S. HALDEMAN.

Roman Catholic Church, that body of Christians which acknowledges the authority of the pope of Rome. It styles itself the "Holy, Catholic, Apostolic, and Roman Church." It is the largest and most powerful denomination of Christians, numbering nearly 200,000,000 souls, or more than one-half the Christian population of the globe, though in general intelligence, energy, and enterprise the Protestant nations are far in advance. The Roman Church is scattered all over the world, but has its chief hold on the Latin races in the south of Europe and America, and on the Celtic portion of the Irish. It stretches in unbroken succession back to the palmy days of heathen Rome, it has outlived all the governments of Europe, and it is likely to live when Macaulay's New Zealander, "in the midst of a vast solitude, shall take his stand on a broken arch of London Bridge to sketch the ruins of St. Paul's." In our age Romanism has furnished the singular spectacle of corruption and decay in its roots and new life in its topmost branches. Undermined by its own children in Italy and Spain, it has reaped a rich harvest of learning, culture, and piety from the Tractarian school of Oxford, and is marshalling its forces for the conquest of the Saxon race, which must chiefly control the future destinies of the Church.

I. *History*.—The earliest record of a Christian church in Rome we have in Paul's Epistle to the Romans (A. D. 58). Though not founded by Peter or Paul, who came to Rome after the year 60, it may possibly be traced to those "strangers of *Rome*, Jews and proselytes," who witnessed the Pentecostal miracle on the birthday of the Christian Church (Acts ii. 10). The metropolitan position of the city which for so many centuries had been the mistress of the world, and the martyrdom of Peter and Paul, the two leading apostles, who closed their labors there, together with the widespread belief that Christ (Matt. xvi. 18) has instituted a perpetual primacy of the Church in the person of Peter and his successors in office, supposed to be the bishops of Rome, are the chief causes of the rapid growth of that congregation to the highest influence. It inherited the ambition and prestige of empire, and simply substituted the cross for the sword as the symbol of power. For fifteen centuries the fortunes of Western Christendom were bound up with the papacy, which even now, in the decrepitude of old age and shorn of its temporal power, exercises a more unlimited control over the consciences of its subjects than any government on earth. We may distinguish three stages in the development of Roman Catholicism.

(1) The age of ancient *Græco-Latin Catholicism*, from the second to the eighth century, before the final rupture of the Greek and Latin communions. This is the common inheritance of all churches. It is the age of the Fathers, of œcumenical creeds and councils, and of Christian emperors. Many of the leading features of Roman Catholicism, as distinct from Protestantism, are already found in the second and third centuries, and have their roots in the Judaizing tendencies combated by St. Paul. The spirit of traditionalism, sacerdotalism, prelacy, ceremonialism, asceticism, monasticism, was powerfully at work in the East and the West, in the Nicene and post-Nicene ages, and produced most of those doctrines, rites, and institutions which are to this day held in common by the Greek and Roman churches. There is scarcely a dogma or usage of modern Rome which may not be traced in embryo to the Greek and Latin Fathers, from Ignatius and Cyprian down to John of Damascus. But alongside with these Romanizing tendencies we find also in St. Augustine the evangelical doctrines of sin and grace which were, next to the Bible, the chief propelling force of the Reformation.

(2) The age of *Mediæval Latin Catholicism*, as distinct and separated from the Greek, extends from Gregory I. or Charlemagne to the Reformation of the sixteenth century. It is the missionary age of Catholicism among the Latin and Teutonic races in Europe. Here we have the conversion of the barbarians in the North and West of Europe under the fostering care of the bishops of Rome; here the growth of the papal hierarchy, though in constant conflict with the secular power, especially the German empire; here the scholastic theology, but in opposition to it also the various forms of mysticism and a more liberal biblical theology; here an imposing theocracy, binding all the nations of Europe together, yet with strong elements of opposition in its own communion urging forward toward a reformation in head and members. The Middle Ages cradled the Protestant Reformation as well as the papal counter-reformation. Wickliffe in England, Hus in Bohemia, Wesel in Germany, Savonarola in Italy, the Waldenses, the Bohemian Brethren, the Councils of Pisa, Constance, and Bâle, and the revival of letters, prepared the way for the great movement of the sixteenth century which emancipated for ever at least one-third of the population from the tyranny of Rome.

(3) The age of modern *Romanism*, dating from the Reformation, or rather from the Council of Trent (1563). This is Latin Catholicism, not only in distinction from Greek Catholicism, but also in opposition to evangelical Protestantism. In some respects it was an advance upon the Middle Ages, and shows clearly the wholesome moral effect of the Reformation. No Alexander VI., who was a monster of wickedness, nor Julius II., who preferred the sword to the staff, nor Leo X., who had more faith in classical art than in the "*fabula de Christo*," could now be elected to the chair of Peter. On the other hand, the papacy gave formal sanction to those scholastic theories and ecclesiastical traditions against which the Reformers protested; it expressly condemned their doctrines, and by claiming to be infallible it made itself irreformable.

In modern Romanism we must again distinguish two periods, which are divided by the reign of Pope Pius IX.

(*a*) Tridentine Romanism is directed against the principles of the Protestant Reformation, and fixed the dogmas of the rule of faith, original sin, justification by faith and works, the seven sacraments, the sacrifice of the mass, purgatory, invocation of saints, the veneration of relics, and indulgences. The "Old Catholics," who seceded and were excommunicated after 1870, took their stand on the Council of Trent in opposition to the council of a Vatican, and charged the latter with apostasy and corruption, when in fact it is only a legitimate logical development.

(*b*) Vatican Romanism is directed against modern infidelity, and against liberal Catholicism within the Roman Church itself. It created, or rather brought to full maturity and exclusive authority, two new dogmas, and two corresponding heresies, concerning the Virgin Mary and the power of the Roman pontiff. These questions were left unsettled by the Council of Trent, and a considerable difference of opinion continued to prevail in the Roman communion. Gallicanism flourished in France during the golden age of its literature, but gradually the Ultramontane school, which defends papal absolutism, gained the ascendency, and accomplished a complete triumph—first in 1854, when Pius IX. proclaimed the immaculate conception of the Virgin Mary to be a divinely-revealed dogma of faith, and in the Vatican Council in 1870, which declared the pope to be the infallible bishop of bishops. The same pope in 1864 issued the "Syllabus of Errors," which must be considered by Romanists as an infallible official document, and which arrays the papacy in open war against modern civilization and civil and religious freedom.

II. *Catholicism and Romanism*.—These should not be confounded, as little as we should confound the people of Israel at the time of Christ with the Jewish hierarchy which crucified him and expelled his apostles. Catholicism is the general Christianity which is held in common by the Greek, the Roman, and the Protestant churches. Romanism is the papal system, which, it is true, identifies itself with *the* Church of Jesus Christ, and regards all other Christians as schismatics and heretics. But this is the fundamental error of Romanism, against which both the Greek and the evangelical churches have always protested. Christianity existed before the Church of Rome, and has since lived independent of it. The very name of Romanism implies sectarian exclusiveness, which, as far as it goes, is opposed to the spirit of true Catholicity. "Romanism is the weakness of Catholicism—Catholicism is the strength of Romanism." Romanism, like Phariseeism of old, accumulates a mass of traditions over the Catholic foundations, and makes them almost ineffectual.

III. *Romanism and Protestantism*.—Romanism makes all of the Church—Protestantism makes all of Christ. The one measures Christianity by Catholicity; the other measures Catholicity by Christianity. The one knows only a visible Church ruled by the pope: the other puts the invisible Church ruled by Christ above all visible churches. Romanism obstructs man's relation to God by interposing traditions and saints; Protestantism brings man into direct communion with God through Christ the only Mediator. Romanism appeals to the voice of popes and councils; Protestantism to the word of God. Romanism overrules the Bible by the traditions of men, and restrains its circulation; Protestantism spreads it in all languages over the world. Romanism makes justification dependent on faith and good works; Protestantism, solely on the grace of God as apprehended by a living faith, which manifests its power by good works. Romanism in its worship appeals to the senses and the imagination; Protestantism, to the intellect and the conscience. Romanism is a religion of priests; Protestantism, the religion of a self-governing Christian people. Romanism is a religion of authority, and at heart opposed to civil and religious liberty; Protestantism is a religion of freedom and the pio-

neer of modern Christian civilization, especially in all Western lands, whither "the star of empire takes its course." The contrast between Roman Catholic and Protestant civilization can be best seen by comparing the Roman Catholic with the Protestant cantons of Switzerland, the southern with the northern part of Ireland, Western with Eastern Canada, Italy with Prussia, Spain with England, Portugal with Scotland, Mexico with the United States. France and Belgium, which are both Catholic and prosperous, make an exception. (Comp. *Protestantism and Catholicism in their bearing upon the Liberty and Prosperity of Nations*, by Émile de Laveleye, with an introduction by Hon. W. E. Gladstone, 1875.)

IV. *Doctrines.*—The doctrines of the Roman Catholic Church are laid down in the œcumenical creeds, the acts of nineteen or twenty œcumenical councils, the bulls of the popes, and especially the Tridentine and Vatican standards. The principal authorities are the canons and decrees of the Council of Trent (1563), the Profession of the Tridentine Faith, commonly called the Creed of Pius IV. (1564), the Roman Catechism (1566), the decree of the Immaculate Conception (1854), and the Vatican decrees on the Catholic faith and the infallibility of the Pope (1870). The best summary of the leading articles of the Roman faith is contained in the Creed of Pope Pius IV., which is binding upon all priests and public teachers, and which must be confessed by all converts. It consists of the Nicene Creed and the following eleven articles:

1. Ego, ——, firma fide credo et profiteor omnia et singula, quæ continentur in symbolo fidei, quo sancta Romana Ecclesia utitur, videlicet: Credo in unum Deum, Patrem omnipotentem, etc. [Symbolum Nicenum.]	1. I, ——, with a firm faith believe and profess all and every one of the things contained in that creed which the holy Roman Church makes use of: I believe in one God, the Father Almighty, etc. [Here follows the Nicene Creed.]
2. Apostolicas et ecclesiasticas traditiones, reliquasque ejusdem Ecclesiæ observationes et constitutiones firmissime admitto et amplector.	2. I most steadfastly admit and embrace apostolic and ecclesiastic traditions, and all other observances and constitutions of the same Church.
3. Item sacram Scripturam juxta eum sensum, quem tenuit et tenet sancta mater Ecclesia, cujus est judicare de vero sensu et interpretatione sacrarum Scripturarum, admitto; nec eam unquam, nisi juxta unanimem consensum patrum accipiam et interpretabor.	3. I also admit the holy Scriptures, according to that sense which our holy mother Church has held and does hold, to which it belongs to judge of the true sense and interpretation of the Scriptures; neither will I ever take and interpret them otherwise than according to the unanimous consent of the Fathers.
4. Profiteor quoque, septem esse vere et proprie sacramenta novæ legis a Jesu Christo Domino nostro instituta, atque ad salutem humani generis, licet non omnia singulis, necessaria: scilicet baptismum, confirmationem, eucharistiam, pœnitentiam, extremam unctionem, ordinem et matrimonium; illaque gratiam conferre; et ex his baptismum, confirmationem et ordinem sine sacrilegio reiterare non posse. Receptos quoque et approbatos Ecclesiæ Catholicæ ritus in supradictorum omnium sacramentorum solemni administratione recipio et admitto.	4. I also profess that there are truly and properly seven sacraments of the new law, instituted by Jesus Christ our Lord, and necessary for the salvation of mankind, though not all for every one, to wit: baptism, confirmation, the eucharist, penance, extreme unction, holy orders, and matrimony; and that they confer grace; and that of these, baptism, confirmation, and ordination cannot be reiterated without sacrilege. I also receive and admit the received and approved ceremonies of the Catholic Church, used in the solemn administration of the aforesaid sacraments.
5. Omnia et singula, quæ de peccato originali et de justificatione in sacrosancta Tridentina synodo definita et declarata fuerunt, amplector et recipio.	5. I embrace and receive all and every one of the things which have been defined and declared in the holy Council of Trent concerning original sin and justification.
6. Profiteor pariter, in missa offerri Deo verum, proprium et propitiatorium sacrificium pro vivis et defunctis; atque in sanctissimo eucharistiæ sacramento esse vere, realiter et substantialiter corpus et sanguinem, una cum anima et divinitate Domini nostri Jesu Christi, fierique conversionem totius substantiæ panis in corpus et totius substantiæ vini in sanguinem; quam conversionem Catholica Ecclesia transsubstantionem appellat.	6. I profess, likewise, that in the mass there is offered to God a true, proper, and propitiatory sacrifice for the living and the dead; and that in the most holy sacrament of the eucharist there is truly, really, and substantially, the body and blood, together with the soul and divinity, of our Lord Jesus Christ; and that there is made a change of the whole essence of the bread into the body, and of the whole essence of the wine into the blood; which change the Catholic Church calls transubstantiation.
7. Fateor etiam, sub altera tantum specie totum atque integrum Christum, verumque sacramentum sumi.	7. I also confess that under either kind alone Christ is received whole and entire, and a true sacrament.
8. Constanter teneo, purgatorium esse, animasque ibi detentas fidelium suffragiis juvari. Similiter et sanctos una cum Christo regnantes venerandos atque invocandos esse, eosque orationes Deo pro nobis offerre, atque eorum reliquias esse venerandas.	8. I firmly hold that there is a purgatory, and that the souls therein detained are helped by the suffrages of the faithful. Likewise, that the saints reigning with Christ are to be honored and invoked, and that they offer up prayers to God for us, and that their relics are to be had in veneration.
9. Firmissime assero, imagines Christi ac Deiparæ semper Virginis, nec non aliorum sanctorum habendas et retinendas esse, atque eis debitum honorem ac venerationem impertiendam. Indulgentiarum etiam potestatem a Christo in Ecclesia relictam fuisse, illarumque usum Christiano populo maxime salutarem esse affirmo.	9. I most firmly assert that the images of Christ, and of the perpetual Virgin the Mother of God, and also of other saints, ought to be had and retained, and that due honor and veneration are to be given them. I also affirm that the power of indulgences was left by Christ in the Church, and that the use of them is most wholesome to Christian people.
10. Sanctam Catholicam et Apostolicam Romanam Ecclesiam omnium ecclesiarum matrem et magistram agnosco, Romanoque pontifici, beati Petri apostolorum principis successori ac Jesu Christi vicario, veram obedientiam spondeo ac juro.	10. I acknowledge the holy Catholic Apostolic Roman Church for the mother and mistress of all churches; and I promise and swear true obedience to the Bishop of Rome, successor to St. Peter, Prince of the Apostles, and Vicar of Jesus Christ.
11. Cætera item omnia a sacris canonibus et œcumenicis conciliis, ac præcipue a sacrosancta Tridentina synodo tradita, definita et declarata indubitanter recipio atque profiteor; simulque contraria omnia, atque hæreses quascumque ab Ecclesia damnatas, rejectas et anathematizatas ego pariter damno, rejicio et anathematizo.	11. I likewise undoubtingly receive and profess all other things delivered, defined, and declared by the Sacred Canons and General Councils, and particularly by the holy Council of Trent; and I condemn, reject, and anathematize all things contrary thereto, and all heresies which the Church has condemned, rejected, and anathematized.
12. Hanc veram Catholicam fidem, extra quam nemo salvus esse potest, quam in præsenti sponte profiteor et veraciter teneo, eundem integram et inviolatam usque ad extremum vitæ spiritum constantissime, Deo adjuvante, retinere et confiteri, atque a meis subditis vel illis, quorum cura ad me in munere meo spectabit, teneri, doceri et prædicari, quantum in me erit, curaturum. Ita ego idem —— spondeo, voveo ac juro. Sic me Deus adjuvet, et hæc sancta Dei Evangelia.	12. I do, at this present, freely profess and truly hold this true Catholic faith, without which no one can be saved; and I promise most constantly to retain and confess the same entire and inviolate, with God's assistance, to the end of my life. And I will take care, as far as in me lies, that it shall be held, taught, and preached by my subjects, or by those the care of whom shall appertain to me in my office. This I, ——, promise, vow, and swear, so help me God, and these holy Gospels of God.

To complete the doctrinal system two more articles of faith must be added, which have been defined in these words: (1) That "the blessed Virgin Mary, by a singular grace and privilege of Almighty God, in view of the merits of Christ Jesus the Saviour of mankind, has been preserved free from all stain of original sin" (in other words, that Mary was absolutely sinless, and hence in no need of redemption); and (2) that "the Roman pontiff, when he speaks *ex cathedrâ*—that is, in discharge of the office of pastor and doctor of all Christians, by virtue of his supreme apostolic authority, he defines a doctrine regarding faith or morals—is possessed of that infallibility with which the divine Redeemer willed that his Church should be endowed, and that therefore such definitions of the Roman pontiff are irreformable of them-

selves, and not from the consent of the Church." It is against the last of these new dogmas that the Old Catholics, led by some of the ablest divines of the Roman Church (Döllinger, Reinkens, Schulte, etc.), revolted and organized a Church similar to the Jansenist communion in Holland.

V. *Government and Discipline.*—The Roman Church is an absolute monarchy, which culminates in the pope. The people are excluded from all participation even in temporal matters; they must obey the priests, as the priests must obey their bishop, and the bishops the pope, who claims to be the universal bishop, the successor of Peter, the vicar of Christ, and the visible representative of Almighty God on earth. This system is the growth of ages, and has only reached its maturity in the Vatican Council. The claim of the bishop of Rome to universal dominion over the Christian Church, and even over the temporal kingdoms professing the Catholic faith, goes back to the days of Leo I. (440–461), and was renewed from time to time, by Nicholas I., Gregory VII., Innocent III., and Boniface VIII. But this claim was always resisted by the Greek Church, which claimed equal rights for the Eastern patriarchs, and by the German emperors and other princes, who were jealous of their sovereignty. The conflict between the pope and the emperor, between priestcraft and statecraft, goes through the whole Middle Age, and has been recently revived under a new aspect by the papal syllabus of 1864 and Bismarck's determination "not to go to Canossa." The Papal Syllabus of 1864 reasserted the most extravagant claims of the mediæval papacy and threatened the sovereignty of the state and the peace of modern society. But the stream of history cannot be turned backward.

VI. *Worship and Ceremonies.*—They are embodied in the Roman Missal, the Roman Breviary, and other liturgical books for public and private devotion. The Roman Church accompanies its members from the cradle to the grave, receiving them into life by baptism, dismissing them into the other world by extreme unction, and consecrating all their important acts by the sacramental mysteries and blessings. Its worship is the most elaborate system of ritualism, unless we except the Greek and Russian service. It is chiefly addressed to the eye and the ear. It draws all the fine arts into its service. Gothic cathedrals, altars, crucifixes, Madonnas, pictures, statues, and relics of saints, rich decorations, solemn processions, operatic music, combine to lend their great attractions for the common people and for cultured persons of prevailing æsthetic tastes, especially among the Latin races. But while the external splendor dazzles the senses and pleases the imagination, the mind and heart, which crave for more substantial spiritual food, are often left to starve. Converts from Rome usually swing to the opposite extreme of utmost simplicity. Catholic worship is the same all over the world, even in language, the Latin being its sacred organ, and the vernacular being only used for sermons, which are subordinate. Its throne is the altar, not the pulpit (which usually stands away off in a corner). It centres in the mass, and this is regarded as a real though unbloody repetition or continuation of the atoning sacrifice of Christ on the cross. At the moment when the officiating priest pronounces the words, "This is my body," the elements of bread and wine are believed to be changed into the very substance of the body and blood of our Saviour, and these are offered to God the Father for the sins of the living and the dead in purgatory. This must be either an awful truth or an awful error or a pious illusion. The Reformers saw in the mass a relapse into Judaism, a refined form of idolatry, and a virtual denial of the one sacrifice of Christ, who "by one offering hath perfected for ever them that are sanctified" (Heb. x. 14). There are, however, eminent Roman divines who so spiritualize and refine the doctrine of the mass as to make it only a dramatic commemoration and renewed application of the one and ever-living sacrifice of Christ.

(For particulars compare PAPAL STATES, POPE, JESUITS, GALLICANISM, ULTRAMONTANISM, IMMACULATE CONCEPTION, INFALLIBILITY, TRENT, VATICAN COUNCIL, etc.)

Literature.—The standard writers in explanation and defence of the doctrinal system of Romanism are Bellarmine, Bossuet, Möhler, John Perrone, Klee, Dieringer, Friedhof, Wiseman. The chief historical works by Roman Catholics are the *Annals* of Baronius, the *Church Histories* of Rohrbacher, Möhler, Alzog, Hefele (*Concilien-geschichte* down to the Council of Constance), and Döllinger (before 1870). In England and America the Roman Church has found its ablest advocates among converts, such as Dr. John Henry Newman, Cardinal Manning, Dr. Orestes Brownson, and others who, wearied and tired of Protestant liberty, have sought rest in absolute submission to an infallible pope. PHILIP SCHAFF.

Romance. See NOVEL, by MRS. S. B. HERRICK.

Roman Cement. See CEMENTS, by GEN. Q. A. GILLMORE.

Romanesque Architecture. See ARCHITECTURE, by CLARENCE COOK.

Roma'ni (FELICE), b. at Genoa in 1798. Among his instructors was Galliuffi, the celebrated improvisatore of Latin verse. Romani took his legal degree, but literature attracted him more strongly than the law, and he began his career as composer of *libretti* for the theatre of Milan, a position which he ennobled by the verses written for the *Sonnambula*, the *Norma*, the *Pirata*, the *Straniera*, the *Beatrice di Tenda* of Bellini, and for the *Elisire d'Amore* of Donizetti. He has also left a volume of fine lyric poems. Carlo Alberto appointed him editor of the *Gazetta Piemontese*. D. at Turin 1865.

Roma'nia, or **Rouma'nia,** a quasi-independent European state, comprising the former principalities of Moldavia and Wallachia, with a part of Bessarabia ceded by Russia in 1856, has a total area of 46,637 sq. m., and lies between 43° 38′ and 48° 50′ N. lat., and 22° 30′ and 30° 5′ E. lon. It is bounded N. and W. by Austro-Hungary, E. by Russia, the Black Sea, and Turkey, and S. by the Danube, which divides it from Turkey. Its territory is of a crescent shape, and its surface rises gradually from the Danube and the Pruth to its N. and W. frontier, the crest of the Carpathian Mountains, the loftiest of whose peaks, the Ciacleul or Pion, rises to the height of 8900 feet above the Black Sea. Romania is drained wholly by affluents of the Danube. The principal rivers are—the Olto, which rises in Transylvania, cuts through the Carpathians, and after a course of more than 200 miles empties into the Danube at Islar; the Sereth, of about the same length, which joins the Danube below Galatz; the Dumbovitza, on which lies the capital, Bucharest; and the Pruth, which empties into the same river between Galatz and Reni. Fresh-water lakes are numerous in the interior, and the Black Sea coast is skirted with salt and brackish lagoons. Romania is divided into 33 districts, comprising 2965 communes, which contain above 30,000 villages or hamlets. The largest towns are—Bucharest, pop. 121,754; Ployesti, 26,468; Braila, 25,467; Giurgevo, 10,554; Crajova, 25,521; Jassi, 90,236; Bolochani, 37,594; Galatz, 36,107; Ismail, 20,869; Bolgrad, 13,937. The total population, which in 1841 was 3,519,000, is reported to have risen to little less than 5,000,000 in 1874, including about 50,000 foreign residents. The proportion between the sexes was 516 males to 484 females in 1000. There are 274,000 Israelites, 45,000 Roman Catholics, 29,000 Protestants, 8000 Lipovans, 8000 Armenians, and 1300 Mohammedans. The remainder of the inhabitants are of the dominant or national Church, which professes the orthodox Oriental faith, but claims to be independent of all foreign spiritual control. The law promises protection to the worship as well as to the persons of dissenting religionists, but even in recent years the Jews have been treated with great intolerance and cruelty. The national Church has 8 dioceses, 2 of which are archiepiscopal—the metropolitan sees of Bucharest and Jassi. There are 8 seminaries for the orthodox clergy, and 6858 churches administered by 9702 priests. There are 2 Roman Catholic bishops with the title of apostolic vicar, and 63 Roman Catholic churches.

Along the lower course of the Pruth and the Danube are extensive alluvial tracts; the soil of the upland plain between the mountains and the Danube is of Quaternary formation; the foot-hills of the Carpathians are of Tertiary formation, containing Pliocene, Miocene, and Nummulitic deposits; the summits of the mountains represent the Secondary, Primary, and Metamorphic or Azoic rocks. About one-half of the territory is fit for cultivation and pasturage, one-sixth part is occupied by forests, and about one-third is waste.

Romania abounds in animals of the chase, as well as in the smaller quadrupeds, and its fauna appears to include all the mammals which occur in other European regions of similar climate, though we do not find mention of the ibex or of the beaver. Its woods and its waters are frequented by the same birds as those of Central Europe, including the cock of the woods, and even the ibis and pelican are enumerated as occurring. The rivers and the lakes abound in fish of every European species, but the fisheries do not seem to be actively pursued. The climate varies according to elevation and position. The extremes noted in 1866 are + 101° F. and − 11°. The principal agricultural products are wheat, maize, rye, barley, oats, millet, colza, flax, hemp, and tobacco, the average crop of wheat being estimated at 25,000,000 bushels, that of maize at 33,000,000 bushels. All the garden vegetables and all the fruits known to European horticulture grow in perfection in Romania. The grapes and some of the wines, which are little known abroad, are of excellent quality.

Manufacturing industry can hardly be said to exist in Romania, except in the fabrication of coarse household tissues and the simple handicrafts of rustic life. All finer wares are imported from abroad. Numerous varieties of marble are found on the right flank of the valley of the Olto; millstones, gypsum, and alabaster abound; fuller's earth and hydraulic lime are common; carbonate and sulphate of soda, azotate of potassa, and the sulphates of alumina and magnesia occur, and native sulphur is found in various localities. Gold, iron, copper, rich lead ores, cobalt, and arsenic exist, and there are large salt-works, as well as numerous petroleum-wells, the product of which has importance. Grain and other seeds, black cattle, swine, sheep, and the products of these animals, horses, and vegetable and mineral raw material, including lumber, are exported. The imports consist almost entirely of manufactured articles, sugar, coffee, spices, and objects of luxury. The monetary system of Romania is assimilated to that of France, the unit of computation being the *leu* (pl. *lei*), which is equal to one franc. The foreign commerce is almost wholly carried on by ships under foreign flags at the ports of Galatz and Braila, both on the Danube, but the construction of railways from Tschernawoda and Ruschtschuck to the Black Sea ports of Kustendschi and Varna, combined with the difficulty of the navigation of the lower Danube, has diverted much traffic from that channel. In 1812 upward of 3800 foreign vessels entered the Romanian ports, about half being Greek; the English were 245, the American 5. The Danube is navigable for vessels of several hundred tons burden from the Austro-Hungarian boundary quite to the sea, and hence, though a frontier stream, it facilitates commerce between the river provinces; but the other rivers are not available for much internal transport. In 1875 there were above 800 miles of railways in operation, and about 100 in course of construction. Until 1869 there were no postal establishments in Romania, except those conducted by the commercial agencies of Russia and Austria; but at that date a regular postal service was organized, and has since been administered by the government. In 1874 upward of 3,000,000 private and 1,000,000 official letters passed through the 274 post-offices of the state. There were in 1874, 2510 miles of telegraphic lines in operation, generally with two wires.

Public instruction is obligatory for both sexes. There are 1975 rural primary schools (1891 for boys, 84 for girls), with 56,000 pupils and 1900 teachers, and 246 city primary schools, with 26,160 pupils and 570 teachers. There are 14 gymnasiums or colleges, several lyceums, 3 central female schools, and 3 secondary female day schools at Bucharest, Jassi, and Braila. Bucharest and Jassi have each a university with the usual faculties, and there are various special schools. The budget of 1875 fixed the army, including the gendarmerie and other corps charged with civil duties, at 1613 officers and 62,758 rank and file, chiefly provided with improved small-arms and ordnance, and 15,000 cavalry. The navy consists of 3 armed steamers, 6 gunboats, and 400 seamen. The national flag is blue, yellow, and red, arranged as in the flag of France.

Romania claims to be a completely independent political state, enjoying, by virtue of ancient capitulations with Turkey, by the Treaty of Paris of 1856, and by the Convention of Paris of 1858, all the rights of sovereignty, including that of negotiating treaties of commerce and making war and peace. Her publicists maintain that the annual contribution to the Porte—the sole *indicium* of Turkish suzerainty—is not technically a tribute, but a compensation for the obligation of Turkey to defend the Romanian soil. Turkey contests this opinion, and in 1872 the question of sovereignty was debated with an acrimony which threatened serious complications. The throne is hereditary in the male line of the ruling family, a branch of the house of Hohenzollern; but the chief of the state does not assume the title of king, and is called prince-regnant, or, in Romanian, *domnu* or *domnitor*. The constitution is liberal, guarantying to all citizens equality before the law and liberty of conscience, of the press, and of public meetings. Legislative power is exercised by a senate and chamber of deputies, both elective. The civil and judicial system is based on the Code Napoléon. There is a court of errors or cassation; 4 courts of appeal, each having an inferior court, with a jury, for criminal cases; and there are 48 courts of civil jurisdiction, besides commercial tribunals.

The Roman province of Dacia, as established after its conquest by Trajan, embraced all Moldavia W. of the Pruth and the whole of Wallachia. Its native population had been almost wholly destroyed or dispersed by war, and Eutropius informs us that Trajan repeopled the province with colonists *ex toto orbe Romano*. The Romans, after a possession of about 170 years, were expelled by the Goths. The country was subsequently overrun by the Gepidæ, the Slaves, the Huns, and other barbarous tribes; but, according to native historians, the territory between the Olto and the Carpathians, called Little Wallachia, was never occupied by any of these invaders, and it became ultimately a centre from which the Daco-Latin race and their language spread over a great extent of adjacent country. After the conquest of Constantinople by the Ottomans, Moldavia and Wallachia became Turkish provinces, but enjoyed a practical independence under Christian rulers until the reorganization of the territory by the allied powers in 1856.

The Romanian language, now spoken with great uniformity of dialect throughout Romania, and by a nearly equally numerous population in the adjacent provinces, belongs substantially to the Italic stock, though its vocabulary embraces a considerably larger proportion of foreign words, chiefly borrowed from remotely-allied tongues, than most of the Romance dialects, and it has consequently an unfamiliar aspect and accent to the eye and the ear of the Germanic and Latin races. The mixed character of its colonial population and other considerations render it highly improbable that classical Latin ever became the general vernacular of Dacia. The military and foreign jargons introduced by the colonists doubtless coalesced under the influence of the official and ecclesiastical tongue into a common dialect much resembling that now spoken, though numerous Slavic, Magyar, Greek, and Turkish words have been introduced into it at later periods. There is but a very small number of words believed to be Dacian, and native philologists deny that there are any traces of ancient Gothic, all words of that stock now occurring being late importations from German commerce and literature. This, if accurate, seems a singular fact, when we consider that Mœso-Gothic was so extensively employed in the fourth century in Mœsia, and doubtless in Dacia also, as to induce Ulfilas to translate the Scriptures into that tongue; and that, as we learn from Busbequius, a Gothic dialect continued to be spoken in the Crimea down to the sixteenth century. The most numerous class of foreign words are Slavic. The Cyrillic alphabet was introduced with the liturgy, and continued in general use until very lately. The Roman character, encumbered by inconvenient diacritical points and accents, is now almost universally employed. The orthography and pronunciation have a general resemblance to Italian, and the only very marked grammatical distinction between Romanian and other Romance dialects is that, as in the Scandinavian languages, the definite article is a suffix in all the cases except the ablative. No Romanian writer can be said to have acquired a European reputation, though several native authors are in high repute in Romania. The only literary productions of much interest to foreigners are the popular ballads and the native chronicles edited by Michael Cogolnichan, of which a second edition, in 5 vols. royal 8vo, is now in course of publication at Bucharest under the title of *Chronicele Romaniei séŭ Letopisetzele Moldaviei si Valahiei*. Two volumes of the *Istoria Critica a Romanilorŭ*, by B. P. Hasden, a very learned work, have been issued, in an improved ed. in 4to, at Bucharest, and we must notice the *Dictionariulu Limbei Romane*, compiled under the patronage of the Romanian Academy, and now advanced to letter S, as an important contribution to the lexicography of the languages of the Latin stock, though the adoption of puristic principles, which have led to the exclusion of almost all words not of Latin or Greek etymology, greatly detracts from its usefulness. F. A. P. Barnard.

Romanic Languages, or **Romance Languages,** the common name of those languages which developed from the ancient Latin tongue, either by direct transition or by amalgamation of other elements—Germanic, Celtic, etc. They comprise the Italian, Spanish, Portuguese, French, Provençal, Romansch, and Wallachian.

Roman Law. See Law, Civil, by Prof. J. N. Pomeroy, LL.D.

Romano (Giulio). See Giulio Romano.

Romanoff. See Russia, by Clemens Petersen.

Romans′, a handsome old town of France, department of Drome, on the Isère, here crossed by a bridge of the ninth century, has manufactures of silk. P. 11,814.

Romansch, Romaunsch, Romonsch, or **Rhæto-Romansch,** is the language of about half the population of the Swiss canton of the Grisons, and is spoken in some other Alpine valleys comprised, like that canton, in the ancient Roman province of Rhætia. The local varieties of speech in the Romansch language are numerous; and Ascoli groups under the general name of *dialetti Ladini* both these and the allied dialects used along an irregular curve extending, though with some interruptions, from the upper valleys of the Vorder-Rhein on the northern to the lower course of the Tagliamento on the southern slope of the Alps. Popularly, however, the appellation *Ladino* has long been restricted to the two vernaculars of the Upper

and Lower Engadine, or valley of the Inn, while the local dialects of the Grisons, spoken in the upper basin of the Rhine and the neighboring valleys, are called by the general name of *Romansch*. This latter appellation embraces various subdivisions, the most important being known as *Subsilvan* and *Suprasilvan*.

The differences between the Romansch and the Engadine or Ladino are rather in articulation than in inflexion or in grammatical construction. There are, nevertheless, in the conjugation of the verbs and in some other points dialectical differences of a certain importance. Thus, the Romansch has a greater richness of inflexion in the subjunctive mood; the Engadine, on the other hand, has three forms of the future expressive of distinct shades of meaning. It is a curious fact that though the Protestant and Roman Catholic parishes, as well as the communes using respectively the German and the Romansch languages, are so confusedly intermixed that a general fusion in language would seem to be inevitable, still the Romansch Roman Catholics are plainly distinguishable in speech from their Protestant neighbors, who use a dialect, grammatically speaking, substantially the same. The differences are probably due to the influence of the Latin employed in the church services among the Roman Catholic population.

The vocabulary of the various dialects does not show a great range of difference in etymology, though the orthography is so capricious and unsettled as to create an impression of greater discrepancy than really exists. The proportion of German vocables is everywhere considerable, and they occur in all the parts of speech, even the particles. There is also a certain number of words of obscure origin and formation apparently not belonging to either the Gothic or the Italic family of languages.

As a whole, the Romansch in all its dialects very decidedly belongs, both by its vocabulary and by its grammatical structure, to the Italic stock; and though not distinguished from its sister tongues by any very striking peculiarities, it is nevertheless a valuable source of illustration of the etymological processes by which what are called the modern Romance languages have been formed. Its most ancient written memorials are from the fifteenth century. Its literature is almost exclusively ecclesiastical, and consists chiefly of translations of the Scriptures and other works of religious instruction and edification. The first translation of the Bible into any of the Romansch dialects appeared at Scuol in 1679, under the title of *La sacra Biblia quai ais tuot la sancta Scrittüra . . . vertida e stampada in lingua Romanscha d'Engiadina Bassa, di Jac. Ant. Vulpi e Jac. Dorta a Vulpêra*. This translation was republished by Nott da Porta in 1743, and there are several later editions. Another translation of the Bible, in the Suprasilvan dialect, by Stephen Gabriel, appeared at Coire in 1719, entitled *La sacra Bibla quai ei tut la Soinchia Scartira*. One of the chief works in Romansch literature is the *Martyrologium Magnum oder il Cudesch Grand dels Martyrs*, translated by Conrad Riola into the Lower Engadine dialect, of which the first part was issued at Strada in 1718 in a quarto volume of 556 pp. The second part was never published. The infusion of the German element is much more conspicuous in the diction of this volume than in most older Romansch works, and especially than in the compositions of the present century, during which puristic principles have been in vogue. The secular prose literature of the Romansch language is not extensive, the only works of much interest being—Nott Aporta, *Chronica Rhatica, l'Historia del origine, guerras, alleanzas, etc. de la Rhetia* (Scuol, 1742), and Ant. Vulpius, *Historia Rhætica translatada e scritta in lingua vulgar Ladina*, a narrative of the religious wars of the seventeenth century in the Grisons, written about 1680, but first published at Coire in 1866. Travers wrote in the fifteenth century a rhymed chronicle entitled *La Chanzun della Guerra dalg Chiasté d'Müsch*, and Gioerin Wietzel is the author of a poetic account of the war of the Valtelline. There are in these dialects a few essays in dramatic composition, and many short descriptive, didactic, and lyrical poems, among which those of Z. Pallioppi are very popular. The *Poesias Umoristicas Populeras, etc.* da S. Caratsch (Turin, 1865) are also much esteemed. Several well-conducted weekly journals in the native tongue are published in the Engadine.

The special interest of the Romansch lies in its relations to the ancient Italic languages. It has been maintained by some that the Etruscans, in their original emigration across the Alps into Italy, left a portion of their tribe, and of course their language, in Rhætia, which took its name from that by which the Etruscans called themselves, *Rasena*, and that the modern Romansch is a lineal descendant from the Etruscan. Others hold that Rhætia was occupied by Etruscans driven out from their seats in Lombardy by the Gauls, or from Etruria by the Romans; and it is at least well established that the Etruscans embraced Rhætia, as well as other countries in and beyond the Alps, in the wide range of their commerce. (See Genthe, *Ueber den Etruskischen Tauschhandel nach dem Norden* (Frankfurt-am-M., 1874), and Steub, *Ueber die Urbewohner Rhætiens* (München, 1843).) Others, again, believe that Rhætia was Romanized by its conquest about fifteen years before the time of Christ, and that its language has been formed by the same process as the other Romance dialects of the ancient Roman provinces. Diez and Fuchs have elucidated the grammatical character of the Romansch dialects, and their phonology has been most fully and ably treated by Ascoli, *Glottologia* (vol. i., Turin, 1873). Among the many native grammars we may mention those of Carisch (Coire, 1852 and 1859); Bühler, *Grammatica elementara del Lungatg Rhæto-Romansch* (first part, Cuera, 1864); Pallioppi, *Ortografia e Ortoepia del Idiom Romauntsch d'Engiadin'ota* (1857), and *La Conjugaziun del Verb* (Samedan, 1868). Carisch published a Romansch-German dictionary at Coire in 1848, and a grammar in 1852. The death of Pallioppi (1870) prevented the completion of an important general Romansch lexicon on which he had long been engaged. To those whose curiosity is satisfied with such a view of the language as can be obtained by a comparison of texts we recommend, besides the translations of the Bible, Bühler, *Guglielm Tell, drama de Friderie Schiller, vertius e publicaus en lungatg Rhæto-Romonsch* (Cuera, 1865).

GEORGE P. MARSH.

Ro'mans, Epistle of St. Paul to the, was probably written from Corinth. It is one of the most important of the Pauline books, and affords so many fine examples of the noble and altogether peculiar style and reasoning of the great apostle that its authenticity has never been seriously called in question. Its contents are largely doctrinal, but it contains fine hortatory passages and directions for practical conduct. Its exegetical literature is extensive. The Epistle contains a thorough and comprehensive statement of the theology of Paul. He wrote the epistle to the church at Rome, which had been already established, probably by some of his own disciples, in order to prepare the way for a visit which he was anxious to make to them (xv. 23). At the time of writing he was under the necessity of going to Jerusalem (xv. 25–27). He therefore stood at the point described in Acts xx. 3; that is, about the year 58.

Romantic School. See APPENDIX.

Romayne' (NICHOLAS), M. D., b. at Hackensack, N. J., in Sept., 1756; studied medicine under Dr. Peter Wilson, also at Edinburgh, Paris, and Leyden; commenced practice at New York about 1782; gave private lectures on anatomy and other medical topics; was the first president of the New York Medical Society 1806; was one of the founders and the first president of the College of Physicians and Surgeons (1807), in which he lectured on anatomy and the institutes of medicine. D. in New York July 21, 1817.

Rome [Lat. *Roma*; Gr. Ῥώμη]. *Heathen Rome, History of.*—According to legends, Romulus, the son of Mars and of Rhea Silvia, the daughter of the king of Alba, founded the city and the kingdom of Rome, which grew rapidly in size and power by the establishment of an asylum on the Capitoline Hill and by the union with the Sabines and other Etruscan dwellers on the Cœlian Hill. Niebuhr in his *Roman History* proved the thoroughly mythical character of these legends, but so far the true history of the foundation of Rome has not yet been ascertained. Several kings, probably of Etruscan origin, seem to have ruled the young state some 600 years before Christ. In the days of Servius Tullius (578–534) Latium became part of the state, and a new constitution was given to the monarchy. The people consisted of three tribes, representing the Latin, Sabine, and Tyrrhenian elements, which constituted the *patricians*, free-born members of the original families or *gentes*, with their clients or dependants. The *plebeians* were also free, but had originally no political rights, being generally of Latin origin, and only admitted into the state by favor. By a change of laws under Servius they became entitled to equal rights, but for centuries the struggle between the conservative patricians and the more or less republican plebeians was the cause of great trouble and endless strife. The kings, elected for their lifetime, had by their side a senate, while the priests, forming a college of *pontifices*, and the *augurs*, employed in explaining the will of the gods as manifested in sacrifices and the flight of birds, controlled the will of the people largely through their religious influence. Regal Rome ruled the whole Latin coast, and treaties made with powerful Carthage, with Massilia in France, and with the Greeks of Southern Italy bear witness to the respect it enjoyed abroad, while imposing structures, still extant, recall its greatness at home. Servius fell through the misdeeds of his daughter

Tullia and her husband, the seventh king, Tarquin the Proud. With him ended the monarchy, and Rome was conquered by the Etruscan Porsenna. When the latter was slain at Aricia, Rome recovered her independence, though much curtailed in power and territory, and became a republic, ruled by two consuls, chosen annually from the patricians. Inner dissensions long retarded the growth and the prosperity of the commonwealth. In 494, however, the plebeians, constantly increasing in number and power by new acquisitions of territory, obtained by threatened secession the right to choose tribunes and ædiles to protect their liberties against the tyranny of the patricians. Chosen from among themselves, the tribunes were sacred and inviolable in their person, and possessed the veto power annulling any law or decree of the senate. Thus, they had tried and banished already in 491 the patrician Coriolanus because he had violated their rights; the incensed general appeared at the head of a Volscian army at the gates of Rome, but by his own generosity the city was saved from imminent ruin. An agrarian law, which was to secure to plebeians also a share in the public lands, became a source of long-continued strife at home, while almost incessant wars with neighboring tribes prevented a more rapid growth of the state. To this period belong the legends of the elder Brutus, of Lucretia, Horatius Cocles and Mucius Scævola, of Cincinnatus and the Fabii. Cincinnatus, however, was really for a time a stern ruler of Rome, and the Fabii were actually employed in the wars against Veii. In 457 the supreme power was vested in ten men, the decemviri, but two years later lost by the latter through the legendary insult suffered by Virginia. The plebeians seceded a second time, whereupon the old constitution was restored, and the Twelve Tables, the basis of all subsequent Roman law, were publicly acknowledged and exhibited. An appeal to the people was secured to every citizen, plebeians and patricians were allowed to intermarry, the tribes obtained legislative power, and military tribunes as well as censors were appointed. These offices, as well as the quæstorship, were thrown open to the plebs, and soon they were admitted to the senate also.

Hardly, however, had Veii been conquered by Camillus (395) when a more formidable enemy, the Gauls, appeared, defeated the army, and burnt Rome, the citadel, called the Capitol, alone escaping their fury. Through the heroism of Manlius and Camillus the barbarians were driven out, but the former paid with his life for an effort to assist the impoverished and ill-treated plebeians, and for ten years Rome was once more the scene of a fierce struggle between the plebs and the patricians. The latter succumbed, and by the Licinian Rogations (376) debtors were relieved, the public domain was partly thrown open to the plebs, and one of the two consuls left to be chosen by them. The return of peace led to the gradual relief of the latter; step by step they obtained access to all the higher offices of state, and when in 300 even the colleges of priests and augurs became accessible to them, there was virtually no longer any political difference existing between the two classes. L. Sextus was the first plebeian consul, but a *prætor urbanus* was invested with the judicial powers formerly wielded by the consuls, and curule ædiles were invested with great prerogatives, though members of both orders were eligible for the office. Thus, the patricians lost ground, and gradually gave way to a new nobility formed by high officials irrespective of their origin. The end of civil contests enabled Rome, with the aid of newly-formed legions, to carry on the war against rivals and enemies with increased energy, and gradually to conquer the whole of Italy. With wise moderation and great political foresight Rome treated the vanquished with kindness, incorporated them into the state, and admitted them to citizenship. The Samnites, the bravest and freest of Italian tribes, were not subdued till after three long and bloody wars (290), when the Gauls and Etruscans also were defeated. King Pyrrhus of Epirus, called by the Tarentines to assist them against Rome, at first obtained several victories by superior military skill and the use of elephants, but was finally defeated by Curius Dentatus near Beneventum (275), and compelled to leave Italy. The various tribes of Gauls had been previously subjugated; now Tarentum also was conquered (272), and with this conquest of the most powerful of Greek communities in Italy, and a victory over the last of the hostile Umbrians (266), the subjugation of the whole of Italy from Cisalpine Gaul to Sicily was accomplished (264).

Sicily, however, was still in the power of Carthage, and when a body of mercenaries, called Mamertines, who had obtained possession of Messina, asked for help against Hiero, king of Syracuse, the Romans eagerly seized the opportunity to weaken the power of Carthage. Thus began the First Punic war (264–242), which resulted in the conquest of the larger part of Sicily—leaving Hiero independent in his small kingdom—and the formation of the first Roman fleet. Misfortunes like the defeat of Regulus in Africa, and his well-known tragic end, only led to more energetic efforts, but also, after peace was made and Sicily had become the first Roman province, to the unwarranted occupation of Sardinia and Corsica, which Carthage, prevented by domestic broils, could not defend. In 235 the temple of Janus was closed, indicating that for once Rome was at peace with the world, but soon afterward new wars commenced and new victories were obtained against the Ligurians and the Illyrians. The Gauls, who had invaded Italy, were driven out, but Cisalpine Gaul was lost almost as speedily as it was won, when the Second Punic war threatened the very existence of Rome. Carthaginian generals—Hamilcar, the dreaded adversary of the Romans in the First Punic war, and Hasdrubal—had conquered portions of Spain, and soon after, Hannibal completed the conquest to the S. of the Ebro and the Douro, taking Saguntum, a Greek colony in alliance with Rome. War was declared 219, and Hannibal marched through Spain and Gaul, aided by the Gauls, reaching Italy with a small but enthusiastic army, with which he defeated the Romans in two pitched battles at Lake Thrasymenus, where the consul Flaminius fell, and at Cannæ, where both consuls were defeated with immense slaughter (216). Rome was in imminent danger, but her senate calmly and courageously exerted every means to prepare resistance, and the dictator, Fabius Cunctator, with great skill husbanded his forces while exhausting those of his adversary. Southern Italy having risen in favor of Hannibal, the latter with his army went to Capua, but could obtain reinforcements neither from home nor from Spain, where his brother Hasdrubal was hard pressed by the Romans. The latter gradually recovered ground; they retook Capua; then Syracuse and the rest of Sicily were conquered by Marcellus (212); in Spain Scipio avenged the death of his father and his uncle by brilliant victories; and finally Hannibal himself was defeated by Scipio on his native soil at Zama (202). Peace was made and the power of Carthage for ever destroyed. Massinissa, king of Numidia, an ally of the Romans, was liberally rewarded.

These victories only increased the desire of Rome to become the mistress of the world, while the rich booty acquired in these wars inspired the armies with thirst for new conquests. The alliance of Philip of Macedon with Carthage gave a pretext to Rome for turning her weapons next against the East. War was declared, Philip's army routed at Cynoscephalæ (197), and by a nominal acknowledgment of the liberties of the Greeks a foundation was laid for the supremacy of Rome in Greece. Antiochus the Great, king of Syria, who had invaded this country, was promptly driven out, and at Magnesia in Phrygia defeated by the younger Scipio (190). Thus the Romans entered Asia, granting the provinces which they had obtained from Antiochus to their near allies, Eumenes of Pergamus and the Rhodians. Almost at the same time Cisalpine Gaul was reconquered and created a province, and nearly the whole peninsula of Spain subjected to Roman dominion. A second Macedonian war, against Perseus, Philip's son, and his ally, Gentius, king of Illyria, ended with the capture of the latter at Scodra and the brilliant victory of L. Æmilius Paulus at Pydna (168). Perseus and his sons were carried captive to Rome, and with them such immense booty that the citizens were for ever relieved of the burdensome tribute paid heretofore. Macedonia and Illyria were declared free; the Rhodians were stripped of their possessions on the peninsula; Antiochus IV. of Syria was compelled to admit the supremacy of Rome; and 1000 Achæans were carried as hostages to Italy. When the 300 survivors, after their return, induced in 150 the Achæan League to declare war against Sparta, Rome's ally, they were defeated by Q. Cæcilius Metellus at Scarphæa, and later by Mummius at Leucopetra, whereupon Corinth was destroyed, and Greece, with the exception of Sparta and Athens, became a Roman province under the name of Achaia. The same fate befell Macedonia and Illyria, and Rome was now virtually mistress of the East and the West; for in the same year Rome, incited by Cato, had declared war once more against Carthage, and the third Punic war, under the second Scipio (Africanus), led to its conquest and its organization as a Roman province (146). This great general also took Numantia, a Spanish city, after a noble defence of ten years (133), reducing Spain also to a dependency—a fate which the Asiatic kingdom of Pergamus shared (133) when Attalus, its last king, bequeathed it in his will to Rome.

In the mean time, Rome had undergone great changes at home. The constant wars, the vast booty flowing from all sides into the capital, the lawless habits of life contracted by a victorious soldiery in foreign parts, and the vast admixture of foreign elements produced boundless

self-indulgence and general faithlessness and corruption. New vices were imported, mainly from Greece and Asia—new creeds from all parts of the world. The stern simplicity and strict morality of former times disappeared; manly virtues and noble self-sacrifice were supplanted by intrigues and vile cunning. In vain did the censor Cato inveigh against the sad innovations; in vain were all attempts to check extravagance and vice by sumptuary laws and strict prohibitions. The influence of Greece, first felt in the development of a Roman literature after the First Punic war, and then in the almost universal adoption of Greek philosophy and Greek manners, exercised a baneful influence. Simultaneously with this corruption of morals, the political institutions of ancient Rome also were fatally undermined. The new aristocracy, almost exclusively in possession of the higher offices, and hence immensely rich, developed a hostile antagonism to both the old aristocracy of the patricians and the people at large. Their wealth, amassed in the administration of provinces and the oppression of allies, contrasted all the more painfully with the poverty of the mass of the people as the rich gradually possessed themselves of almost all landed property and cultivated the soil exclusively by countless slaves. The poor congregated in vast numbers in Rome, where food had to be distributed in incredible quantities—first for a small price, and after 50 B. C. gratuitously. To remedy this crying evil, to relieve the poverty of the masses, and to increase the number of small land-owners, the tribune T. Gracchus proposed a new agrarian legislation (133). He succeeded, not without violating existing laws, but the optimates, the ruling party, resisted violently, and both he and his brother Caius paid with their lives for their noble though injudicious efforts to benefit the people (121). His followers were cruelly put to death, and henceforth, legal reform becoming impossible, a revolution could clearly be foreseen. The utter corruption of Rome became manifest in the war against Jugurtha, king of Numidia (111), who succeeded in bribing Roman consuls. At last C. Marius was elected consul—a triumph of the people over the optimates—and he opened the ranks of the legions to a lower class of men, thus making the army a readier instrument in the hands of great political leaders. He not only conquered Jugurtha, who was starved to death, but, being frequently re-elected, defeated also the Cimbrians and Teutons, who had destroyed two Roman armies at Noricum (113) and in Gaul (105). The Teutons were routed by C. Marius at Aquæ Sextiæ—the Cimbrians in Cisalpine Gaul (101). A short servile war in Sicily prevented him for a time from turning against the senate, but a social war in Italy itself between the Romans and the various allies, in which the former were victorious, led to the great rivalry between Marius and Sulla and the breaking out of a bloody civil war. The latter had as consul obtained the supreme command of the army in a war against Mithridates, king of Pontus, who had risen in Asia against Rome. Marius endeavored to deprive him of this place, but Sulla returned with his whole army, defeated Marius, banished him and his adherents, and was appointed perpetual dictator. As such he reconstructed the government of Rome in favor of the aristocracy, ended the war against Mithridates victoriously, and then resigned his honors. During his absence, however, Marius had been recalled by Cinna, and Rome had been taken and fearfully devastated, but both Cinna and Marius died before Sulla returned to Italy. In 83 he landed at Brindisi; Pompey brought him additional troops, and after a number of victorious battles Sulla remained sole master of Italy (82). He became dictator, avenged himself by merciless proscriptions on his adversaries, bestowed on his vast army rich gifts in land and money, and increased his party by granting citizenship to large numbers of freedmen. In 79 he abdicated and died in retirement; with him fell nearly all the changes he had made in the government of Rome. In the mean time, Lucullus and Pompey had conquered Armenia, made Syria a Roman province, subjugated Judæa, and subdued the Mediterranean pirates. Another servile war, in which Spartacus, a Thracian gladiator, proved at first victorious against several Roman armies, ended with his defeat (73) by M. Crassus; and Spain also, where Sertorius had ably maintained the banner of Marius, was finally pacified. Pompey found himself on his return from Asia (61) the most powerful man in Rome, with no rival but Julius Cæsar, and no danger but the conspiracy of Catiline. The latter was defeated by the matchless eloquence of M. T. Cicero, who had already rendered most eminent services to the commonwealth. The rivalry with Cæsar and the enmity of that stern republican, the younger Cato, he cunningly anticipated by forming with Cæsar and Crassus the triumvirate. Crassus, whose great wealth and brilliant talents would have made him most formidable, fell soon afterward in a war against Parthia. Cæsar went, after Cicero had been banished from Rome, into Cisalpine Gaul, completed the conquest of that province, and invaded Germany and Britain. Strong in the great renown which he had thus acquired, and supported by enormous wealth and the enthusiasm of a large, well-disciplined army, he returned to Italy; and when Pompey, on the plea of supporting the senate, took hostile measures, he defeated his rival and gained victory after victory. His crossing the Rubicon, the boundary-line of his province, began the civil war, in which he defeated all his enemies. He compelled Pompey's adherents to leave Spain, and took Massilia; Rome was forced to make him dictator, and the next year saw him land in Illyria. At Pharsalus (48) he defeated Pompey, who was soon after killed in Egypt. After the Alexandrian war and the victory over Pharnaces of Pontus he returned to Rome, where he was re-elected dictator and invested with almost unlimited power. Equally successful in the African war, which ended with the battle of Thapsus (46), and in the final annihilation of Pompey's party by the battle of Munda, he was now made imperator (45), and the senate ordered divine honors to be paid to him. The desire to add to royal power the name of king led to a conspiracy which resulted in his assassination through M. Brutus (44). This murder did not save the republic, but caused a fearful civil war between the republican party, led by Cassius and Brutus, and Cæsar's nephew, Octavianus, who, united with Lepidus and Antony, triumphed at last. The battle of Philippi made an end to the republic, and henceforth Rome became a monarchy. Lepidus was soon set aside, but Antony, by preferring Cleopatra, the queen of Egypt, to his wife, the sister of Octavianus, offended the latter, and open war broke out between the two triumvirs. Antony had gone to Greece. Agrippa pursued him and defeated him in the great naval battle of Actium (31), whereupon Antony and Cleopatra fled to Egypt, and killed themselves when pursued by Octavianus. After having settled matters in the East, the latter returned to Rome, which Mæcenas had ruled during his absence, and under the title of Augustus became master of the Roman empire (30). During his reign his stepsons, Drusus and Tiberius, conquered parts of Germany, but his general, Varus, was ingloriously defeated and perished there.

For a time the emperors maintained the legal fiction of a lifelong magistracy, causing all military and civil offices to be conferred upon them in the prescribed legal way. In the days of Diocletian and Constantine, however, this apparent respect for the ancient liberties of Rome also passed away, and the emperors became absolute monarchs. Augustus was succeeded by Tiberius (14–37), who at once deprived the people of certain rights, established his bodyguard, the prætorians, in the city of Rome, and at a later period of his life abandoned the government to his favorite Sejanus, and retired to Capri. After him followed Caligula, Claudius, and Nero, all three at least distantly related to the founder of the dynasty. Tyranny and fearful moral corruption increased steadily, till insanity was admitted as a plea in behalf of the bloodthirsty Cæsar. Under Nero the first persecution of Christians took place. The emperors Galba, Otho, and Vitellius followed each other in rapid succession; then came Vespasianus, proclaimed Cæsar by his victorious legions, and the founder of the Flavian family. His son Titus conquered Jerusalem, and then ruled with wisdom and moderation (79–81). His brother, Domitianus, was the only cruel emperor among those who for nearly a century gave peace and prosperity to Rome. Under him Britain was finally conquered by Agricola. He was succeeded by the humane Nerva, and he by Trajan (98–117), who conquered Armenia, Mesopotamia, and Assyria, and found in the younger Pliny a worthy chronicler. Hadrian abandoned the most distant provinces on the Persian Gulf again, and took wise measures for the administration of justice and the restoration of prosperity throughout the vast empire, through which he travelled assiduously. The two Antonines followed in his footsteps—the latter better known as Marcus Aurelius (161–180)—but with him end the better times of the empire. Under his cruel and dissolute successor, Commodus, began the period designated by Gibbon in his great work as the period of decline. Commodus was assassinated by conspirators, and his stern successor, Pertinax, by the prætorians, who sold the empire to Julian; he was in his turn murdered upon the arrival of Septimius Severus. Under this emperor, who ruled Rome with power and great success, Roman law reached its perfection by the aid of Ulpian, Paulus, Papinian, and Modestinus. He was succeeded by his sons, Caracalla and Geta, whose vicious and cruel rule was surpassed by that of Heliogabalus. Alexander Severus restored for a short time peace and prosperity to the empire; Aurelian destroyed Palmyra and captured Zenobia (273); but under their successors Rome became the scene of ruinous confusion. Rival emperors

contended for the supreme power, provinces rose in rebellion, and at the frontiers appeared new races of barbarians. The Goths devastated Asia Minor and the coasts of Greece; Alemanni penetrated through Helvetia into Italy, and reached Milan; Franks overran Gaul, and even entered into Spain. In vain were the victories of Claudius over the Goths (270), in vain the success of Aurelian against the Marcomanni and Alemanni (275). Already in 286 the empire had been divided in two, and soon after in four parts; then Constantius took the West, and Galerius the East, as separate empires. Constantine the Great, the son of the former, and the first Christian emperor, formally transferred the seat of government to Byzantium, now called Constantinople, and completely changed the constitution of the empire (330). From that time Rome ceased to be the mistress of the world, and sank till it finally became the capital of a mere province. The emperors became despots, exacting not only obedience, but adoration, their court-officers were at the same time state officers, civil and military powers were carefully kept separate, and the beautiful municipal system of ancient Rome was utterly destroyed. After the death of Constantine the empire was divided among his three sons, of whom, however, one, Constantius, soon became sole ruler (353). His successor, Julian, drove out the barbarians who had invaded Belgium and Alsace, restored paganism (hence his title, "Julian the *Apostate*"), and fell fighting against Persia. The army chose Jovian, who restored Christianity, but died soon, and was succeeded by Valentinian, who gave the East to his brother Valens. The latter fell in an attempt to resist the Visigoths, who fled before the Huns and sought refuge on Roman soil (378). His whole army was destroyed, and the Goths ravaged the country up to the walls of Constantinople. Gratian was summoned from distant Treves to come to the rescue of the imperilled empire, and he chose Theodosius, a renowned general, as his colleague, causing him to be proclaimed emperor of the East (379). The latter succeeded in restoring peace, defeated several rivals and usurpers, and as Theodosius the Great was acknowledged sole master of the whole Roman empire (394). After his death, however, the empire was once more divided between his two sons, Arcadius and Honorius, the former ruling over the Byzantine empire, which henceforth remained separate from Rome, and continued as such till it fell in the middle of the fifteenth century into the hands of the Turks. Honorius assumed the rule over the Western empire, which comprised, besides Italy, Illyria and Africa, Gaul, Britain, and Spain, but he resided first in Milan and then in Ravenna. The government was virtually in the hands of Stilicho, who defeated Alaric the Visigoth in Greece and in Italy (403), and Radagasius with his German hosts at Florence (406), but was murdered soon after (408). Now the barbarians began to press closer and closer upon the crumbling empire. Alaric laid Italy waste and took Rome (410). Vandals and Suevi, who had passed with the Alani through Gaul, conquered Spain (409). Franks, Alemanni, and Burgundians took possession of Gaul, while in the S. the Visigoths established a kingdom which extended into Spain. Britain was abandoned in 421; Africa fell into the hands of Vandals (429); and although the Romans under Aëtius defeated the Huns on the Catalaunian plains, Attila could not be kept from invading Italy (452). The widow of the emperor Valentinian, Eudoxia, to avenge personal injuries, called in the Vandals under Genseric, who plundered Rome. The unfortunate emperors were either mere puppets in the hands of ambitious generals, or paid promptly with their lives for their efforts to be independent, till Romulus Augustulus (as he was contemptuously called) abdicated in 476 at Ravenna. Odoacer, a barbarian, was proclaimed ruler of Italy as a simple patrician, and thus ended the Western Roman empire in name as well as in power.

Literature.—There is no lack of works to be consulted on the history of Rome, although a really scientific treatment of the subject was unknown till the last century. Up to that time fable, myth, and legend were so closely interwoven in all accounts of the great empire as to make them worthless to the historian. The first valuable work on the subject is the *History of the Emperors* by Sebastien le Nain Tillemont (Paris, 1701), a book of immense research and full of most valuable authentic information. Written at Port Royal, it bears a strong religious impress, but the author's uncompromising faith never interferes with his clear judgment and conscientious statements. Gibbon's great work on the *Decline and Fall of the Roman Empire*, finished in 1787, is written from the opposite point of view, but invaluable by the thorough study of all available sources of information and its matchless eloquence of style. The attention paid by him not only to documents and annals, but also to inscriptions and coins, led to a valuable work by Eckhel on the *Doctrine of Ancient Coins* (in Latin), which appeared in 1792, and was of invaluable assistance to Niebuhr. This great German writer opened in his *Roman History* (1842) and his *Lectures on Roman History* (1846) entirely new views on the political record of the republic, on the value of authorities, and the critical distinction between legend or myth and real facts. Drumann also, like Niebuhr, dwelt mainly on the history of republican Rome in his *History of Rome* (1844), and wrote exclusively from the standpoint of an ardent monarchist. English authors, since Gibbon, have preferred the history of Greece, and hence the principal recent authorities are H. F. Clinton's *Fasti Romani* (Oxford, 1850) and Charles Merivale's admirable work, *The History of the Romans under the Empire* (1862). Of the 7 large vols. the first two end with the fall of Cæsar, the two next treat of the Augustan age, and the last three of the period from Tiberius to the death of Marcus Aurelius. The work lacks originality, but is always instructive, very attractive in form, and popular in its general treatment of the subject. By far the most important contributions to Roman history have of late been made by Theodor Mommsen, a German historian, whose *Oscan Studies* and *Dialects of Southern Italy* opened entirely new views on the philology and archæology of ancient Rome, while his researches in Roman law met with similar success. His *History of Rome* abounds in new and valuable information and in striking views of great interest. Of other German works, C. Hoeck's *Roman History* (1850) is unfortunately incomplete, but invaluable for its clear and complete exposition of the inner administration of the empire under Augustus. In France, where the history of Rome has always been treated with special preference, Count Champigny has presented us in three independent works (*Les Césars*, 1843; *Rome et la Judée*, 1850; *Les Antonins*, 1853) with a continuous history of the empire from the fall of the republic to the death of Marcus Aurelius. An ultra Roman Catholic, the author is led to see all the light on the side of Christianity, all the shadows on the side of paganism, and thus the work, in spite of its attractive style and profound erudition, loses much of its value as an historical work. Very different is M. Beulé's famous work, *Auguste et sa Famille*, 1868 (4th ed.), in which the former minister employs the history of Rome with great skill and infinite tact as a mirror reflecting the image of modern imperialism. The historical portraits, the detailed descriptions, and the astute guesses at character with which the book abounds make it of great interest and no small value to the philosophic student of history. Recent researches have here, as elsewhere, been mainly directed to special subjects, such as inscriptions, coins, and monuments. For the first, the *Corpus Inscriptionum Latinarum*, published since 1863 by the Academy of Berlin, is invaluable. Ancient monuments have been most successfully studied by Rossi, especially as far as the oldest Christian records are concerned, while the Germans Mommsen and Henzen, and Renier and Waddington in France, have co-operated with the Italians Borghesi and Rossi in happy unanimity and with brilliant success. (See ROMAN ARCHÆOLOGY.) SCHELE DE VERE.

Rome (CHRISTIAN). Upon the ruins of the ancient Roman empire there arose gradually a new empire, which soon became all the more powerful as it claimed control over the souls of men as well as over their bodies, and extended its dominion beyond this life into eternity. Rome became, after a short interregnum, once more the seat of the central power in Europe, and thus earned its historic name of the "Eternal City." It owed this supremacy to the gradual development of Christianity. At first the new Church consisted simply of priests and laymen. Among the former, however, external circumstances soon produced a certain hierarchy. The heads of large and wealthy congregations naturally enjoyed advantages which raised them above the great mass of clergymen. Out of this number a few, again, rose to special eminence because they controlled the churches of great provincial centres, such as Ephesus, Antioch, Alexandria, and Rome. They claimed, and gradually obtained, superior powers, presided at great councils, and enforced obedience to their decrees. The bishop of Rome not only inherited the prestige of the former capital of the world, but skilfully enhanced it by claiming supreme spiritual authority as successor to St. Peter, the presumed first bishop of Rome. As the Founder of the new faith had declared, "Thou art Peter, and upon this rock I will build my Church," and "Whatsoever thou shalt bind on earth shall be bound in heaven, and whatsoever thou shalt loose on earth shall be loosed in heaven," the same special prerogatives were claimed for his successors, and the bishop of Rome assumed, as vicegerent of Christ on earth, supreme power in this world over all Christendom, and the keys of heaven and hell for the world to come. The patriarchs of Antioch, Alexandria, and Constantinople, who had long been his equals in rank and authority, were gradually led to acknowledge him as

their superior, till in 1054 a great schism divided Christendom into a Roman Catholic and a Greek Church independent of the pope of Rome. The full supremacy of Rome as the capital of the new Church-empire may be referred to the time of Pope Gregory I. (590–604), through whose great energy and matchless political wisdom the authority of the Church was everywhere established upon a solid and permanent foundation.

Rome itself—and with Rome the whole of Italy—had in the mean time been the easy prey of the new races which at that time broke forth from their unknown home in the East, overran the whole of Europe, and gradually obtained the supreme power in Europe. Under various names, as Goths and Germans, as Longobards, Franks, and Avares, they conquered one province after another. Large portions of Italy were laid waste, cities were sacked and razed to the ground, and whole populations butchered or carried into captivity. The surviving inhabitants remained in possession of the land, which they were forced to cultivate for the benefit of the conquerors. The ancient laws of Rome ceased to be enforced, the municipalities became extinct, the country was divided into duchies and governed by foreign masters. Although the Longobards at no time were masters of the whole of Italy, their influence was powerful enough to give a new German character to the whole peninsula. Repeated efforts, made by the Roman emperors at Constantinople, to recover possession of Italy led to bloody wars, but remained unsuccessful. A greater danger threatened Rome when the Church was violently agitated by a great schism between the followers of Arius, who denied the divinity of Christ, and the Roman Catholics, who condemned Arianism. Thanks to the skilful management of Gregory the Great and his influence over Theodelinda, the queen of the Longobards, the latter were won over to his side, Rome was saved from destruction, and Roman Catholicism became supreme in Italy. This great triumph not only relieved the Church in Rome, but enabled it to increase its strength at home and to extend its power abroad, untrammelled by the irksome authority of Greek emperors or the barbarous interference of German invaders. About the same time that the laws of the Longobards were collected (644) the decrees of councils and the canons of the Church also were codified.

The influence of Rome grew with the power of the popes. The Germans were converted by St. Boniface, and even the Eastern nations of the Slavonic race began to acknowledge the authority of the Church, but the appeal of the Frankish king, Pepin, first established the claim of the popes to judge in secular matters as well as in matters of faith. Pepin rewarded the pope's assistance by a grant of land in Italy, and thus the foundation of the secular power of the popes was firmly laid. Pepin's successor, Charlemagne, relieved the pope of great danger, defeated his enemies the Longobards, and after several bloody campaigns entered Rome, where he accepted at the hands of Pope Leo III. the dignity of emperor of Rome and protector of Christendom (800). It was little more than a restoration in name of the old Roman empire; Charlemagne acquired no new provinces and no new powers, but the deep-rooted reverence felt all over the world for ancient Rome was silently transferred to the new Cæsar. Thus, the emperors gained much by this consecration of their power, while Rome resumed once more its sway over the world as the fountain-head from which all authority flowed.

Italy was, however, not long to enjoy this newly-won greatness in peace. New enemies arose on all sides, and already in 846 the Saracens invaded the country and threatened Rome. Leo IV., a Roman by birth and a man of extraordinary vigor, enclosed that part of the city which has ever since been known as the Leonine City with strong walls, and made it for a time impregnable. After a period of turbulent warfare an appeal was made by John XII. to Otho, the German emperor, and the journey of the latter to Rome inaugurated a series of expeditions made by the emperors of Germany into Italy. Otho was, like Charlemagne, crowned in Rome, and confirmed and enlarged the donations made by his predecessors, but reserved to himself and his successors the sovereignty of Rome. Unfortunately, this divided authority led to the commission of atrocious political crimes by the popes and the three Othos, and this period of Roman history is full of shame and disgrace. The papal party and the imperial party —later known as the Guelphs and the Ghibellines—were in constant conflict, and Italy was the bloodstained battlefield on which the war was waged. At times the popes triumphed, as when the celebrated Hildebrand compelled the emperor Henry to do penance at Canossa, a fortress in Lombardy, and, kissing the pope's foot, to swear a formal oath of submission. Then, again, he saw himself deposed, Rome devastated by Norman troops under Guiscard, the city burnt, the inhabitants slaughtered or sold into slavery, and he himself driven to seek refuge at Salerno, where he died. Crusaders, German armies, and lawless bands of soldiers ravaged Rome by turns, and in the thirteenth century, a period of unbroken faction and fighting, the city suffered fearfully. Ancient tombs and monuments were transformed into fortresses, towers were built everywhere, and the houses of the tyrannical nobles were so many impregnable strongholds. Within the walls vast districts were lying waste, gardens were planted where once stood the proudest temples and loftiest palaces, and the inhabited portions of the city were filled with perpetual tumult. "Peace had abandoned Rome," says W. W. Story in his *Roba di Roma*, "and Desolation wandered in the streets." The popes were confined to their castle, and yet their power abroad was greater than ever. Emperors, kings, and princes bowed before Innocent V., who claimed the government of the whole world, basing his rights upon divine ordinance and sustaining them by the fearful weapons of excommunication and interdict. When, however, by a turn of fortune, his successors were compelled to abandon Rome and to reside in France at Avignon (1309–77), the city became a prey to complete anarchy, a fate which the adjoining country shared. Rome was virtually left without a government, the Guelphs and the Ghibellines, Neapolitan and German armies, and the noble families of the Orsini and the Colonna being alternately masters. The provinces were ravaged by robbers and freebooters, and commerce and industry ceased to exist. For a time peace was restored, order secured, and law resumed by the marvellous success of Cola di Rienzi, a man of the people, who by the rare power of genuine enthusiasm made himself master of Rome, and even of most of the Italian states (1347). But this last "tribune of the people," as he called himself, was murdered, and when he fell Rome had been so depopulated by wars and tumults that it counted less than 20,000 inhabitants. Herdsmen pastured their cattle on the Forum, flocks of wild-fowl haunted the streets, and beasts of all kinds roamed through the deserted quarters. The ancient tombs alone were alive, being still held as fortresses by the nobles. The record of this period is one of unbroken violence, murder, and battle. The family of the Borgia, which furnished two popes, became identified with the most shameful crimes and fearful abominations. Fortunately, the return of Gregory IX. after the termination of the great schism (1378–1417) had begun a new era, during which vast wealth accumulated in Rome, and all Italy bloomed forth in the so-called renaissance of ancient art and science. Popes like Julius II. and Leo X., one of the Medici, encouraged these efforts by their liberality, and thus Rome was enabled to recover from a terrible calamity —the pillage of the city by the infuriated troops of the constable of Bourbon (1527). But still the popes were either unable to restore peace and order or were held in subjection by foreign powers; for in the mean time the end of the long wars between France and Spain had secured the supremacy in Italy to the latter power. Milan and Naples, Sicily and Sardinia, were Spanish provinces, and the other princes of Italy willingly yielded to the paramount influence of Spain. The increasing power of Protestantism absorbed all the energies of the popes; Pius V. in vain persecuted heretics with increased rigor, and Gregory XIII. was rendered almost powerless by the overwhelming number of banditti. His reform of the calendar, known henceforth as the Gregorian, though at first rejected by Protestant nations and never adopted by the Greek Church, gave him unusual eminence in the annals of Rome. At last the papal sceptre fell into the hands of a really strong man, a born ruler. This was Sixtus V., whose restless energy and stern administration of justice once more restored peace to Rome. From this time the aspect of the city was changed, the reckless power of the nobles was broken, brigandage was rooted out, and property and life were once more safe. Law and justice reigned again where tumult and violence had so long been supreme. Unfortunately, the next epoch in the history of Rome, the seventeenth century, is a period of political death in Italy. Complete apathy succeeded the fierce turmoil and the fire of passions which had so long desolated the Eternal City. The popes lost their influence in the world; their home rule was such that the people preferred to suffer in silence; inveterate libertinage took the place of political strife, and nepotism prevailed in the Church. At last, the French Revolution broke out, and the overflowing current of loosened passions found its way to Rome also. A French army entered Italy (1796), conquered the northern provinces, and threatened Rome. For a time the payment of large sums of money averted the storm, but soon after Gen. Berthier invaded the papal states and took possession of Rome. The pope, Pius VI., became a prisoner—first at home, and then in France—and Rome was formally an-

nexed to France (1806). It was not until 1814 that the city became free once more and saw the pope return to his palace. In 1848, however, the people rose in rebellion, drove out Pius IX., and established a republic under the triumvirate of Mazzini, Armellini, and Saffi. An appeal to France brought once more a French army to the gates of the city, and a siege was begun. Garibaldi was in the open field with his soldiers, and the Romans within fought with the valor of their ancestors—so bravely that the French were disgracefully defeated. Overwhelming numbers, however, soon put an end to the short-lived republic. Rome was taken, the assembly, convened at the Capitol to meet the invaders, was dispersed, and the pope brought back to Rome. For twenty years French troops garrisoned the Eternal City, and when they were at last withdrawn (1870) Italy had become one great nation. Soon afterward Rome, having been made the capital of the new kingdom, saw the temporal power of the Holy See abolished and Victor Emmanuel enter as its new master. It presents now the strange anomaly of being the residence of two sovereigns, the king of Italy and the pope—the one ruling over the whole peninsula from the Alps to the island of Sicily, the latter ruling in undiminished authority over the consciences of all the members of the Roman Catholic Church.

Literature.—On the mediæval history of Rome few books of value have been written since Gibbon published his *Decline and Fall of the Roman Empire.* The German work of Dr. Gregorovius, *History of Rome in the Middle Ages* (1863), refers mainly to the city; T. Dyer's *History of Rome* (London, 1865) is more comprehensive. The Very Rev. Dr. Donovan's *Rome, Ancient and Modern* (Rome, 1842), is specially rich in matters of interest to English students and in information on Christian edifices and worship in early times. M. Letarouilly's *Édifices de Rome moderne* mentions incidentally much of the history of the great noble families whose palaces form the subject of the work. Valuable information may also be obtained from the works of Sir G. Head, Burgess, and Burton, while the *Beschreibung der Stadt Rom*, by Bunsen and others (1842), gives the fullest description of the city. By far the most valuable contribution made to the subject in our day is A. de Reumont's *Geschichte der Stadt Rom* (1869). W. W. Story's (the sculptor) admirable *Roba di Roma*, and A. Hare's *Walks through Rome*, are of great value, though more confined in their purpose. (For additional information see the articles on ITALY, PAPAL STATES, POPE, ROMAN ARCHÆOLOGY, and ROME, THE CAPITAL OF THE KINGDOM OF ITALY.) SCHELE DE VERE.

Rome (THE CAPITAL OF THE KINGDOM OF ITALY). On Feb. 26, 1861, the Parliament of the kingdom of Sardinia unanimously resolved to confer on King Victor Emmanuel II. and his successors the title of king of Italy, and on the 27th of the same month the Chamber of Deputies resolved that, the dignity, decorum, and independence of the pope and the full liberty of the Church being duly secured, the principle of foreign non-intervention ought to be applied in concert with France, and that Rome, proclaimed as capital by the national opinion, should be annexed to Italy. The continued occupation of Rome by France prevented the carrying out of this resolution, but the events of the Franco-German war induced that power to withdraw her troops from the city, and on Aug. 19 the last detachment of the French garrison evacuated Rome. On Sept. 11 a corps of the Italian army entered the pontifical territory and marched directly upon Rome. On the 16th of that month Civita Vecchia, which the French still held, was surrendered to an Italian force under Gen. Bixio, and a foreign flag no longer floated over Italian soil. After a brief resistance by the pontifical troops, which cost the Italian army 138 killed and wounded, Rome capitulated to the royal army on Sept. 20. A provisional government was forthwith organized, and a popular vote on the question of annexation to the kingdom of Italy decreed. The vote in the city of Rome was 40,785 in the affirmative, 46 in the negative; in the whole pontifical territory the affirmatives were 133,681, the negatives 1507. On Oct. 9 a royal decree for the annexation of the Roman territory was promulgated, and Gen. La Marmora was charged with the civil government *ad interim.* On Nov. 1, Pope Pius IX. issued an evangelical letter excommunicating all who had taken part in the establishment of the kingdom of Italy. On Dec. 21 the Chamber of Deputies of the Italian Parliament, then in session at Florence, voted their acceptance of the popular vote of the Roman people, and that the seat of government should be transferred to Rome at the end of June of the following year. On May 13, 1871, Parliament passed what is called *la legge delle guarantizie*, granting to the pope the most ample liberties, immunities, and privileges, together with a perpetual income of 3,225,000 *lire* or francs; all which the pope refused to accept by an evangelical letter of May 15, 1871, in which he protested against the acts of the Italian government, and appealed to the powers of the world to restore him to his rights and sustain him in the exercise of them. Preparations were now made for the transfer of the ministries and other governmental agencies, and on July 2, King Victor Emmanuel, accompanied by the great officers of state and the members of the foreign diplomatic corps, made his solemn entry into the new capital of Italy. On Nov. 27, 1871, the king opened the first session of the Italian Parliament in Rome, and the transfer of the seat of government was now complete.

The transfer of the capital being decided upon, the work of material improvement was commenced and prosecuted with alacrity. The most urgent need was that of suitable buildings for the accommodation of the royal household, the ministries, and other public officers. For the former purpose the Quirinal Palace was selected, and apartments were arranged in it both for the king and for the royal princes. Several of the departments of the national government were established in old official buildings of the papal administration, some in suppressed convents fitted up for the reception of different bureaus; halls for the legislature of united Italy were extemporized; and when the removal of the seat of government was completed, it was found that the necessary facilities for the transaction of the affairs of a great kingdom had all been provided. The only important new public construction which it has yet been found indispensable to undertake is an office for the ministry of finance, which is now nearly finished on a scale commensurate with the extent of the functions of that department. The completion of this important structure happily coincides with the final triumph of a financial policy which has at last succeeded in establishing the *pareggio* on equality between the income and the outgoes of the state.

In the mean time, private enterprise and the municipal administration of the new capital, encouraged and aided by the national government, have vied with each other in the material improvement and embellishment of the city. A large extent of unoccupied ground has been covered with new and commodious dwellings; old and unsightly houses have been repaired, raised, and enlarged; spacious and convenient hotels built for the accommodation of the many thousands of visitors who annually flock to Rome; new streets have been cut and old thoroughfares widened, straightened, and reduced in grade; street-lights immensely multiplied, by which and by the creation of a new and efficient police the public security has been greatly advanced; the system of drainage, formerly most imperfect, has been thoroughly reformed by the construction of new sewers of enlarged capacity; the aqueducts repaired; and the accumulated filth of centuries, which from time immemorial had made Rome the foulest of European cities, has been swept away.

The material difficulties which have retarded the progress of these improvements have been most serious. The soil of Rome is a mass of rubbish consisting to an almost incredible depth of the débris of old buildings and other refuse. To reach the natural undisturbed soil—and none other is safe for foundations—it is very frequently necessary to go to a depth of more than thirty feet. The substructure of the new Protestant church of St. Paul-within-the-Walls is laid at 40 feet below the level of the adjacent streets, and that of the ministry of finance from 15 to 20 feet lower still. The removal of such masses of loose and often polluted earth is not only very costly, but prejudicial to the health of the laborers and of the neighborhood; but, happily, improved drainage and other sanitary arrangements have so far obviated this latter difficulty that the general condition of the city in this respect has not been sensibly impaired, and there can be no doubt that even independently of the adoption of the contemplated measures for restoring the healthfulness of the environs of Rome by draining the Campagna and preventing the inundations of the Tiber, the mere cessation or diminution of operations which involve the disturbance of large bodies of impure soil will of itself much ameliorate the salubrity of the local climate.

In the course of the extensive excavations referred to very numerous archæological discoveries have been made. The municipality has wisely provided for the preservation of the ancient monuments now brought to light as far as possible, and for the collection of the statuary and other lately-found transportable works of art in a new museum at the Capitol, which is already an important addition to the attractions of Rome and to its facilities for the study of ancient art. The ministry of public construction, under the enlightened administration of Signor Bonghi, has contributed much to the same end by bringing together at the Collegio Romano various collections and deposits of ob-

jects illustrative of ancient and mediæval history and art; and hence, in spite of the illiberal partial withdrawal of the Vatican museums from public use, Rome still offers unrivalled advantages for archæological study. The libraries of the suppressed convents have been collected in a general deposit at the Collegio Romano, and, though pillaged of many rare and valuable books and manuscripts before they came into the hands of the Italian government, still form a very valuable nucleus for a great national library.

But public authority and private patriotism have not confined themselves to mere material improvements. The university has been reorganized on a wise and liberal basis; the number of schools has been vastly augmented; numerous institutions for the increase and diffusion of knowledge in all its branches have been opened; and it may fairly be said that few cities now surpass emancipated Rome in opportunities for the acquirement of the widest and soundest culture. Several new Protestant churches have been constructed and old buildings adapted for Protestant religious services within the walls of Rome; and in this old retreat of bigotry and intolerance every man may now freely worship God without let or hinderance according to the dictates of his own conscience.

The population of the city has been increased by many thousands, partly in consequence of the removal of official persons and their families to the new capital, partly from the enterprise of merchants and artisans seeking a new field for the employment of their funds and the exercise of their industry, and partly from the unsurpassed attractions which Rome now offers, both as an eminently cosmopolite centre and as a residence uniting advantages which are elsewhere to be found only in wide dispersion. The present population of the city is stated at 263,000, and there is little doubt that Rome will in the course of a few years approximate the other European capitals in the number of its inhabitants, even if it does not again rise to the overshadowing extent and magnificence of the ancient mistress of the world.

The modern city occupies the same site as the ancient, in lat. 41° 5′ 54″ N., lon. 12° 28′ 40″ E., on both sides of the Tiber, 14 miles from its entrance into the Mediterranean. It is surrounded by a wall 12 miles in length, constructed of brick, 50 feet high on the outside, generally less than 30 feet on the inside, surmounted with 300 towers and pierced by 12 gates, several having been walled up; but by far the largest part of the area enclosed by this wall is covered with gardens, vineyards, and ruins. The wall itself dates from various periods; that part of it which is situated on the left side of the river was commenced in 271 by Aurelian, and completed by Probus; the principal restorations belong to Honorius, Theodoric, Belisarius, and several popes. Of the gates, the most remarkable is the Porta del Popolo, situated on the left side of the Tiber, through which the route to Northern and Eastern Italy leads, crossing the Tiber by the Ponte Molle, 1½ miles distant.

The Tiber traverses the city from N. to S., and is spanned by five bridges—Ponte Sant' Angelo, the ancient Pons Ælius, built by Hadrian opposite the castle of the same name; Ponte Leonino, a new suspension bridge, crossing from the Longara; Ponte Sisto, built by Sixtus IV. in 1474 on the ruins of the ancient Pons Janiculensis, and crossing from the Trastevere; Ponte San Bartolommeo, the ancient Pons Cestius, connecting Trastevere with the Isola di San Bartolommeo, an island of the Tiber, and Ponte di Quattro Capi, the ancient Pons Fabricius, leading from the island to the left shore of the river; and, finally, Ponte Rotto, below the island. By the river the city is divided into two unequal parts. The smaller and more modern part, situated on the right bank, consists of a northern and southern portion. The former contains the VATICAN PALACE (see that article), the church of St. Peter (see the article PETER'S, ST., CHURCH), and the castle of Sant' Angelo. This last structure (*Molis Hadriani*), commenced by Hadrian and finished in 140 by Antoninus Pius, was intended for a mausoleum for Hadrian and his family, and connected with the Monte Pincio by the Pons Ælius. When the Goths conquered Rome under Vitiges, the structure was used as a fortress, and during the feuds of the early Middle Ages it constantly formed a stronghold in the hands of the ruling faction. Urban V. constructed the outworks; in 1500 the covered passage which connects it with the Vatican palace was built; and in 1527, Clement VII. sustained here a long siege, in which the constable of Bourbon was killed. The later popes used the structure principally as a dungeon. The southern portion, Trastevere, occupies the ancient Mons Janiculus. Here was in the oldest time a fortified outpost against the Etruscans, and in the time of Augustus a populous suburb. At present the quarter is mostly inhabited by workingmen, who claim to be the true descendants of the old Romans. The most remarkable points here are the church of S. Pietro in Montorio, erected in 1500 by Ferdinand and Isabella of Spain on the spot where St. Peter is said to have suffered martyrdom, and the magnificent fountain Acqua Paola, built in 1611, under Paul V., by Fontana and Maderno, after the restoration of the ancient Aqua Trajana, an aqueduct erected by Trajan and carrying the waters of the Lago di Bracciano, 35 miles distant, into the city. These two portions of the western part of the city are connected by the Via della Longara, ¾ of a mile long, constructed by Sixtus V., and containing the Villa Farnesina, which was built in 1506 by Bald. Peruzzi, came into the possession of the Farnese family in 1580, and was lately occupied by the ex-king of Naples, and the Palazzo Corsini, in which Queen Christina of Sweden died Apr. 19, 1689; the former containing a celebrated series of frescoes after designs by Raphael, the latter an excellent picture-gallery, one of the largest collections of engravings in the world, and a valuable library.

The larger, eastern part of the city, situated on the left bank of the Tiber, occupies the far-famed seven hills; the modern city, however, is mostly crowded together in the low plain between the hills and the river, the ancient Campus Martius. Farthest to the N., near the Porta del Popolo, rises Monte Pincio (*Collis Hortorum*), 175 feet above the level of the sea, which in ancient times was covered with gardens and not reckoned a part of the city; the famous gardens of Lucullus were situated here. Separated from Monte Pincio by the Piazza Barberini extends the Esquiline Hill in a long curve, forming three buttresses toward the plain—the Quirinal, 157 feet, the Viminal, 170 feet, and the Esquiline proper, 188 feet. Farther to the S. rises the Cœlius, 160 feet, and between this and the river the Aventine, 155 feet. In the southern part of the plain, between this range of hills and the Tiber, rise, insulated, two other hills—the Palatine, 170 feet, and the Capitoline, 161 feet. The last formed the most prominent point of ancient republican and imperial Rome, the principal part of which extended over the Capitoline, Aventine, Cœlius, and the southern part of the Esquiline. These districts are now almost deserted, but covered with the grandest ruins, and at present the Capitoline Hill forms the boundary-line between ancient and modern Rome. It contains the church of Santa Maria in Araceli, which occupies the site of the ancient temple of Juno Moneta, and was erected before the tenth century; the Piazza del Campidoglio, designed by Michael Angelo, and begun in 1536 by Paul III., with a bronze equestrian statue of Marcus Aurelius in its centre; the Palace of the Senators, erected by Boniface IX.; the Palace of the Conservatory and the Capitoline Museum, containing collections of sculptures and antiquities of the greatest interest. From the Capitoline, toward the Palatine, extends the ancient Forum Romanum. The Palatine contains the ruins of the ancient imperial palaces. Between the Palatine and the Aventine lay the Circus Maximus; to the S. E. of the Aventine the Baths of Caracalla. In the depression between the Palatine, Esquiline, and Cœlius stands the COLISEUM (which see). The Thermæ Antoninianæ were begun by Caracalla in 212, extended by Heliogabalus, and finished by Alexander Severus. The establishment could accommodate 1600 bathers at the same time, and was arranged throughout with surpassing splendor; only the bare walls, showing the outlines of the building, have been preserved. Between the Cœlius and the Esquiline stand the church of San Giovanni in Laterano and the Museum Gregorianum Lateranense, which are described under the head of the LATERAN; and beyond the southern slope of the Esquiline the ruins of ancient Rome become scarcer and the monuments of mediæval and modern Rome more frequent. Here are the church of Santa Maria Maggiore, also called the Basilica Liberiana, erected by Pope Liberius 352–366, altered in 432 by Sixtus III., enlarged in 1292 by Nicholas IV., and restored in 1575 by Gregory XIII.; the Palazzo Rospigliosi, founded in 1603 by Cardinal Scipio Borghese, and containing many fine frescoes and pictures; the Palazzo Apostolico al Quirinale, described under the head of the QUIRINAL; the Palazzo Barberini, begun by Maderno, finished by Bernini, with a library containing 7000 manuscripts of Latin and Greek authors; the Villa Albani, built in 1760 by Cardinal Albani, and now belonging to Prince Torlonia, with excellent art-collections; the railway dépôt, opposite the Thermæ Diocletiani; and the Porta Pia, designed by Michael Angelo in 1564, and restored by Pius IX. 1861–69. Through the Porta Pia the Italian army entered Rome Sept. 20, 1870.

The modern city, occupying the space between the river and the hills, is by the Corso divided into two parts, of which that situated between the Corso and the hills is elegant

and mostly inhabited by foreigners visiting Rome, while that situated between the Corso and the Tiber forms a bewildering maze of narrow and crooked streets and alleys inhabited by the lower classes. The Corso, running in a straight line for a distance of nearly a mile from the Piazza del Popolo to the Piazza Venezia, is the finest and gayest street of the city. Among the many elegant buildings which line it on both sides are the Palazzo Doria, one of the most extensive and most magnificent palaces of Rome, containing large and rich art-collections; the Palazzo Colonna, and the Palazzo di Venezia. The portion of the city situated between the river and the Corso, although mostly inhabited by the lower classes, and not of a very inviting aspect, contains, nevertheless, many admirable monuments, among which are the Mausoleum of Augustus, erected by that emperor as a burial-place for himself and his family, consisting of an immense substructure containing the burial-chambers, and covered with a terraced mound of earth adorned with cypresses and a statue of the emperor, used in the Middle Ages as a stronghold, now fitted up as a day theatre and circus, the burial-chambers being empty; the Palazzo Borghese, built in 1590 by the elder Longhi, and containing an excellent picture-gallery; the church of Santa Maria Rotonda, or the PANTHEON (which see), the only ancient edifice in Rome which has been preserved entire. Here is also the Palazzo Farnese, one of the finest palaces of Rome, begun under Paul III. after the designs of Da Sangallo, continued under the direction of Michael Angelo, and completed by Della Porta. It afterward came into the possession of the kings of Naples, and many of the beautiful sculptures and interesting antiquities which it contained were removed to Naples. It still contains a series of fine frescoes by Annibale Caracci, and other pictures.

The commerce and industry of Rome are not very important. Woollens, silks, and velvets, leather, glass, mosaics, jewelry, and articles connected with the fine arts, hats, gloves, stockings, and artificial flowers, are manufactured, but not on an extensive scale; progress has been made, however, in this respect since the city came under the Italian government. Similar progress may be observed with respect to public education; the number of pupils in the new elementary schools in 1873 amounted to 14,389. (See Robert Burn, *Rome and the Campagna* (London, 1871); Augustus J. C. Hare, *Walks in Rome* (London, 1871); Francis Wey (*Rome*, 1872); Charles Isidore Hemans, *Historic and Monumental Rome* (1874.) See also ROMAN ARCHÆOLOGY.) F. A. P. BARNARD.

Rome, tp., Tallapoosa co., Ala. P. 1026.

Rome, city, cap. of Floyd co., Ga., on Coosa River and on Selma Rome and Dalton, at W. terminus of Rome R. R., has 5 newspapers, and is an important business-centre for the N. W. of the State. P. 2748.

Rome, p.-v. and tp., Perry co., Ind. P. 221.

Rome, tp., Jones co., Ia. P. 1067.

Rome, p.-v. and tp., Kennebec co., Me. P. 725.

Rome, p.-v. and tp., Lenawee co., Mich. P. 1454.

Rome, tp., Faribault co., Minn. P. 396.

Rome, city and cap. of Oneida co., N. Y., on New York Central and Hudson River, Rome Watertown and Ogdensburg, and Rome and Clinton branch of Delaware Lackawanna and Western R. Rs., at the junction of Erie and Black River canals and Mohawk River, 110 miles W. of Albany. The city is built upon a level plot of ground at the head of Mohawk Valley, at the former site of old Fort Stanwix of Revolutionary fame. Rome occupies the site of what in those early days was called the "carrying-place," it being then the only strip of land-interruption in a continuous water-communication between the Atlantic and the great lakes of the West. The city contains 13 churches, a public library, a free academy, excellent schools, 3 national, 1 State, and 2 savings banks, 2 newspapers, and the Central New York institution for deaf mutes. Rome is the centre of the dairy interest, the cheese-factory system having originated here. Its manufactures embrace puddled and railroad iron, merchant iron, locomotives, railroad rolling-stock, knit goods, lumber, builders' woodwork, fishing tackle, agricultural implements, cigars, and patent medicines. The city is supplied with waterworks, reservoir, and direct-pumping system combined, erected in 1873. The Mohawk River furnishes water and water-power. P. 11,000. A. C. KESSINGER, ED. "SENTINEL."

Rome, v., Greene tp., Adams co., O. (STOUTS' P. O.), on Ohio River. P. 471.

Rome, p.-v. and tp., Ashtabula co., O. P. 669.

Rome, tp., Athens co., O. P. 1972.

Rome, tp., Lawrence co., O., on Ohio River. P. 2096.

Rome, p.-v. and tp., Bradford co., Pa. P. 230; tp. 1333.

Rome, tp., Crawford co., Pa. P. 1274.

Rome, tp., Adams co., Wis. P. 143.

Rome, Archæology of. See ROMAN ARCHÆOLOGY.

Rome City, p.-v., Orange tp., Noble co., Ind., on Grand Rapids and Indiana R. R. P. 351.

Ro'meo, p.-v., Washington tp., Macomb co., Mich., on Michigan Air-line R. R.

Rö'mer (OLE), b. at Aarhuus, Jutland, Sept. 25, 1644; studied mathematics and astronomy at the University of Copenhagen; attracted the attention of Picard, who came to Denmark to visit Uranienborg, formerly the residence of Tycho Brahe; was invited to Paris by him and Colbert in 1672; appointed teacher in mathematics to the dauphin, and made a member of the Academy of Sciences; assisted Picard in his meridional measurements, invented the transit instrument, and determined the velocity of light by observations of the eclipses of the satellites of Jupiter; was appointed professor of mathematics and astronomy at the University of Copenhagen in 1681; subsequently director of the mint, inspector-general of the arsenal and the port, and burgomaster of Copenhagen; regulated the weights and measures of Denmark and improved the harbor of Copenhagen. D. in 1710.

Ro'meyn (JOHN BRODHEAD), D. D., son of Dr. Theodoric D., b. at Marbletown, N. Y., Nov. 8, 1778; graduated at Columbia College 1795; was pastor of Dutch Reformed churches at Rhinebeck (1799–1800) and Schenectady (1800–04), of the Presbyterian church at Albany, N. Y., 1804–08, and from 1808 to his death of the church in Cedar street, New York. He published a collection of *Sermons* (2 vols., 1816). D. in New York Feb. 22, 1825.

Rom'illy (JOHN), BARON, son of Sir Samuel, b. in London in 1802; graduated at Trinity College, Cambridge, 1826; was called to the bar at Gray's Inn 1827; sat in Parliament as a Liberal 1832–35 and 1846–52; knighted and made solicitor-general 1848, attorney-general and privy councillor 1850, and was master of the rolls 1851–72, in which capacity he was instrumental in causing the publication of the very valuable "Rolls Series" of *Calendars of State Papers* and other documents illustrating the earlier history of England. He was raised to the peerage as Baron Romilly of Barry in the county of Glamorgan Jan. 3, 1866. D. at London Dec. 23, 1874.

Romilly (Sir SAMUEL), b. in London, England, Mar. 1, 1757; entered Gray's Inn May 11, 1778, where he was called to the bar 1783; enjoyed the friendship and patronage of Lord Lansdowne; became eminent as a chancery lawyer; was appointed king's counsel 1800, chancellor of Durham about 1805; knighted and made solicitor-general 1806; attempted the reform of English criminal law 1807; urged in Parliament, with great eloquence, the abolition of the slave-trade, Catholic emancipation, and electoral reform. D. by suicide, consequent on the loss of his wife, Nov. 2, 1818. His *Speeches* were published in 1820, and his autobiographical *Memoirs* in 1840.

Romine, tp., Marion co., Ill. P. 893.

Rommany (Gypsy) Language. Though the first conjecture ever made by a scholar in Europe as to the origin of the tongue spoken among themselves by gypsies declared it to be Indian, and though a full specimen of it appeared in Vulcanius in 1597, the world, and even the learned, long believed that this language was only a jargon or cant, and under this impression more than one work has been published as a dictionary of gypsy which contained no gypsy words whatever. In Italy, Laurentio Hervas mistook the Italian thief-jargon for gypsy. In England, Capt. Grose made the same mistake, and in *The Life and Memoirs of Bampfylde More Carew* (London, 1789), there is a slang dictionary given as "gypsy." So desirous, however, are gypsies to keep their language a secret that they often encourage this error. The late Lord Lytton (E. Bulwer) once passed while a young man several weeks among gypsies, and believed he had learned their language (see introduction to *Pelham*, later editions), but the specimens which he gives in *Pelham*, such as *patter-cove* (the gypsy for a clergyman), are merely cant, the true gypsy or Rommany for a clergyman being *rashai* (Sansk. *rishi*). It is, however, a curious fact that in every country the gypsies have carefully excluded the current "slang" words from their own tongue, and when they find that a Rommany word has become known beyond themselves they discontinue its use. Thus, the writer has heard gypsies say that a certain word has *gone out* of use or is going out, because the "tramps" have got hold of it or because it has become "canting." Yet, as their object is to have a *secret* language, they have not scrupled when migrating from one country to another to use many of the words which belonged to the language of their last home, since these an-

swered every purpose and replaced those which had been eliminated because they were becoming known. These facts should be borne in mind as necessary to understand the gradual formation of this curious tongue in its dialects, for it is by these additions to the original "new Indian" language, whatever it was, which the first gypsies spoke when they came to Europe, that their wanderings have been accurately traced by Miklosich. (See GYPSIES.) Great interest has of late years been taken in the Rommany language, as gypsies themselves call their tongue, owing (1) to the extraordinary number of curious words, both ancient and modern, from different languages, which abound in it; (2) because it is possible that even if it be in the main a new Indian tongue formed with Urdoo, its germ may still have existed originally as an obscure but very ancient Aryan language; (3) because, while the origin of every *word* in Rommany is known, and with it the grammar of the languages from which it comes, that of the Rommany grammar itself is as yet a mystery, nor is it ascertained whether it was formed in India previous to the great migration between the tenth and thirteenth centuries, or during the early travels of the race. And though there is one Indian element common to Rommany wherever spoken, and many words the same in all its dialects—*e. g. churi*, "a knife"—yet much of this may be found in one country which is not known to gypsies in others. The universal dissemination of Rommany, the great unwillingness of all who speak it to have it made known, and finally the number of words which it has contributed to English slang, are also causes which invest it with interest. Little was known regarding it until J. C. C. Rüdiger (*Neuester Zuwachs der Sprachkunde*, Halle, 1782) announced that the gypsy language, apart from its Slavonic and German additions, consisted of Hindoo words. At the same time, Büttner (see GYPSIES) published his views regarding the Rommany and collected several of its grammatical forms. In the following year H. M. G. Grellmann cleverly availed himself of the labors of these his predecessors, and published a work (see GYPSIES) from which the public for many years inferred that he was the first to discover the Indian origin of Rommany. The subsequent labors of George Borrow, A. F. Pott, A. G. Paspati, G. J. Ascoli, and others have done much to show that each word of the language, *so far as they have collected them*, is respectively of Sanskrit, Persian, Slavonian, Greek, or other character. It has not as yet, however, been pointed out by any writer through what *media* of more recent Indian tongues the Sanskrit words have passed, nor have any philologists (C. G. Leland, *English Gypsies*) shown to what degree the Slavonic and Greek words in Rommany are really Indian, but simply Slavonized or Græcized. This process is continually going on in Rommany. It is but a few hours since the writer overheard a girl say to a boy in a street of London, "You'll get *lelled*"—(*i. e.* "taken" or "arrested"). This was the Rommany word *lello*, "taken," from the Hindoo *lena*, to "take," but Anglicized with the *-ed* participial termination. In this case the English element is limited. When a gypsy, however, calls a fist a *puncher*, it would naturally be assumed that he uses an entire English slang word, when in reality he claims it as Rommany, as coming from *punj*, "five;" and with justice, since in Hindostani *punja* means the hand (with the five fingers extended).

Thirteen dialects have been given (see GYPSIES) as characteristic of the principal European tribes, but several of these are so corrupt that those speaking them would not comprehend the others, although a great number of isolated words are common to them. With little effort or practice Turkish, Hungarian, and German gypsies could talk together, and the few Rommanies in England who have still preserved the grammar of their tongue could join them in mutual intelligence. But the majority of English gypsies, with all the Spanish and their Scandinavian and Egyptian brothers, would find themselves no nearer than a Spaniard and an Italian. It is impossible to assume with certainty any dialect as the type, but the Turkish, as set forth by Dr. Alexander G. Paspati, may be taken for a basis, since its grammar is the most perfect known. Its main features are as follows: The articles are *o* (masculine) and *i* (feminine), as *o rakló*, "the boy," *i raklí*, "the girl." *A* or *an* is generally expressed in all gypsy dialects by *yeck*, "one," as in French, *l'une*. In the declined cases *o* becomes *e*, except when the accusative of the noun is the same as the nominative. *Nouns.*—These are masculine or feminine. Abstract nouns are formed in Hindoo by the termination *pan*, like the English "-ship" or "-hood." In English Rommany this termination is still *pen* or *ben*; in Turkey it is *pé* or *be*. Thus, *kushto*, "good," becomes *kushtopen* or *kushtopé*. In English Rommany, and to a certain extent in other dialects, an active agent or person doing anything is ingeniously expressed by the termination *engro*. Thus, from *giv*, "wheat," we have *givengro*, "a farmer:" *saster*, "iron," *sastengro*, "a smith," corresponding to the generally applied *walla* of India. The origin of *engro* is to be found in the *koro*, genitive termination of all nouns, which is itself derived from the verb *ker-ava* (Sansk. *kâra*, m. rad. *kri*, *faciens*, factor). (Bopp, *Glos. Skr.*) This is so general that it may be said that almost every adjective and active verb yields an agent. English gypsies make nouns by changing *engro* to *engrī* ("a thing"), thus *mui*, "a face," becomes *muiengree*, "a pillow" (lit. "a face-thing," also "a portrait"); *wast*, "a hand," *wast-engri*, "a hand-cuff." The regular declension is

Rakló = "a boy."

	Singular.		Plural.
Nom.	*o rakló*,	the boy.	*o raklé*.
Gen.	*e rakléskoro*,	of the boy,	*e raklèngoro*.
Acc.	*e raklés*,	the boy.	*e raklén*.
1st Dative,	*e rakléste*,	to the boy,	*e raklénde*.
2d Dative,	*e rakléske*,	in the boy.	*e raklénghe*.
Instr.	*e raklésa*,	with the boy,	*e raklèndja*.
Ablat.	*e raklestar*,	from a boy,	*e raklèndar*.
Voc.	*rakleya*,	O boy!	*raklale!*

Nouns ending in *i* take *a* after it and before the inflection, as *rakli*, "a girl," *rakliákoro*, *raklia*, *rakliáte*, *rakliáke*, *rakliása*, *rakliatar*, and *raklie*. Feminine nouns ending in consonants are declined similarly: *len*, "a river," gen. *leniákoro*. *Eskoro* is commonly used to form adjectives; in England it is used like *engro*; *e. g. wardo*, "a wheel," *wardomescro*, a "wheelwright" or "cooper." The genitive is of wonderful extension in Rommany, and sometimes difficult to seize. These cases are not all *pure* inflections; several are formed with *post-positions* (as occurs in the Ural-Altaic groups and in Dakota). Thus the Rommany instrumental is formed by adding the Sanskrit *saha*, "with" or "together." The ablative sing. term. *ato* (*tar*) is the Sanskrit particle *tas*. "The gypsy noun has properly only four cases." (*Paspati.*) In English Rommany the plural and sing. *ia* has been corrupted into *yor*, sometimes into *yas*, as *lav*, a "word," which should be *larya*, becomes *lavyor* or *lavyas*. Nouns ending in *o* are generally masculine—those in *i*, feminine. Diminutives are formed by *oro* or *tso*. Adjectives are formed in *o* (masc.) or *i* (fem.). *O* is kept in the nom.; it becomes *e* in the other cases, as *kálo manush* (Eng. Rom. *kālo mūsh*), "a black man;" gen. *kalé manusheskoro*, "of a black man;" plural adj. termination for all cases, *e*. Many adjectives applicable to living beings end in *no* or *ni*, more in *lo*; *e. g. bākht*, "luck," *bakhtalo*, "lucky." From many verbal adjectives in Rommany lost verbs have been recovered. Whether these indicate an ancient Rommany language, or some early tongue merged in it, no one can say. But it is very certain that there is no language so very simple, and yet so rich—so capable of expressing thought, and yet so easy to learn. The comparative degree is formed in Turkey by adding *po* ("more"), as *lachó*, "good," *polachó*, "better." Also by *der*, as *baro*, "great," *baroder*, "greater." In England it is formed by *dir* or *diro*; *e. g. bāro*, "great," *bordir* or *borodiro*, "greater." No superlative exists. A false superlative is formed in England (*C. G. Leland*) by *irus*; *e. g. borodirus*. Pronouns are formed in the singular like nouns plural; *e. g. me*, "I," *mangoro*, *man*, *mánde*, *mánghe*, *mándja*, *mandar*; plural, *amén* ("we"), *améngoro*, *amén*, *améndе*, *aménghe*, *améndja*, *améndar*. *Tu* ("thou") is formed thus: *Tu* (gen. wanting), *tut*, *túte*, *túke*, *túsa*, *tutar*; plural, *tumen*, *tumengoro*, *tumen*, *tumende*, *tumenghe*, *tumendja*, *tumendar*. In England *tu* and *tute* are generally used for "you" in all cases, as "you" is used in English; *tukey*, "to you," rarely. *Ov* ("he," Eng., and Ger. *yov* or *yuv*) becomes *leskoro*, *les*, *leste*, *leske*, *lesa*, *lestar*; fem. *oi*, *ai* (Eng. *yoi*), *lakoro*, *la*, *láte*, *láke*, *lása*, *latar*. *Ol* ("they," Eng. Rom. *yúl*), *lengoro*, *len*, *lende*, *lenghe*, *lendja*, *lendar*. All of these inflections are commonly known in England, but are greatly confused and corrupted. *Mo*, "my," simply becomes *me* in all other cases, and *me* in the plural: also *mino* ("mine"), *tino* ("thine"). *Amaro*, "our," is in Eng. *moro*. *Tumaro*, "your," is unchanged. Hindoo *pes* is the reflective pronoun "self," taking in Germany the form *peskro*, also very rarely in England, where the common form is *kokero* (*i. e.* "alone"). *Lester kokero*, "his self." In Turkey, *po* and *pi*, plural *po*, are the common possessive pronouns; *e. g. po drom*, "his road," evidently from the Hindoo. *Aka* and *araka* ("this" and "that") exist in English Rommany as *akovo*, *'covo*, and *kacakoi*; *e. g. 'covo*, "that man" (slang, *cove*, *covey*). Also in T. G. *okovka*, *odora*, "this" or "that," is in English Rommany *odova* or *dovo*, "that." *Verbs.*—All simple verbs are of Indian origin, to which is added *ava*; *e. g. avava*, "to come," which may be conveniently assumed as a general form. "To come" suggests the idea of the future in time, and *kamar*, "to desire, love, or wish," suggests the same as to mental ac-

tion. Thus, *kamavao*, "I shall be," and from *chinava* ("cut") comes *kamachinava*, "I shall or will cut," expressing both intention and time. This influence of *avava* ("to come") on *all* verbs, affirmed by the first writers on Rommany grammar, and denied by the later, is, however, convenient as a means of simply learning the language. Paspati (*Tchingianes*, p. 80) advances *uvava* (Turkish Rommany) "to become," *devenir*, as one hitherto confounded with *avava*, "to come," as the true type. *Avava*, "to come," is thus conjugated:

Indicative.		*Imperfect.*	*1st Aorist.*
Me avava,	I come,	*Me avávas,*	*Avilom.*
Tu aveka,	Thou comest,	*Tu avênas,*	*Avilan.*
Ov avella,	He comes,	*Ov avêlas,*	*Avilas.*
Amen avâsa,	We come,	*Amen averas,*	*Avilomas.*
Tumen avêna,	Ye come,	*Tumen avénas,*	*Avilonas.*
Ol avenas,	They come,	*Ol avenas,*	*Avilas.*

In German Rommany the indicative present of this verb gives *avaka, avena, avena* in the plural, and in the aorist *eveiom, eveial, eveias, eveiam, eveian, eveien.* The second aorist (Turkish Rom.) is formed by adding *as* to the first and second persons singular and plural. The future is given as *avava, avesa, avela, avasa, avéna, avéna;* imperative, 1, *av*, 2, *me avel;* subjunctive, same as future; gerund, *avindos;* participle, *aló.* Paspati recognizes two classes of verbs—the first including Indian roots with *ava* termination, or verbs simple, and the verbs causative ending in *avava.* Thus, *asava* (verb simple), "to laugh," becomes *asâvava*, "to make laugh;" *piava*, "to drink," becomes *piavava*, "to make drink." Paspati makes these and other merely superficial differences the basis for five separate conjugations, which are, however, *grammatically* but one. The second class of compound verbs consists of a simple verbal root combined with another verb, such as *dava*, "to give," *kerava*, "to do or make," and *lava*, "to take." One division of these consists of verbs in which the root is placed either before or after the verb. This and every other variation is made by Paspati into a separate conjugation, giving thereby to the simplest language in the world eleven conjugations, while it possesses in reality but one. All participles in Turkish Rommany end in *to* or *do, lo, no*, and these are derived directly from the aorist. Thus, *avava, avilom, avilo, anava* ("to carry"), *andom, ando.* We can trace in Rommany verbs a class formed with an Indian root and the auxiliaries "I am to be," or *uvava*, "to become," which is or was probably in reality the same with *avava*, "to come." "I am" is conjugated—

Me isam,	I am.	*Me isamas,*	I was.
Tu isan,	thou art.	*Tu isanas,*	thou wert.
Ov isi,	he is.	*Ov isas,*	he was.
Amen isâm,	we are.	*Amên isámas,*	we were.
Tumen isan,	ye are.	*Tumén isánas,*	ye were.
Ol isi,	they are.	*Ol isas,*	they were.

In Sanskrit *asmi, asi, asti*, plural *sma, stka, santi.* It is remarkable that in England gypsies use commonly several Oriental forms of the verb not known in Germany. Thus, the English Rommany verb runs *me shom*, "I am," *tu shan*, "thou art," *yuv se*, "he is," *men shom, tute shan, yul see.* In fact, the verb is nearly the same with the Turkish, while in Germany it is *hom, hal, hi, ham, ham shi.* The future of *isam* is *kamovav-es, el, vasa, vena, venas.* (For a criticism of Paspati's grammar see Ascoli, *Zigeunerisches*, Halle, 1865; for the German Rommany forms see Pott; also GYPSIES.) This future, *kamovav*, as Ascoli indicates, is merely from *avava.*

There is as yet wanting a grammar which shall reduce Rommany to its original simple elements. Pott and Ascoli have collected the material and cleared it, but no one has distinctly set forth in paradigms this curious tongue, which with the simplest elements is capable of as much expression as English. Even in its present popular and corrupt form, English Rommany is only unmusical where the English grammar intrudes, as may be seen in the following verses by Miss Janet Tuckey, who was the first to write *poetry* in this dialect:

"I tāni mūllos 'pré ó dóeyav
Shān sār i sāni chūmor fon o báv;
O lūllopen apré i pābor chám
Li se i tátti chūmor ó the kám;
Te dóvo rinkeni hév pré tíri mūi,
Shán mīri chūmor, o mi kāmeli."

"The little bubbles floating on the wave
Are all soft kisses which the west wind gave;
The luscious glow upon the peach's face
Bears blushing witness to the sun's embrace;
And those two dimples, sweet, that come and go,
Tell tales of true-love kisses: is it so?"

No writers have as yet sufficiently indicated the influence of Persian dialects on the Rommany. A few words, with their origin, drawn from English gypsy and taken down by the writer in gypsy tents, are as follows: *Sakkū*, "a swan," Persian and Arabic, *sakka; purser*, "to ask," P. *pursidan; pusht*, "the back" (also *dūmo*), P. *pusht; pish*, "before," P. *pish; shock*, "a bough," P. *shakht; rushni*, "bright," P. *rūshán; bunner*, "to build," "shape," etc., the foundation of a house, P. *bunyad; sikar*, "a clothes-line," Hind. *sikhar; sig-tud*, "milk-weed," H. *sij; sim*, also *rupp*, "silver," both the same in Hindoo; "*Yeck sim mery covva se yeck ruppeny covva*," *i. e.* "a silver thing *is* a silver thing;" *bero*, "a ship," H. *buhr; sīrni*, "sacred," "magical," H. *sīhr.* The transposition of Oriental words through a Slavonic medium may be seen in *sivety*, "people" (as in French *le monde*), which the gypsies are supposed to have picked up in Slavonic, as *sweti*, "the world," but which they probably had originally as *saraswati* in Hindoo. All Rommany dialects are extremely corrupt, and even in Turkey and Romania it has been almost impossible to determine their grammar, simple as it is. The English gypsy generally uses *tute* for *you* in all cases, and will say *mandy avella* for *man avava* ("I go"), and *yoi wellas* for *yoi avilas.* In Germany the language is spoken with very little admixture of German words, and with a great exercise of ingenuity English gypsies often contrive to do this. To do this one word must do duty for many. Thus, *chiv* means to "put," "place," "throw," "lay," and in fact almost any positive *action;* while *hatch* expresses "resting," and *kér* to make, do, cook, cause. Most words for the different kinds of trees, animals, minerals, fish, and insects are wanting in Rommany, showing that they have recently come from a land where nature is different; and in many cases they have applied the name of a similar animal, etc.; *e. g. sakku*, "a swan" (E. R.), is the P. Arabic *sakká*, "a pelican." No language in the world is so easy as Rommany; most persons can learn it in three months, and when learned it is of incredible assistance in acquiring Hindostani and Persian. In fact, a proficient in Rommany can within a month make himself readily intelligible in Hindostani. In pronunciation Rommany resembles the soft Latin tongues; *e. g. kūshto* or *cōōshto*, "good;" *mās* or *mawhs*, "meat;" *tūte* or *tooty*, "thy;" *mán kamāva*, "I love." The English Rommany pronounce *sīg*, with *i* as *ee*, and the *g* very soft (between the German *ch* and *g*, inclining to the latter strongly accented). It is not impossible that the thousands of Rommanies of every kind reuniting in the U. S. may in time originate an American Rommany dialect. If the more intelligent among them would take the pains to publish among themselves a journal or work in pure Rommany, they would have no difficulty in rehabilitating their beautiful and expressive old language. CHARLES G. LELAND.

Rom'ney, p.-v., Randolph tp., Tippecanoe co., Ind., on Louisville New Albany and Chicago R. R. P. 104.

Romney, p.-v. and tp., cap. of Hampshire co., West Va., on S. branch of Potomac River, has 1 newspaper. P. of v. 482; of tp. 1031.

Romney (GEORGE), b. at Furness, Lancashire, England, Dec. 15, 1734; left school at the age of eleven to enter the workshop of his father, a wealthy cabinetmaker; displayed such genius in drawing likenesses that he was apprenticed to a portrait-painter at Kendal; married against his parents' will 1756; commenced painting on his own account at York 1758; acquired a simple and natural style of portraiture, which procured him favor among the gentry of the North; set out for London 1762, leaving his wife and two children at Kendal; obtained a prize of 50 guineas from the Society of Arts for a picture of the *Death of Wolfe* (1763), and a year or two later a similar premium for his *Death of King Edmund;* began his metropolitan career by painting heads for four guineas; met with rapid success; soon raised his price; obtained patronage among the members of the bar; soon took a studio at the West End; removed to Great Newport street 1767 and to Cavendish Square 1776, having then greatly improved his style by studies at Paris, Rome, and Venice; was efficiently patronized by the duke of Richmond and many of the nobility, becoming a formidable rival to Sir Joshua Reynolds; attained a professional income of £4000 per annum; painted a number of striking scenes from Shakspeare's plays; is said to have been the original projector of Boydell's *Shakspeare Gallery*, and at a later period devoted his best energies to a fine series of works of fancy, among which the best were *Milton and his Daughters* and *Newton making Experiments with the Prism.* He obtained from Rome, through Flaxman, a magnificent collection of casts from antique statuary; built a house and gallery at Hampstead after his own plans, and settled there 1797, but soon felt the effects of age upon his head and hand, which obliged him to stop painting. In 1799 he suddenly returned to Kendal to his wife and children, whom he had neglected for thirty-seven years; was received with kindness; sold his estate at Hampstead and bought a house at Kendal, but had scarcely become accus-

tomed to his new life when he fell into a state of utter imbecility, and after lingering two years died at Kendal Nov. 5, 1802. He was never a member of the Royal Academy, and never sent works to its exhibitions in consequence of an early and lasting rivalry with Reynolds. An elaborate biography was written by the poet Hayley (1809), a briefer one by his son, Rev. John Romney (1830), and a sufficiently full account is given by Allan Cunningham in his *Lives of British Painters*. PORTER C. BLISS.

Romorantin′, town of France, department of Loir-et-Cher, at the confluence of the Sandre and Rantin, manufactures cloth, oil, and sword-blades. P. 7642.

Rom′ulus, in Roman mythology, the founder of the city of Rome, was the twin-brother of Remus and a son of Mars by Rhea Silvia, a priestess of Vesta. Her father, Numitor, king of Alba Longa, was dethroned by his brother, Amulius, and her two sons were thrown into the Tiber by the order of her uncle. But the river landed them safely at the foot of the Palatine Hill; a she-wolf carried them to her den and suckled them, and a shepherd afterward found them and educated them together with his own children. The legend goes on narrating how the two brethren discovered their descent, reinstated Numitor, emigrated from Alba Longa, determined to build a city on the Palatine Hill, but then fell out with each other; how Romulus killed Remus, built the city, procured wives for the citizens, established all the fundamental institutions of the Roman state, and finally was removed to Olympus, where he took a seat among the gods as the god Quirinus. In many of its details, however, the legend is by no means mere fancy, but the imaginative explanation of real facts whose true origin was unknown or forgotten.

Romulus, p.-v., Tuscaloosa co., Ala. P. 540.

Romulus, p.-v. and tp., Wayne co., Mich., on Huron River. P. 1463.

Romulus, p.-v. and tp., Seneca co., N. Y., extends across the county from Cayuga Lake to Seneca Lake. P. 2223.

Romulus Augustulus. See WESTERN EMPIRE.

Ro′nald, tp., Ionia co., Mich. P. 1353.

Roncade, town of Italy, province of Treviso, about 8 miles S. E. of the town of Treviso. Its chief ornament is the fine palace of the Giustiniani, the work of the celebrated architect Sansovini. It contains an active and robust pastoral population of 5300.

Roncesval′les [Fr. *Roncevaux*], a small Spanish village, province of Navarre, in a narrow valley enclosed by lofty mountains, through which one of the principal roads leads from France across the Pyrenees into Spain. Here Charlemagne was attacked in 778 by the Basques, and his whole rear-guard destroyed. In honor of those who had fallen he built a chapel on the spot where the battle took place, and among the names enumerated in the inscription was that of Roland. By some incident this event and this name became the centre of all the romantic poetry which sung of Charlemagne and his paladins, and many fantastical alterations and additions took place, behind which the simple historical facts are hardly recognizable. In the modern French-Spanish wars several bloody encounters (in 1793, 1794 and 1813) occurred in the same valley, and in 1833, Don Carlos was first proclaimed king here.

Ronciglio′ne, town of Italy, province of Rome, about 30 miles N. W. of the city of Rome. The town is well built, and the inhabitants are remarkable for industry and thrift. The iron and copper works here are extensive and flourishing, and powder, soap, cotton cloths, etc. are largely manufactured. Education, too, is much better cared for than is usual in this part of Italy. P. 6100.

Ron′da, town of Spain, province of Malaga, at an elevation of 2300 feet above the sea, on a precipitous promontory of the Sierra Nevada, at the Guadiaro, which here is crossed by lofty bridges built by the Moors. The city is celebrated not only for its romantic and picturesque location, but also for the salubrity of its climate, and for its large annual fair, held in May, attended by a great number of merchants, and enlivened by bull-fights and other national entertainments. Elegant arms, fine woollen fabrics, and saddlery are the principal manufactures of the city; the vicinity is rich in wine and possesses an excellent breed of horses. P. 19,334.

Ron′deau Har′bor, p.-v., Kent co., Ontario, Canada, on Lake Erie, has a safe but shallow harbor, and a weekly newspaper. Its harbor is protected by Pointe aux Pins. P. about 150.

Ron′do [It.], in music, a composition in which the theme, as it is given in the first strain, returns upon itself in the last, after passing through various expansions and elaborations.

Rondout′, p.-v., Kingston tp., Ulster co., N. Y., on Rondout Creek, 1 mile above its confluence with Hudson River, is the E. terminus of New York Kingston and Syracuse R. R., and also of Delaware and Hudson Canal, by which it receives immense quantities of coal from the anthracite region of Pennsylvania, has 8 churches, 2 banks, 2 newspapers, 1 Roman Catholic orphan asylum, 22 steamers on the Hudson, and does a large business in shipping building-stone and cement to New York City. P. 10,114. Since 1872 it has formed the central portion of the city of KINGSTON (which see).

Rong′e (JOHANNES), b. at Bischofswalde, Prussian Silesia, Oct. 16, 1813; studied theology at Breslau, and was appointed a chaplain at Grottkau in 1840, but quarrelled with the ultramontane clergy on account of his liberal views, and was suspended in 1843 because of an article, *Rom und das breslauer Domkapitel*, which he published in the *Sächsische Vaterlandsblätter*. Next year he was excommunicated on account of his letter to Bishop Arnoldi of Oct. 1, 1844, denouncing as idolatrous the exhibition at Treves of the "holy coat." Through a number of pamphlets, and by travelling from town to town preaching and lecturing, he exhorted people to secede from the Roman Catholic Church, and, supported by the general irritation against the ultramontane hierarchy, he succeeded in forming several congregations of the so-called German Catholic denomination. By degrees, however, he was himself attracted by the political fermentation, sided in 1848 with the radicals, and fled in 1849 to England. Returning in 1861, he settled in Frankfort, where he founded a reform association in 1863.

Ron′neburg, town of Germany, duchy of Saxe-Altenburg, has manufactures of cloth, woollens, tobacco, porcelain, and earthenware, and a large trade in horses and cattle. P. 6402.

Ronsard′, de (PIERRE), b. at the Château de la Poissonnière, Vendômois, France, Sept. 11, 1524; was educated at the French court as page to the duke of Orleans; lived for nearly three years at the court of James V. of Scotland (1538–41), but having become almost entirely deaf, he determined to devote himself to literature, and retired shortly after his return to France to the Collége de Coqueret, where he spent five years studying the Latin and Greek literatures and languages. Among his companions here were Baïf, Remi Belleau, Muret, Jodelle, and Du Bellay, and among them sprang up that new literary ideal whose first representative Ronsard became, and which for centuries reigned not only in the French, but in all European literatures. It broke at once and absolutely with the romantic ideals of the Middle Ages, and substituted the classical models of the Greek and Latin literatures. Ronsard was not a prolific writer himself. In 1550 appeared his *Amours* and *Quatre Livres d'Odes*; in 1555, his *Hymnes*; in 1572, the four first books of his grand epic, *La Franciade*, which was never finished; his collected works in 1 vol., 1584. But his influence was decisive, and the enthusiasm he awakened was most extraordinary. The kings of the house of Valois loaded him with honors and benefices; Elizabeth and Mary Stuart sent him presents; the city of Toulouse presented him with a Minerva of solid silver; Tasso came to Paris to show him his poems. In France he founded the classical school, which reigned absolutely up to the second or third decade of this century, and in other European countries he also exercised a great influence, directly or through his school. D. at St. Cosmus, Tours, Dec. 27, 1585.

Rood, the fourth part of an acre, forty square rods. The square perch of masonry, 272¼ square feet, is often called the rood.

Rood (OGDEN N.), b. Feb. 3, 1831, in Danbury, Conn.; graduated at Princeton 1852; studied at the Sheffield Scientific School of Yale College and in the universities of Munich and Berlin; was elected professor of physics and chemistry in Troy University 1858; professor of physics in Columbia College, New York, 1863; member of the National Academy of Sciences 1864; vice-president of the American Association for the Advancement of Science 1868; has contributed largely to the transactions of scientific associations and to scientific journals. His original investigations have been numerous, embracing many interesting questions in mechanics, optics, acoustics, and electricity. He was among the first to apply photography to the microscope, and the first to construct fluid prisms of highly dispersive power for the study of the spectrum. His studies of the nature of the electric spark and of the duration of the flashes are particularly interesting, involving the determination of intervals of time greatly more minute than

any ever before measured. His methods of photometry are also extremely ingenious, as well as his investigations of phenomena dependent on the physiology of vision. His published papers number about forty. F. A. P. BARNARD.

Roodhouse, p.-v., Greene co., Ill., at the junction of Missouri division of the Jacksonville branch of Chicago and Alton R. R., 21 miles S. of Jacksonville, has 3 churches, 2 graded schools, 1 bank, 1 flouring-mill, 2 coal-shafts, 2 hotels, 1 newspaper, engine-house and waterworks, railroad shops and stock-yards, and 1 elevator. P. about 1200. THOMAS MCEWEN, ED. "ROODHOUSE SIGNAL."

Roof [Ang.-Sax. *hrof;* Gr. ὀροφή], the covering of a building. As generally used, the term includes the covering and the framing which supports it, though in carpentry the use of the word is restricted to the latter meaning. Roofs vary greatly in form and material, and require a higher degree of skill and more science than any other part of a building. Greek temples were covered with long thin pieces of marble; the roofs of the halls of the ancient Assyrians and Babylonians consisted of exceedingly large stones, some of them so big as to cover a whole room singly. Remains of buildings belonging to pre-historic times have been discovered in the East of a circular shape, in which a column standing in the centre was evidently intended to support rafters whose outer ends rested upon the enclosing wall.

FIG. 1.

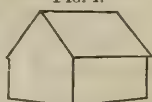
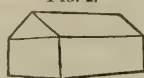


FIG. 2.



The inclination or pitch of a roof is most generally a matter of taste alone, and not of climate, though with some coverings a certain inclination is necessary; the curious theory has been advanced that it should vary with the latitude, being zero at the equator, and having three degrees added for every climate as we advance northward. In England and in France in the later times of mediæval architecture the roof took a very different growth; in the former country, though of a higher latitude, it became flatter; in France and in Germany it grew high and steep. To the flat roofs were added parapets, and the church-towers were built without spires and furnished also with parapets. In France the roof grew with the rest of the building, and particularly on the tower, when spires had fallen into disuse, it assumed almost the inclination if not the place of the spire. In Persia and Arabia the roofs are flat; in Greece invariably sloping, made on an angle of about 16° with the horizon; in Rome on an angle of about 24°. In hot climates the chief reason for the flatness of the roofs is, that they may serve as terraces in the cool of the evening and morning, and for this purpose are covered with concrete or cement carried on joists like a floor.

FIG. 3.

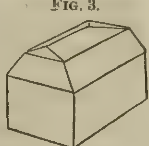
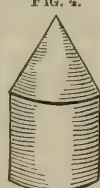


FIG. 4.



When the base is a circle, an ellipse, or a polygon, and its vertical section a curved line concave toward the interior, the roof is termed a dome or cupola. Different names are given to roofs according to their forms; thus, Fig. 1 is a gabled roof; Fig. 2 a hipped roof; Fig. 3 a gambrel, curb, or Mansard roof (the term Mansard is from a celebrated French architect who died in 1666); Fig. 4 a conical roof. Fig. 5 shows a very simple frame for a roof, consisting of two rafters resting at their lower ends upon the wall or frame of the house; sometimes the rafters are prevented from spreading by a collar-beam uniting them near their lower ends. Fig. 6 is a king-post frame or truss, suitable for a span of 35 to 40 feet, where A is the ridge; B, purlin (a beam at right angles to the rafters); C, king-post; D, strut; E, tie-beam; F, pole-plate; G, wall-plate; H, common rafter; I, principal rafter. Fig. 7 is a Norman roof. Fig. 8 is the celebrated roof of Westminster Hall, completed in A. D. 1399, of which the span is 68 feet. The horizontal pieces resting upon the walls are termed hammer-beams. This span is unusually large, as the span of the Gothic roofs seldom exceeded 35 feet. The builders of these roofs aimed to construct them of very short pieces of timber, always oak or other hard wood, which were very strongly fastened together. The thrust of this roof against the walls is prevented to a great extent by the rigidity of the frame, which causes it to act somewhat as a beam. The woodwork of the Gothic roofs was very elaborately carved and ornamented. In the roof of St. Paul's, Rome (Fig. 9), destroyed by fire during the present century after having stood over 400 years, the king- and queen-posts are not framed into the tie-beam, but attached by iron straps. This is one of the earliest instances where iron has formed a feature in the construction of roofs. The span of this was 78 feet 4 inches.

FIG. 5.

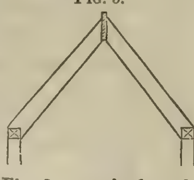


FIG. 6.

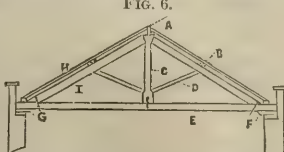


FIG. 7.

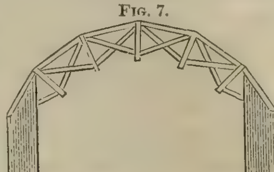


FIG. 8.

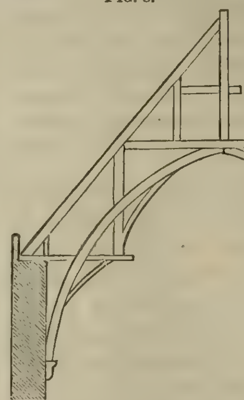
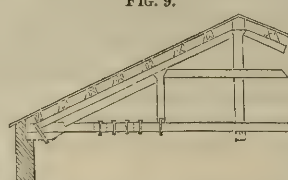


FIG. 9.



The use of iron for roofs has become very general in the present day, on account of the many advantages which it possesses, such as economy, lightness, and facility of transportation and erection. Figs. 10, 11, 12, 13, and 14 illustrate some of the simpler and more generally-used forms of trusses made of iron; they are so tied as to prevent any outward thrust against the walls. The roof over the central transept of the Crystal Palace, Sydenham, England, is arched and composed of two semicircular ribs connected by double-lattice bracing. The whole of the roof is of wrought iron, the covering being entirely of glass on the ridge-and-furrow principle. The span is 120 feet, and the arch is of such depth that it exerts but little horizontal thrust upon the supporting walls. The roof of the Royal Albert Hall, Kensington, is oval, with four centres; the half of one of the trusses is shown in Fig. 15. The span is 219 feet 4 inches by 185 feet 4 inches. The roof of the rotunda of the Vienna Exhibition of 1873 is conical. The span is 343 feet 9 inches. The lower edge is supported and strengthened by a heavy wrought-iron curb or continuous circular box-girder. At the top there is a circular aperture 95 feet 8 inches in diameter, which is stiffened by another curb, and on this curb is erected a lantern from which the whole space below is lighted. To prevent sagging between the upper and the lower curbs, the whole structure is stiffened by heavy girders of plate iron running from curb to curb, while to prevent distortion in any other way, ring-girders at right angles to the rafter-girders run round the roof. All the girders have been put outside the roof, instead of inside. The trusses of the roof of St. Pancras Station are latticed iron arches of 240 feet span. This roof springs virtually from the ground, the side walls being merely screens to hide the springings. The main ribs are tied

FIG. 10.

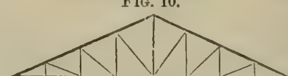


FIG. 11.

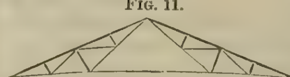


FIG. 12.

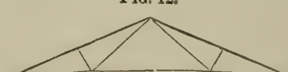


FIG. 13.

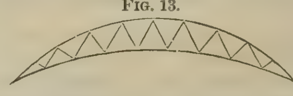


FIG. 14.

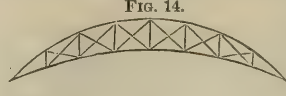
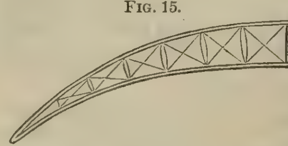
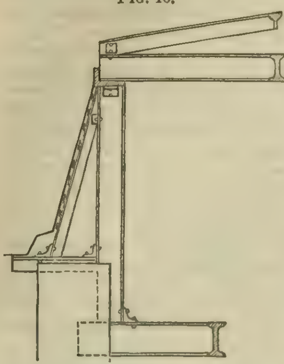


FIG. 15.



underneath the platform by a system of wrought-iron girders, for the purpose of counteracting the outward thrust of the roof. These girders support the floors of the building as well as act as ties. Fig. 16 shows the iron framing of a Mansard roof. These roofs (which have since their invention formed so common a feature of French architecture) of different styles, slopes, and coverings have recently been very generally adopted for all classes of buildings both in the city and in the country. They were at first built almost exclusively of wood and covered with slate, but the great liability to taking and communicating fire has caused the use of iron for framing purposes.

FIG. 16.



The coverings for roofs are made of various materials, among which may be mentioned the following: Thatch of straw, reeds, and heath, used probably in primitive times, and even in the present age abroad, in rude dwellings; tiles of various shapes, which have been used from the Roman period to the present day, and which probably covered the Saxon buildings; thin slabs of stone or flag; slate; lead, which was always used on mediæval roofs; tin, iron, zinc, copper; asphalted felt coated with a hot preparation of tar on which gravel is spread; shingles; canvas covered with cement and glass.

SAMUEL H. SHREVE, A. M.

Rook [Ang.-Sax. *hrôc*], (*Corvus frugilegus*), a species of the family Corvidæ congeneric with and closely related to the common crow, which it also resembles nearly in size (it is a little smaller), as well as black color; but it is distinguished therefrom by the bill being little longer than the head, and in the adult naked at the base; the first primary is shorter than the eighth, the second shorter than the fifth, and the third and fourth are the longest. It is generally distributed throughout Europe and Eastern Asia. It lives in considerable communities, and their nesting and gathering places are known as rookeries; these sometimes are very populous, occasionally containing as many as 2000 to 3000 nests, and a corresponding number of birds of different ages and sizes. In England by many they are considered as an attractive feature in the landscape, and are therefore protected. The nests are generally made in tall trees. The female lays, early in the spring, about four or five greenish-blue and spotted eggs. The species is quite omnivorous in feeding, but does not trouble the farmer like the crow. It is capable, like its congeners, of mimicking the sounds of other animals. The young are to some extent used as food in England and on the Continent.

THEODORE GILL.

Rooke (Sir GEORGE), b. near Canterbury, England, in 1650; became post-captain in the navy 1680, and vice-admiral 1692; headed a daring and successful night-attack in boats upon the French squadron off Cape Lattogue, burning 13 French vessels, May 19, 1692, for which exploit he was knighted and received a pension of £1000; entered Parliament 1697; was appointed commander-in-chief of the navy at the commencement of the war of succession in Spain 1702; made an unsuccessful attack upon Cadiz; destroyed the Spanish "plate fleet" of 17 vessels in the harbor of Vigo 1702; participated in the capture of Gibraltar Aug. 3, 1704, and engaged the French fleet off Malaga Aug. 24, 1704, but that fleet having escaped in the night, he was severely blamed, and was dismissed the service Feb., 1705. D. near Canterbury Jan. 24, 1709.

Rooke (LAWRENCE), b. in 1623; was educated at King's College, Cambridge, and Wadham College, Oxford; became professor of astronomy and geometry in Gresham College, London, and was considered one of the most learned men of England. Besides many astronomical and other papers, he published *Observationes in Cometam qui mense Decembri Anno 1652 apparuit* (1653). D. in 1662.

Rooks, new county of N. W. Kansas, on the S. fork of Solomon River, has a rolling prairie surface and very few inhabitants. Area, 900 sq. m.

Rook's Creek, p.-v. and tp., Livingston co., Ill. P. 945.

Room'-Elee, the old metropolitan province of the Turkish empire, consisting of the ancient Thracia and parts of Macedonia, and comprising the land bordering on the Black Sea, the Strait of Constantinople, the Sea of Marmora, and the Dardanelles. It is now divided into the eyalets of Constantinople and Adrianople.

Roon, von (ALBRECHT THEODOR EMIL), COUNT, b. Apr. 30, 1803; entered the Prussian army in 1821; attended the military school of Berlin 1824–27; was appointed teacher to the cadets in 1828, member of the topographical survey of the staff in 1833, teacher in the military school in 1835, and captain on the staff in 1836. In 1842 he was made a major, and subsequently took charge of the military instruction of Prince Friedrich Charles. During the campaign in Baden he was chief of the staff of the 8th army corps; was made a colonel in 1851, commander-in-chief of the 20th brigade of infantry in 1856, and commander-in-chief of the 14th division at Düsseldorf in 1858. On Dec. 5, 1859, the prince-regent called him to take charge of the ministry of war, and (Apr. 16, 1861) also of the ministry of the marine. After the war of 1866, which gave evidence of his talent for organization, he received from the king the cross of the Black Eagle and a dotation, and after the war with France (1870–71), he was made a count and received a new dotation. The office of minister of the marine he resigned Dec. 31, 1871. In the Prussian government he represented a specific Prussian tendency in opposition to the German and progressive policy of Prince Bismarck, and (Dec. 21, 1872) having handed in his resignation, he was made president of the cabinet, and a few days afterward field-marshal, but resigned in 1873 and retired to his estate.

AUGUST NIEMANN.

Roop, county of Nevada, in the N. W. corner, bordering on California and Oregon, has a broken surface, but embraces a portion of the fertile Surprise Valley lying between Warner's Range and the Granite Mountains, has several boiling springs, and includes the famous Pyramid Lake. Some gold has been found. P. 133.

Roosevelt (JAMES I.), LL.D., b. in New York Dec. 14, 1796; graduated at Columbia College in 1815; studied law, and practised many years; in 1835 and 1840 was a member of the State legislature, and in 1842 was elected a Representative in Congress. Declining a re-election, he travelled several years, and on his return devoted himself to the care of his large estates, but in 1851 accepted the appointment of judge of the supreme court, which he held eight years. D. in New York Apr. 5, 1875.

Roosevelt (ROBERT B.), b. in New York in 1829; studied law, and was engaged in active practice for many years, but finally devoted himself to literature, rural sports, and politics, and in 1871 was elected a Representative in Congress. He is president of the New York Sportsmen's Club; one of the State commissioners of fisheries; for several years edited the *Citizen*, a weekly journal devoted to literature and politics, and has published *The Game Fish of North America* (1865), *Lake Superior Fishing* (1865), *The Game Birds of the Coasts and Lakes of the Northern States* (1866), *Five Acres too Much* (1869), and edited, with a biographical sketch, *The Poetical Works of Charles G. Halpine.*

Roosevelt (THEORORE), b. in the city of New York Sept. 22, 1831; was a partner of the firm of Roosevelt & Son until 1876, when he retired; was the organizer of the allotment commission during the war, founder of the New York Orthopædic Dispensary, one of the State commissioners of public charity, and in many other ways an active philanthropist. D. in New York City Feb. 11, 1878.

Root, in botany. See ROOTS, by PROF. G. L. GOODALE, A. M.

Root [allied to Lat. *radix*]. In algebra, a *root* of an equation is any quantity, whether real or imaginary, which being substituted for the unknown quantity will satisfy it; that is, make the two members equal. Every equation containing but one unknown quantity, and whose exponents are whole numbers, can be reduced to the form

$$x^n + px^{n-1} + qx^{n-2} +, \text{etc.}, + u = 0, \qquad (1)$$

in which n is a positive whole number. The ground on which it is *assumed* that every equation of the nth degree has n roots, real or imaginary—or, in other words, that every analytical expression, such as the first member of (1) may be dissolved into as many factors as the number n which denotes its degree—has been set forth under heading IMAGINARIES (which see). It is there also shown why all *irrational* roots, and consequently all imaginary roots (which result from assignment of such *quantitative values* as make negative the quantities under the radical sign) must occur *in pairs*. Equations may be *transcendental* (*i. e.* involve *logarithms* and *exponential* or circular functions, as *sines*, *cosines*, etc. of the unknown quantity) as well as algebraic: in which case the number of roots (including imaginaries) is infinite. The general subject of roots is too abstruse to be treated here.

Root, in philology. See LANGUAGE, by PROF. W. D. WHITNEY.

Root, tp., Adams co., Ind., on St. Mary's River and Cincinnati Richmond and Fort Wayne R. R. P. 1252.

Root, tp., Montgomery co., N. Y., on Mohawk River and Erie Canal. P. 2492.

Root (George Frederick), b. at Sheffield, Mass., Aug. 30, 1820; became a professor of vocal music, and in 1860 a member of the firm of Root & Cady, music-publishers at Chicago. Author of many popular songs and of several manuals for teaching music, and compiler of numerous collections of sacred music.

Root of a Quantity, a quantity which, taken a certain number of times as a factor, will produce the given quantity. A root of a quantity is one of its equal factors. If a quantity is resolved into two equal factors, one of these is the *square root;* if into three equal factors, one of these is its *cube root;* and so on. Every quantity has *two* square roots, *three* cube roots, *four* fourth roots, and so on. If the quantity is positive, both of its square roots are real; if it is negative, both of its square roots are imaginary. In like manner, if a quantity is positive and the index of its root is even, two of the roots will be real and the rest imaginary; but if the quantity is negative and the index even, all of its roots will be imaginary. If a quantity is either positive or negative and the index of its root is odd, one of the roots will be real and have the same sign as the quantity, and all the rest will be imaginary. The two square roots of 1 are $+1$ and -1; the three cube roots of 1 are 1, $\frac{1}{2}(-1+\sqrt{-3})$, and $\frac{1}{2}(-1-\sqrt{-3})$; the four fourth roots of 1 are $+1, -1, +\sqrt{-1}$, and $-\sqrt{-1}$; and so on. In the foregoing sense the root of a quantity is the root of the equation $x^n - q = 0$; and if q is unity, the above and other roots are found under Imaginaries.
W. G. Peck.

Roots, the organs of plants, by which absorption from the soil mainly takes place, are outgrowths covered at their tip by a cap of peculiar tissue. From the lower end of the rudimentary stem in the embryo the *primary* root strikes down. This may branch more or less, according to the kind of plant, and remain fibrous or become woody or fleshy. The advancing tip, made up of a cluster of multiplying cells protected by the root-cap above mentioned, can work its way past obstructions and through interstices in the soil. The parts of the plant above the radicle may give rise to *secondary* roots. These in some cases never reach the ground, and are therefore *aërial.* The aërial roots of some plants, like the ivy, serve as grapples for the stem to climb by; others, called *epiphytic,* are attached to the surface of other plants. The secondary roots of the banyan swing free in the air for a time, but ultimately reach the soil. Roots which strike into the tissues of other plants and therefrom abstract nourishment are *parasitic.* The smaller roots, or root-branches, are in most cases clothed near the tip with elongated cells, or root-hairs, which constitute the chief means by which liquids are absorbed. Roots seldom contain chlorophyll, and therefore do not share in the work of assimilation. They never directly produce leaves, but may, under certain conditions, give rise to buds and leafy stems, as they do in various trees.
G. L. Goodale.

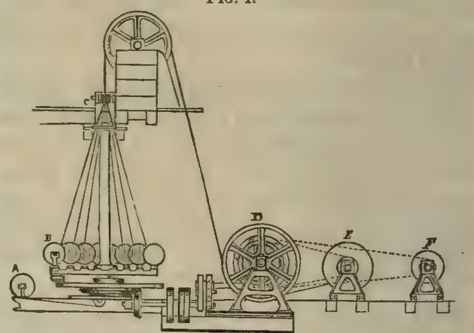
Roots'town, p.-v. and tp., Portage co., O., on Cleveland and Pittsburg R. R. P. 1169.

Rope- [Ang.-Sax. *râp*] **Making** is the art of combining vegetable or other fibres by twisting so as to form a durable and flexible rope. The hemp, the material commonly used, is first *hackled* or combed out to remove the dust and tow. The *hackle* consists of a strong board holding in a vertical position long steel prongs sharply pointed and polished. The hackling is done by hand.

The preparation machines prepare the hemp still further for spinning into yarn by a finer process of hackling. First is the *spreader,* a machine having two endless chains fitted with gill-bars and gill-pins (steel teeth), which combs or straightens out and evens the fibres. The spreader is fed with the hackled hemp at one end, and throws it out in a *sliver* from the other. From the spreader the sliver is passed through two or more *drawing-frames,* by which it is drawn down still more and the fibres still further combed out straight, the size of the sliver being reduced at each step. The drawing-frame is similar to the spreader, but has only one chain. The sliver is now passed to the spinner, where it is spun into yarn, and at the same time reeled upon a bobbin. A recent improvement in the spinner, the invention of Mr. John Good of Brooklyn, N. Y., *tubes* the yarn, rendering it smoother and more even than any process yet devised, leaving little to be desired in the manufacture of rope. The yarn is spun right handed. The size of the yarn varies according to the kind of rope for which it is intended. *Forties*—so called because 40 yarns will just fill a half-inch tube—are for the finer kinds of rope; *twenties,* requiring 20 to fill the tube, are for cables, hawsers, etc. From the spinning-room the bobbins containing the yarn are taken to the tar-house, where they are placed in frames conveniently arranged with reference to the tar-box. This is a long box filled with tar kept during the operation of tarring at a temperature of 220° F. by means of steam heaters. The yarns are led from the bobbins in the frame through two or more guide-plates working in a vertical plane over the tar-box, and convenient for lowering into the tar; thence to the further end between metal rollers, which press out and return to the box the superfluous tar, on to a large wooden drum to cool them; through fair-leaders, and finally to a fresh set of bobbins, where they are wound up with the utmost regularity. The bobbins containing the tarred yarn now go to the *laying-ground,* where they are placed in frames, when the yarns are ready for *hauling down,* or making into strands. The laying-ground, where the rope is laid up, occupies the entire length of the ropewalk. The yarns for the strands, generally three in number, are led from the bobbins in the frame through holes bored on concentric circles in a metallic plate, thence through a tube adapted to the size of the strand, and attached to a hook on the end of a spindle in a movable machine like a car, called the *former.* There is a plate, tube, and hook for each strand; and the number of yarns to a strand is regulated by the size of the intended rope. All being ready, the machinery is put in motion, when the *former* is drawn down the walk, and the yarns as they are hauled through the tubes are formed into left-handed strands. *Closing* the strands is the next step, for which two machines are used. The lower one—the *layer*—lays up or closes the rope, and is movable; the upper one, which keeps the proper twist in the strand while laying, is stationary. Each strand being secured to its proper spindle, the machinery is put in motion and the strands *hardened.* A press attached to the layer prevents too much drawing up as the strands shorten in by the additional twisting. After hardening, the strands are placed together on a central spindle of the layer and closed, a *top* inserted between them preventing too rapid closing. The top is a wooden cone with grooves cut to hold the strands, while *tails* of soft rope attached to it, by being applied to the rope as it is made, still further prevent, by the additional friction, the too rapid closing of the rope. The layer makes two revolutions to one of the upper machine. The skill of the rope-maker consists in knowing how to gear his preparation machines so as to draw a clean and uniform sliver, in giving the proper degree of twist to the yarn and strand, the amount of hardening, and the speed of the top in closing. The foregoing process gives right-hand tarred rope of three strands (*plain laid*). If the yarns are not tarred, we should have *white rope,* the strongest, though when exposed to the weather not the most durable, of all in common use.

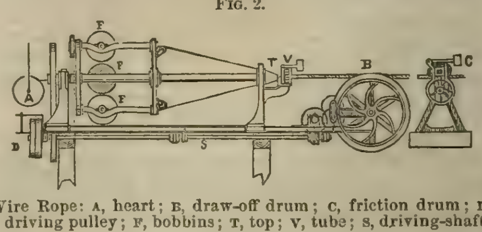
In the manufacture of manila rope the first step in the

Fig. 1.



A twelve-flyer-Machine, for forming the strands: A, heart; B, bobbins; C, top and tube; D, draw-off drum; E, bobbin for larger sizes; F, bobbin for smaller sizes.

Fig. 2.

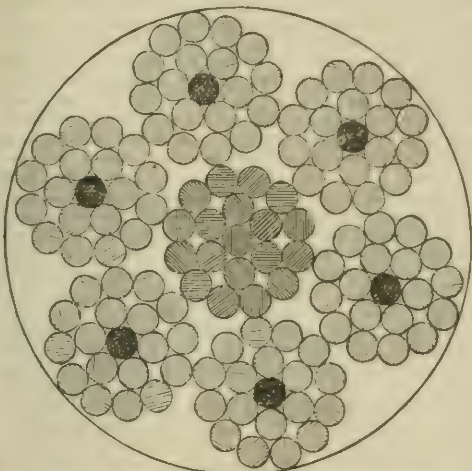


Wire Rope: A, heart; B, draw-off drum; C, friction drum; D, driving pulley; F, bobbins; T, top; V, tube; S, driving-shaft.

foregoing description, hackling by hand, is omitted, as unnecessary; the manila is oiled to enable the harsher fibre to pass the more readily through the preparation machines, and the yarns are not tarred; the remainder of the process is the same in both cases. The size of rope is designated by its circumference; when smaller than 1¼ inches it goes under the general name of *small stuff*. Three ropes laid up together form a cable or hawser of nine strands.

Wire rope may be made either of 49 coarse wires or 133 fine wires, put in six strands, and seven or fourteen *hearts*.

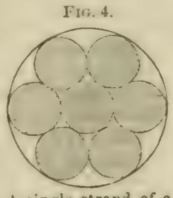
FIG. 3.



Cross-section of wire rope of 133 wires (full size).

To make a 7.8-inch fine wire rope, as in the annexed diagram, fill the bobbins of a *six-flyer* machine, similar to Fig. 1, with No. 8 wire, Birmingham gauge, and for the heart lead a single wire from its bobbin up through the vertical shaft. This will form a seven-wire heart for the strands. Next fill the bobbins of a twelve-flyer machine (Fig. 1) with the same size wire, placing the heart just made as in the figure. Pass all the wires up through holes past the *top*, arrange the wires through the grooves of the top, twist them together by hand, splice in a piece of rope, and pass it five or six times around the *draw-off drum*. Friction-straps attached to the bobbins preserve an equal tension on the wires. Putting, now, the machine in motion, the seven-wire heart is drawn up the shaft, and at the same time the twelve single wires are wrapped about it as the disk revolves, each separate bobbin turning on its own centre in an opposite direction, so as to avoid twisting the wire. As the strand is formed it is reeled upon a bobbin. Having filled seven bobbins, six are placed in a machine similar to Fig. 2, and one in the rear for a heart. The heart, on motion being given to the machinery, is drawn through, and the six strands wrapped about it, giving six outer and one central strand of 19 wires each. In making strands for wire rigging it is the practice to substitute hemp for the single wire of the heart, and to make a hemp heart for the rope. It is plain from the preceding diagram that the diameter of the required rope, divided by 15, will give the diameter of the single wire; from which, by tables in common use, the proper gauge may be found.

FIG. 4.



A single strand of a 49-wire rope.

The annexed diagram shows the cross-section of a single strand of a 49-wire rope, the six strands and the heart all being of the same size. The size of the required rope being given, divide the diameter by 9 to find the diameter, and from the tables the gauge of the wire to be used. Knowing by the old rules the proper size to make a piece of hemp rigging, the corresponding size of wire rope may be found from tables giving the comparative strength of ropes of the two materials. S. B. LUCE.

Roqueplan' (JOSEPH ÉTIENNE CAMILLE), b. at Mallemort, department of Bouches-du-Rhône, France, in 1803; studied painting at Paris under Gros and Pujol; began to exhibit in 1822; attracted great attention in 1827 by a couple of pictures for which he had chosen the subject from Walter Scott's romances, and became soon one of the leaders of the modern French school of painting. The most remarkable of his pictures are the *Amateur Antiquary*, and his genre pieces and landscapes from the Pyrenees, among which is *The Well near the Tall Fig Tree*. For several years during the latter part of his life he suffered much from ill-health. D. at Paris Sept. 29, 1855.

Ro'ree, or **Lohuree**, town of Sinde, in lat. 27° 42′ N. and lon. 68° 53′ E., on the left bank of the Indus, is a filthy, decaying, and unhealthy place, with some manufactures and trade. Close by is a temple to which a large body of men is attached as a guard; in the temple is a box of wood inlaid with silver; in this box is another of gold inlaid with rubies, and in this still a third of amber; in the amber box is one hair of Mohammed's whiskers. P. about 8000.

Roric Figures [Lat. *ros*, "dew"], the name by which are designated the curious images seen upon polished solid surfaces after breathing upon them, and also applied to a class of related phenomena produced under very various conditions, but agreeing in being considered as the effect of either light, heat, or electricity. A scientific explanation was first attempted by Dr. John W. Draper of New York in the *Philosophical Magazine* of Sept., 1840, who called attention to the fact that a roric figure may be preserved intact for an indefinite period, and again brought out by the breath; suggesting that an insensible molecular change had been effected on the surface by the first breathing. The subject was taken up by Möser of Königsberg (July, 1842), who developed the idea of a latent light, and by Mr. R. Hunt, who has given (in his *Photography*, New York, 1852) interesting experiments of what he calls *thermography*, the figures being in his opinion caused by the action of heat. Karsten made many interesting experiments demonstrating the action of electricity in the production of similar figures, and later experiments have been made by Grove, Herschel, and C. A. Seely, the theories of which are still in a transitional stage.

Ror'qual, the Norwegian term of the largest of the whale family; also called FINBACK (which see).

Ro'sa (EUPHROSYNE **Parepa**), b. in Edinburgh, Scotland, in 1836, daughter of Georgiades de Boyescu, a Wallachian nobleman, and his wife, Elizabeth Seguin, who, left a widow at the age of twenty-one years, devoted herself to music as a profession; was carefully trained by her mother; made her début on the operatic stage at Malta as a soprano singer; appeared with success at London 1857; married Capt. Carvell of the East India service 1863; became a widow 1865; came to the U. S. with the Bateman troupe 1865, and again 1866–67; obtained great popularity, singing chiefly in oratorios, but occasionally in operas; married the violinist Carl Rosa 1867; organized with her husband an English opera troupe, with which they sang in the principal cities of the U. S. 1869–72; was at the khedive's court in Egypt during the winter of 1872–73, and afterward made another tour (1873) in the U. S. D. in London, England, Jan. 21, 1874.

Ro'sa (PIETRO), b. at Rome about 1815; began his career as an architect in the employment of Prince Borghese. His chief merit consists in having resurveyed and reconstructed the topographical map of Latium. The restoration of the Appian Way and other ancient localities of Rome to their original levels are truly historical lessons. In 1860, Napoleon III. gave him the charge of several restorations, especially of the prætorian camp at Albano; in 1861 he appointed him conservator of the Palace of the Cæsars, now the property of the Italian government. Rosa is now director of excavations in Rome and senator of the kingdom of Italy.

Rosa (SALVATOR), b. at Renella, near Naples, June 20, 1615; received a liberal education; was designed for the Church, but preferred art; studied music; was led to painting by his brother-in-law, who was an artist; became a pupil of Spagnoletto; went to Rome in 1635, and with occasional interruptions resided there, and won fame by his various and surprising talents. His works are in every style—altar-pieces, battle-pieces, sea-pieces, landscape, history, portraits; he was a writer of satires, too, a wit, and a hearty companion. His best pictures are landscapes, which are remarkable for wildness, loneliness, and gloom. He painted Nature in her roughness and desolation, with accessories of savage or ascetic life, more effectively than in her sweeter aspects, for his genius was impetuous, his imagination audacious and original. He painted swiftly, and his works are numerous. They are found in all the large collections in Europe. Private galleries in England contain good examples of his style. His portrait of himself is in the church of S. Maria dei Angeli, at Rome, where he is buried. D. in Rome in 1673. O. B. FROTHINGHAM.

Rosa'ceæ [from the typical genus, *Rosa*; Lat. *rosa*], an important natural order of polypetalous exogenous trees, shrubs, and herbs, comprising over 1000 species, mostly belonging to northern temperate regions. The

rose, apple, pear, quince, cherry, plum, peach, apricot, almond, blackberry, raspberry, strawberry, etc. belong here. The nearest affinity of the order is, on the one hand, with the Leguminosæ or pulse family, although this might not appear from a superficial comparison of the common representatives of the two; on the other, with the saxifrage family. In general, the rose family is distinguished by having alternate leaves with stipules, along with regular flowers, generally in definite or numerous perigynous stamens and definite seeds without albumen. It divides into marked sub-orders, of which the three following are the principal: (1) Amygdaleæ, or the almond family, with a single simple and free pistil, becoming a stone fruit, such as that of peach, plum, and cherry. (2) Rosaceæ proper, with dry or berry-like fruits, from numerous or few (seldom single) free pistils, and stipules joined with the petiole. To this belong the small fruits above mentioned, and a great variety of useful and ornamental plants, both herbs and shrubs. (3) Pomæ, the apple family, with two or more pistils combined with each other and with a fleshy calyx-tube, which forms the edible fruit. The fruits of the order are all innocent, except that of the cherry-laurel, but the kernels of the stone fruits contain a poisonous principle identical with or analogous to prussic acid, along with a bitter essential oil; and these qualities extend more or less to the bark and foliage. The most active article of the materia medica furnished by this order is from *Hagenia Abyssinica* (or *Brayera anthelmintica*), the koso tree of Abyssinia, the flowers of which are a powerful vermifuge. Astringency generally prevails in the herbage of the order. It yields many useful products, but is most important for its fruits and its ornamental flowers. ASA GRAY.

Rosa, de la (FRANCISCO MARTINEZ). See MARTINEZ DE LA ROSA.

Rosa (SAINT) **of Lima,** b. at Lima, Peru, in 1586, of wealthy Spanish parents, but they having lost their property she supported them by her labor while living as a recluse in the habit of the third order of St. Dominic. D. at Lima Aug. 24, 1617. She was canonized by Pope Clement X. in 1671, being the only saint of American birth in the Roman calendar.

Rosa, Monte. See MONTE ROSA.

Ros'amund, a Lombard queen. (See ALBOIN.)

Rosaniline, and its compounds. See ANILINE COLORS, by PROF. C. F. CHANDLER, Ph. D., LL.D., M. D., M. N. A. S.

Rosa'rio, city of the Argentine Republic, province of Santa Fé, on the W. bank of Paraná River, at E. terminus of Central Argentine and Rio Cuarto R. Rs., and chief port of entry for all the interior provinces, has deep water close to the shore, forming a commodious port, which is accessible to seagoing vessels of the largest draught; is a new city, having acquired nearly all its population and importance since the commencement of the railroad in 1863; is well laid out, paved, lighted with gas, has street-cars, docks, wharves, several hotels, banks, churches, theatres, and newspapers. It has been declared the capital of the republic, but the government has not as yet (1876) been removed thither. P. about 40,000.

Rosa'rio de Cucu'ta, town of New Granada, South America, in a fertile valley which produces much cacao, sugar, coffee, and tobacco. P. about 5000.

Ro'sary [Lat. *rosarium*, a "garden of roses," probably referring to the Virgin Mary as the mystical rose]. (1) A series of prayers prescribed by the Roman Catholic Church. The Greater Rosary is a synonym for the whole series, and is made up of three lesser rosaries. Each of the three lesser rosaries contains five decades or mysteries. Each decade contains one meditation upon one of the fifteen mysteries of the faith, one Pater Noster, or repetition of the Lord's Prayer, ten Ave Marias, and one Gloria Patri. (2) The name rosary also designates the chaplet or string of beads used in the repetition of the rosary. The Pater Nosters are marked by large beads, and the Ave Marias by smaller ones. The beads are of various materials, and are blessed by the pope or by some duly-authorized ecclesiastic. The beads serve as counters during the recitation. They are also in use among Arabs and Hindoos.

Ro'sas, de (JUAN MANUEL ORTIZ), b. at Buenos Ayres about 1793; was the son of a wealthy landowner; spent his youth among the "Gauchos" of the Pampas, receiving little education, but acquiring great influence by his skill in horsemanship and his daring exploits on the Indian frontier, and had figured actively in several revolutions, and was military commander of the Pampas, when in 1829 he headed the movement which overthrew Lavalle and the "Unitarian" party, proclaiming "Federal" principles; became governor and captain-general of Buenos Ayres Dec. 8, 1829; displayed great severity against political opponents; negotiated with the governors of the interior provinces the establishment of the "Argentine Confederation" Jan., 1831, on the basis of local independence, the direction of foreign affairs being entrusted to the governor of Buenos Ayres; retired from office, declining a re-election, Jan. 24, 1832; acquired fresh popularity by leading a successful expedition against the Indians of the desert; was again chosen governor with nearly absolute authority Mar. 7, 1835, and maintained himself in power by successive re-elections for eighteen years, which period was passed in constant civil and foreign wars, in which he displayed great energy and ability, but stained his name with acts of savage cruelty which have throughout South America rendered his name a synonym of tyranny. His success was largely due to the arts of a demagogue in making constant appeal to the "holy principle of federation," denouncing his enemies as "savage Unitarians" intent upon selling independence and republican institutions to Brazil, France, and England; with which countries he also maintained a protracted contest, more useful to him than the most brilliant victories could have been, since the only means of aggression consisted in a blockade of the rivers and ports. Four great uprisings of the Argentine liberals were quenched in blood, the suspected partisans of rebellion being massacred in their houses in Buenos Ayres by the secret society of the "Mazhorca," composed of the tools of Rosas; and Montevideo, the stronghold of the "Unitarians," though capital of a nominally independent republic, had been nine years besieged by his armies, in alliance with the titular president Oribe, when in 1851 his most trusted officer, Gen. Justo José de Urquiza, becoming wearied of the trammels imposed upon him, combined with Brazil and with the liberals or "Colorados" of the Argentine provinces and Uruguay to cast off the yoke of the dictator. Defeated at the great battle of Monte Caseros, near Buenos Ayres, Feb. 3, 1852, Rosas escaped in disguise on board an English vessel, proceeded to England, and with his celebrated daughter, Manuelita, has since resided at Southampton, without having (so far as is known) made the least effort to recover power, or even to propitiate the new public opinion in Buenos Ayres, where he was promptly outlawed and condemned to death and his vast landed property confiscated. PORTER C. BLISS.

Rosch'er (WILHELM), b. at Hanover Oct. 21, 1817; studied at Berlin and Göttingen, and was appointed professor of political economy at Göttingen in 1843, and at Leipsic in 1848. Besides a number of works on special subjects, he wrote *System der Volkswirthschaft* (4 vols., 1854–59, often reprinted) and *Geschichte der Nationalökonomie in Deutschland* (1874).

Ros'cius (QUINTUS), a celebrated Roman actor, a contemporary of Sulla and Cicero, who in his youth received instruction from him, and subsequently defended him in a civil lawsuit by an oration which is still extant. He was equally great in tragedy and comedy, and carried his art to the highest degree of perfection which the Roman stage ever witnessed, accumulating an immense fortune. Cicero speaks often of him, and always with enthusiasm for his art and respect for his character. D. 62 B. C.

Ros'coe, p.-v. and tp., Winnebago co., Ill., on Madison division of Chicago and North-western R. R. P. 1135.

Roscoe, tp., Davis co., Ia. P. 570.

Roscoe, p.-v. and tp., Goodhue co., Minn. P. 811.

Roscoe, p.-v. and tp., St. Clair co., Mo., on Osage River. P. 302; of tp. 922.

Roscoe, p.-v., Jackson tp., Coshocton co., O., on Muskingum River and Ohio and Erie Canal.

Roscoe (HENRY ENFIELD), F. R. S., son of Henry and grandson of William, b. in London, England, Jan. 7, 1833; studied at Liverpool high school; graduated at University College, London, 1852, and at Heidelberg University, where he was distinguished for his attainments in the physical sciences; was associated with Wilhelm Bunsen in his measurement of the chemical action of light 1853–57; was appointed professor of chemistry in Owen's College, Manchester, 1857; has published many papers in the *Philosophical Transactions* and other scientific periodicals; is author of *Lessons in Elementary Chemistry* (1866), *Lectures on Spectrum Analysis* (1869), and of the *Chemistry Primer* in Macmillan's *Science Series* (of which he is associate editor with Profs. Huxley and Balfour Stewart), and received in 1873 the royal medal of the Royal Society "for his chemical researches, more especially for his investigation of the chemical action of light and of the combinations of vanadium."

Roscoe (THOMAS), son of William, b. at Allerton Hall, near Liverpool, in 1791; translated several important works from the Italian, German, and Spanish writers, among which were the *Memoirs of Benvenuto Cellini* (1822), *Sismondi's History of Literature* (1823), *Specimens of Euro-*

pean Novelists (11 vols., 1825–32), and Lanzi's *History of Painting in Italy* (1828). D. at Liverpool Sept. 24, 1871.

Roscoe (William), b. near Liverpool, England, Mar. 8, 1753; was admitted to the bar 1774; commenced practice at Liverpool; wrote several pamphlets against the slave-trade; published in 1796 *The Life of Lorenzo de' Medici*, and in 1805 a *History of the Life and Pontificate of Leo X.*; sat in Parliament 1806–07; edited Pope's works (10 vols., 1824), and was author of many political and miscellaneous treatises. Retiring from practice at the bar in 1796 with a competent fortune, he formed a valuable library and art-collection at Allerton Hall, near Liverpool, and was honorably distinguished for his labors in the cause of philanthropy and his encouragement of younger literary aspirants; but having embarked his fortune in a banking firm, he lost it all by a failure in 1816, and his library was dispersed at auction. D. at Toxteth Park, Liverpool, June 27, 1831.—His *Life* (2 vols., 1833) was written by his youngest son, Henry (1799–1836), who was distinguished at the bar, wrote numerous legal works, and was author of the *Lives of Eminent British Lawyers* (1830; often reprinted).

Roscom'mon, an inland county of Ireland, province of Connaught, bordering E. on the Shannon, comprises an area of 949 sq. m., with a population of 140,670, of whom 47,643 can neither read nor write. The surface is level, with exception of the northern parts, where ranges of low hills are found; the soil is light but fertile, affording excellent pasturage in many places. Agriculture and the rearing of sheep are the principal occupations. From 1851 to 1872 no less than 52,299, or 30 per cent. of the whole population, emigrated. Chief town, Roscommon.

Roscommon, an unorganized county of N. Michigan, on Au Sable, Muskegon, and Titibawasee rivers, includes several lakes, has a broken surface, and no population in 1870. Area, 625 sq. m.

Roscommon (Wentworth **Dillon**), Earl of, nephew of Wentworth, earl of Strafford, b. in Ireland about 1633; educated at Caen under Bochart; obtained several offices about the court of Charles II.; went to Ireland as captain in the Guards; squandered his estate by gaming; returned to England; reformed his habits; married a daughter of the earl of Burleigh; devoted himself to literature in conjunction with Dryden, and produced some poems, the best being the *Essay on Translated Verse* and a version of *Dies Iræ*. D. at London Jan. 17, 1684, and was buried in Westminster Abbey.

Rose [Gr. ῥόδον; Lat. *rosa*], a genus of flowering plants giving its name to the large and important natural order Rosaceæ, and consisting of shrubs, usually prickly, natives of the northern hemisphere from the Arctic zone to Mexico in the New World, and to Abyssinia and the Indian Peninsula in the Old. The genus is characterized by unequally pinnate leaves with serrate leaflets, or rarely simple leaves, which in one species (*R. berberifolia*, Pall.) are entirely wanting, adnately stipulate petioles, and single or corymbose terminal flowers, with five foliaceous sepals imbricated in æstivation, five petals readily multiplying under cultivation, indefinite stamens, and numerous one-seeded carpels enclosed in the receptacular calyx-cup, which becomes fleshy when ripe. Nearly 300 species of the rose have been enumerated, but later botanists (Bentham and Hooker, *Genera Plantarum*) reduce to 30 the number affording real specific distinctions. Twelve species are described as native of North America, the most widely distributed being *R. setigera*, Mich. (Michigan prairie rose), with high-climbing branches, armed with stout, straight prickles, showy corymbose pink flowers, and globular fruit—a native of the Western and Southern States from Michigan to Louisiana and Georgia; *R. Carolina*, L. (swamp rose), with stems four to eight feet high, armed with stout hooked prickles, corymbose pink flowers, and bristly, depressed globular fruit—a frequent inhabitant of low swampy ground from Canada to Florida and westward to the Mississippi; *R. lucida*, Ehrhart (dwarf wild rose), with stems one or two feet high, armed with unequal bristly prickles, mostly deciduous flowers, solitary or in clusters of two or three, and smooth globular fruit—common through Canada and the U. S. east of the Rocky Mountains.

R. rubiginosa, L. (sweet-brier), a native of Europe, has escaped from cultivation, and become widely naturalized in the Atlantic States. *R. Sinica*, Ait. (Cherokee rose), a native of China, with high climbing branches, armed with stout hooked prickles, coriaceous evergreen leaves, and large white flowers, has been naturalized in the Southern States for over 100 years, where it is also extensively cultivated as a hedge-plant. Where sufficient room can be given it, few plants equal the Cherokee rose for winter-blooming in Northern conservatories, where its pure white flowers, produced throughout the winter, make a charming contrast to the shining evergreen foliage. *R. bracteata*, Wend., a native of China and Northern India, with erect branches, armed with stout recurved prickles and large, white, solitary flowers surrounded by conspicuous bracts, has also become naturalized in some of the Gulf States, where it is successfully employed as a hedge-plant, especially in deep rich soils.

From the dried petals of *R. Gallica*, L., an Old-World species of doubtful geographical limits, an infusion is made which is employed as an agreeable vehicle for tonic and astringent medicines. From the petals of *R. centifolia*, L., a native of the Caucasus, and *R. Damascena*, Mill., whose native country is unknown, rose-water, the principal ingredient in astringent collyria, is distilled. During the process of distillation a butyraceous oil of delicious fragrance separates from the rose-water, which, under the name of "attar of roses," is employed in perfumery and largely for scenting snuff. The commerce of Europe and the U. S. is almost entirely supplied with this perfume from the Turkish province of Room-Elee, where roses, cultivated for the purpose of its manufacture, form the principal field-crop, the town of Kizanlik being the chief seat of the trade, which amounts annually to several hundred thousand dollars. In the S. of France, Egypt, and other Mediterranean countries, and in India, roses are also largely cultivated for the manufacture of rose-water. *R. canina*, L. (dog rose), a species widely distributed throughout Europe, Northern Africa, the Canary Islands, Persia, and Siberia, is also of some importance to man. The pulp of its fruit, mixed with twice its weight of sugar, constitutes the *confectio rosæ caninæ*, which is employed as an astringent antiseptic preserve; an infusion of its young leaves has been used as a substitute for tea; its seeds are a vermifuge; while the root was formerly considered a specific against hydrophobia (whence its name).

From the earliest history of gardening to the present day the rose has been the most generally cultivated and popular of all flowers. To this fact, and to its tendency to assume new forms under cultivation, must be ascribed the difficulties of classifying or referring to original types the innumerable races and forms of the rose with which gardens abound. A classification dividing garden roses into two sets—the first, of summer or once-blooming, the second, of autumnal or ever-blooming—although open to several objections, is the most convenient for the horticulturist.

To the first section belong the Provence or cabbage roses, double forms of *Rosa centifolia*, favorite garden-plants from the time of the Romans, and of which the pompon roses are dwarf varieties; also moss roses, descendants from a sport or accidental bud-variation of the Provence rose, with the glands and bristles of the calyx and peduncle developed into a mossy substance. The original moss rose, now vastly increased in the number and variety of its forms, was introduced into England nearly three centuries ago from Holland, but the garden where it originated and the name of its discoverer are lost. Hybrid China roses, a race owing its origin to crossing the Provence and other summer roses with the Chinese rose and its offspring, the tea-scented, Noisette, and Bourbon roses. China roses are remarkable for vigor of growth, often surpassing both parents in this respect, splendid blooms, and great hardiness. They are particularly adapted for growing on pillars or over arbors, and in similar situations. Scotch roses, descendants of *R. spinosissima*, L., of dwarf stature and great hardiness, producing early in the season an abundant crop of red, white, and yellow flowers. Austrian briers, descendants of *Rosa lutea*, Mill., and which in Harrison's Yellow give us our best yellow rose for general cultivation. Prairie roses, descendants of *R. setigera*, Michx., and all of American origin and climbing habit. Queen of the prairie and Baltimore belle (a hybrid with evident traces of the blood of one of the tender Noisette group), are the most generally cultivated.

To the class of summer roses also belong the sweet-brier (*R. rubiginosa*, L.), of which many forms and varieties are in cultivation; the Bursault rose, a descendant of *R. alpina*, L., the evergreen rose, of which many varieties, descendants of the European *R. sempervirens*, L., are in cultivation. Barely hardy at the North, the evergreen roses are worthy of cultivation in the Middle and Southern States. The many-flowered rose, *R. multiflora*, Thunb., a native of China and Japan, of which several double forms are in cultivation in the Southern States, where it is alone hardy. The Banksian rose, generally cultivated only in its double state, having its origin in the Chinese *R. Banksiæ*, Brown, is well suited to the climate of the Southern States, and occasionally finds a place in Northern conservatories.

To the second section (ever-blooming roses) belong Chinese roses, descendants of *R. Indica*, L., and *R. semperflorens*, Curtis. Hardly hardy at the North, they are now

rarely cultivated, other ever-blooming roses having taken their place. Tea roses, descendants of *R. Indica*, L., two varieties of which with sweet-scented flowers, the blush tea and the yellow tea, were introduced into England from China early in the nineteenth century. From the intermingling of these two varieties has sprung the whole race of tea-scented roses. Hardy and highly esteemed in the Southern States, the tea rose is more extensively grown under glass during the winter months by Northern florists than any other flower. The demand for this rose in the Northern States for purely æsthetic purposes has within a few years increased this culture until its products are annually sold for several million dollars, Eastern Massachusetts being the chief seat of this business. The musk roses, double forms of *R. moschata*, Mill., a native of the Mediterranean basin, are occasionally cultivated, but are only hardy in the Southern States. Noisette Roses: this race of generally climbing roses, with flowers in clusters, was originated by M. Noisette, a French florist of Charleston, S. C., by crossing the China and the musk roses, the offspring being again crossed with the tea-scented roses. The noisette is one of the most beautiful of all the hybrid roses, but, unfortunately, it is only hardy in the Southern States. At the North it is often cultivated as a conservatory climber, Lamarque being the best known variety for this purpose. Bourbon Roses, a race of hybrids introduced into Europe from the Isle of Bourbon, where it was produced by crossing the China rose with some other rose of Eastern origin naturalized in that island. Bourbon roses are valuable for their habit of blooming late in autumn, although too tender for general cultivation at the North. Hybrid Perpetual Roses, a race of comparatively recent development, but of such merit as to have already nearly superseded all the older hardy roses. To a French cultivator, M. Laffroy of Bellevue, near Paris, is due the honor of having first, in 1840, produced the hybrid perpetual rose, which has as a basis some hardy once-blooming rose, often the hybrid China, with which has been mingled in sufficient quantities to impart their ever-blooming qualities the blood of the China, tea, or Bourbon rose, or a combination of all three. Hardy in the most severe climates, with flowers unsurpassed in form, color, and perfume, and with the ever-blooming qualities strongly developed, the hybrid perpetual rose is at once the most conspicuous example of the success which rewards the intelligent efforts of the hybridizer, and the most beautiful inhabitant of the garden.

Roses should be cultivated in situations fully exposed to the sun, in deep strong loam well drained and heavily manured. Indeed, too much rich food can hardly be given them to develop their greatest beauties. The soil in which they grow should be constantly stirred and kept free from other plants, and especially from the roots of neighboring trees, while a careful watch must be kept for the many insects which find a favorite food in their leaves and petals. Next to the selection of soil and situation, pruning is the most important operation in the culture of the rose. Strong-growing roses must be pruned slightly, that they may not be stimulated to excessive growth at the expense of the flowers; weak-growing roses must be pruned severely, to encourage more vigorous growth, or, in the words of Francis Parkman, a master in rose-culture, "Roses should be pruned in inverse proportion to the vigor of their growth." (In the following works precise instructions for the cultivation and propagation of the various garden roses, and carefully selected lists of the best varieties, can be found: *The Book of Roses*, Francis Parkman (Boston, 1866); *The Rose Amateur's Guide*, Thomas Rivers (London, 1872); *A Book about Roses*, S. Reynolds Hole (London, 1870); *Le Rosier*, J. Lachaume (Paris, 1874); *Hedging and Hedging Plants in the Southern States*, Thomas Afflick (Houston, 1869).) C. S. SARGENT.

Rose, tp., Shelby co., Ill., on Indianapolis and St. Louis R. R. P. 1494.

Rose, p.-v. and tp., Oakland co., Mich., on Flint and Père Marquette R. R. P. 1169.

Rose, tp., Ramsey co., Minn., on Mississippi River and St. Paul and Pacific R. R. P. 750.

Rose, p.-v. and tp., Wayne co., N. Y. P. 2056.

Rose, tp., Carroll co., O., on Tuscarawas branch R. R. P. 1106.

Rose, tp., Jefferson co., Pa., on Red Bank Creek, includes Brookville, the county seat. P. 1058.

Rose, tp. Waushara co., Wis. P. 397.

Ro'se (GUSTAV), b. at Berlin Mar. 28, 1798; took his degree of Ph. D. at Berlin 1820; studied with Berzelius; was connected with the University of Berlin as an instructor of mineralogy from 1823 till his death; in 1829 visited the Ural Mountains with Humboldt and Ehrenberg. D. at Berlin July 15, 1873. He published many papers on mineralogy, crystallography, and kindred subjects, mostly in Gilbert's and in Poggendorff's *Annalen*; also *Elemente d. Krystallographie* (1829; 2d ed. 1838), *Mineralogisch-geognost. Reise nach d. Ural, d. Altai u. d. Kaspischen Meere* (1837–42), *Das Krystallo-chemische Mineralsystem* (1852). C. F. CHANDLER.

Rose (HEINRICH), brother of Gustav, b. at Berlin Aug. 6, 1795. His grandfather, Valentin Rose, Sr., and his father, Valentin Rose, Jr., were distinguished chemists. He studied with Berzelius at Stockholm, and took his degree of Ph. D. at Kiel 1821. D. at Berlin Jan. 29, 1864. He devoted his attention chiefly to analytical chemistry, and contributed more than any other chemist to advance this branch of the science. His *Handbuch der analytischen Chemie* (Berlin, 1829) has run through many editions, and is still the standard authority. He published more than 200 papers on chemical subjects, mostly in *Schweigger's J.*, *Gilb. Ann.*, and *Pogg. Ann.* In 1851 he read before the Berlin Academy of Sciences his *Gedächtnisrede auf Berzelius*. He was an instructor in the University of Berlin, from 1822 till his death. C. F. CHANDLER.

Rose (HENRY JOHN), brother of Hugh James, b. in England in 1801; graduated at St. John's College, Cambridge, 1821; became fellow there 1824; took orders in the Church of England; was Hulsean lecturer 1833; became rector of Houghton Conquest 1837, and archdeacon of Bedford 1866. D. at Bedford Jan. 31, 1873. He became in 1839 editor of the *Encyclopædia Metropolitana*; commenced the publication of *Rose's Biographical Dictionary* (12 vols., 1839–47), projected by his brother; translated Neander's *History of the Christian Church* (1831); was one of the contributors to the *Replies to Essays and Reviews* (1861) and to the *Speaker's Commentary*; author of a volume of Hulsean lectures (1834) and of a *History of the Christian Church from 1700 to 1858*.

Rose (HUGH HENRY). See STRATHNAIRN.

Rose (HUGH JAMES), b. at Little Horsted, Surrey, England, in 1795; graduated at Trinity College, Cambridge, 1817; became curate of Uckfield 1818, vicar of Horsham 1821, select preacher to the University of Cambridge 1825; was Christian advocate at Cambridge 1829–33, professor of divinity in the University of Durham 1833–38, rector of Fairstead 1833–36, rector of St. Thomas's, Southwark, 1833–38, chaplain to the archbishop of Canterbury 1834–38, and principal of King's College, London, from 1836 to his death, which occurred at Florence, Italy, Dec. 22, 1838. Author of many sermons and theological treatises; founded the *British Magazine* 1832; became editor of the *Encyclopædia Metropolitana* 1836; was joint-editor (with Archdeacon W. R. Lyall) of the *Theological Library*, and projected *Rose's New General Biographical Dictionary*, a design carried into effect after his death by his brother, Henry John, and other writers.

Rose Aca'cia, the *Robinia hispida*, a beautiful ornamental shrub of the order Leguminosæ growing wild in the mountainous parts of the Southern States. It has large, very showy, inodorous flowers of a deep rose-color in drooping loose racemes. It is common in cultivation.

Rose-Apples. See EUGENIA.

Rose Blanche, a port of entry of Newfoundland, in the S. W. part, on the S. coast, 225 miles by water from St. John's. Fishing and mercantile interests are important. It is in a mountainous and barren region, but has ledges of beautiful granite. P. 452.

Rose'boom, p.-v. and tp., Otsego co., N. Y., 4 miles from Cherry Valley, has 2 churches, a cheese-factory, 1 grist and 2 saw mills, 1 hotel, a wagon-factory, and 1 planing-mill. P. 1589. HERBERT D. ELWELL, ED. "CAUSE."

Rose-Bug, the *Macrodactylus subspinosus*, a very common coleopterous insect of North America, belonging to the family Scarabeidæ. It is a small dusky-yellow beetle, very destructive, not only to the rose, but to other vegetation.

Rose'burg, p.-tp., cap. of Douglas co., Or., on Oregon and California R. R., has good schools, 1 daily and 2 weekly newspapers, 2 wagon-shops, 9 distilleries, 2 hotels, 1 mill, and a U. S. land-office. P. about 1000.
W. H. BYARS, ED. "PLAINDEALER."

Rose'crans (WILLIAM S.), b. in Kingston, O., Sept. 6, 1819; graduated at the U. S. Military Academy, and promoted brevet second lieutenant of engineers July 1, 1842. With the exception of four years (1843–47), when he was at West Point as assistant professor of engineering and of natural and experimental philosophy, he was engaged in the construction of fortifications until Apr. 1, 1854, when he resigned from the army and established himself in Cincinnati, O., as civil engineer and architect; was president of a coal company in Virginia 1855–57, and engaged

in the manufacture of kerosene oil in Cincinnati 1857–61. In the early days of the civil war, as volunteer aide to Gen. McClellan, then in command of the department of the Ohio, he served in organizing State troops; was appointed colonel and chief engineer of Ohio June 9, and colonel 23d Ohio Vols. June 10, 1861. He was now commissioned brigadier-general in the regular army, and in the West Virginia campaign commanded a brigade at Rich Mountain, July 11, and on the 21st July succeeded to command of the department of the Ohio, and of the department of West Virginia in Sept., 1861; appointed major-general of volunteers Mar., 1862; in May he commanded a division of the Army of the Mississippi at the siege of Corinth; succeeding to command of that army in June, he fought the battles of Iuka (Sept. 19) and Corinth (Oct. 3–4); transferred to the command of the Army of the Cumberland Oct. 27, the battle of MURFREESBORO' (which see) was fought Dec. 31, 1862–Jan. 3, 1863, where, as at Corinth, his own personal exertions did much to secure success after temporary reverse on the first day. Advancing on Tullahoma June 24, he occupied Bridgeport and Stevenson July 24; crossed the Cumberland Mountains, and Sept. 19–20 fought the battle of CHICKAMAUGA (which see), where, defeated and falling back on Chattanooga, he was relieved Oct. 30, 1863; was placed in command of the department of the Missouri Jan., 1864; repelled the invasion of Missouri by Price; was mustered out of the volunteer service in 1866; again resigned from the army 1867; was for a short time (1868–69) U. S. minister to Mexico, after which he became a resident of San Rafael, Cal., where he possesses a large tract of land, and was in Mexico 1871–73, engaged in an unsuccessful effort to negotiate the construction of a vast system of narrow-gauge railways.

Rose Creek, tp., Perry co., Ark. P. 241.

Rose'dale, v., Van Buren tp., Pulaski co., Ind., on Columbus Chicago and Indiana Central R. R. P. 88.

Rosedale, p.-v., cap. of Bolivar co., Miss.

Rose'field, p.-v. and tp., Peoria co., Ill., on Galesburg div. of Chicago Burlington and Quincy R. R. P. 1108.

Rose Grove, p.-v. and tp., Hamilton co., Ia. P. 68.

Rose Head, p.-v. and tp., Johnson co., Mo. P. 199; of tp. 1439.

Rose Hill, p.-v. and tp., Lee co., Va. P. 3023.

Roselli'ni (IPPOLITO), b. at Pisa Aug. 13, 1800; was appointed professor of Oriental languages at the university of his native city in 1824; joined Champollion in an examination of the Egyptian monuments in Italy 1824–26, and again in 1827 in an exploration of the monuments in Egypt itself. After his return from this journey he was made librarian of the University of Pisa, but resigned and devoted himself exclusively to the editing and publication of his great work, *I Monumenti dell' Egitto e della Nubia* (9 vols. 8vo, and 3 vols. fol. of plates, 1832–43). D. June 4, 1843.

Rose-Mallow. See HIBISCUS.

Rose'mary [Lat. *ros*, "dew," and *marinus*, "of the sea"], the *Rosmarinus officinalis*, a labiate evergreen shrub of Europe and Asia, having fragrant aromatic leaves which yield a pungent volatile oil, valued as a stimulant medicine, and sometimes used as an ingredient in perfumery, in hair-dressings, and in liniments. Off the Spanish coast the rosemary may sometimes be smelt for many leagues at sea. It affords excellent bee-pasture.

Rosemary, tp., Barnwell co., S. C. P. 618.

Rose'mond, p.-v. and tp., Christian co., Ind., on Indianapolis and St. Louis R. R. P. 1107.

Rose'mount, p.-v. and tp., Dakota co., Minn., on Milwaukee and St. Paul R. R. P. 681.

Ro'sen (FRIEDRICH AUGUST), PH. D., b. at Hanover, Germany, Sept. 2, 1805; educated at Göttingen, Leipsic, and Berlin; began in 1824 the study of Sanskrit with the aid of his father; returned to Berlin soon after and devoted himself entirely to that language, which Bopp had just begun to teach; published, on the occasion of taking his degree as doctor of philosophy in 1826, his *Corporis Radicum Sanscritarum Prolusio*, expanded in the following year into his useful work *Radices Sanscritæ* (Berlin, 1827), which contributed largely to extend and facilitate Sanskrit studies in Germany; studied Arabic and Persian; prepared for the press several large episodes of the *Shah Nameh*, and was about to visit the East with the position of attaché to the Prussian embassy at Constantinople (1829) when he was offered and accepted the professorship of Oriental languages in the University of London (now University College), then just established. After studying a few months at Paris, where he enjoyed the friendship of De Sacy and Remusat, Rosen entered upon his duties at London, where, though disappointed in the small number of students of comparative philology, he made himself very useful as a teacher of Hindustani, having mastered that language in a few months; but ultimately resigned that post and accepted the professorship of Sanskrit. Becoming honorary foreign secretary to the Royal Asiatic Society and secretary to the recently-established Oriental Translation Committee, he became intimate with H. T. Colebrooke, by whose advice he published the Arabic text (with English translation and notes) of Mohammed ben Musa's *Algebra* (1831); prepared for publication Ibn Khallikan's great *Biographical Dictionary*, and undertook a work (never completed) on *Indian Jurisprudence;* wrote all the articles on Oriental literature, and some of those on Eastern geography, in the earlier volumes of the *Penny Cyclopædia* (1833–37); revised the work on the Hindoos which appeared in the *Library of Entertaining Knowledge;* published in the *Journal of Education* able reviews of the philological works of Bopp and Pott; edited Sir Graves Houghton's *Dictionary, Bengali, Sanscrit, and English* (1833–34), and 2 vols. of his friend Colebrooke's *Miscellaneous Essays* (1837); maintained an active correspondence with the principal European philologists, and contributed advice or material assistance to nearly every important publication on Eastern history or philology during the last ten years of his life. Among so many important services he will be chiefly remembered as the first European scholar who undertook to edit the Vedas. Having early perceived the necessity of concentrating his attention upon that vast subject, of which he never lost sight, he published his *Rig-Vedæ Specimen* in 1830, and began in 1836 to print the Sanskrit text with a Latin translation and explanatory notes. He had not completed the first volume when he suddenly d. at London Sept. 12, 1837. The Oriental Translation Committee issued the work under the title *Rig Veda Sanhita Liber Primus, Sanscrite et Latine* (1838). His posthumous papers and collections were utilized by Prof. Lassen of Bonn. Rosen attained a distinguished position in English society, and was sincerely mourned for his eminent private virtues.—His brother GEORGE, b. at Detmold Sept. 24, 1821, is a distinguished Orientalist; has been dragoman to the Prussian embassy at Constantinople, consul at Jerusalem 1852–67, and at Belgrade, and has made valuable discoveries concerning the Caucasian group of languages. PORTER C. BLISS.

Ro'senau, town of Hungary, on the Sajo, has copper, lead, and iron mines and manufactures of stone and earthen ware and leather. P. 5053.

Ro'sendale, p.-v. and tp., Ulster co., N. Y., on Rondout Creek and Delaware and Hudson Canal. P. 3625.

Rosendale, p.-v. and tp., Fond du Lac co., Wis. P. 1298.

Rose-Noble, or **Gold Penny,** an ancient English gold coin, first current in the reign of Edward III., and last coined under Henry V. It bore a rose on one side, and was worth one noble—6*s*. 8*d*. sterling.

Ro'senkranz (JOHANN KARL FRIEDRICH), b. at Magdeburg Apr. 23, 1805; at the age of nineteen took up his residence in Berlin, pursuing his studies there, and making the acquaintance of many distinguished scholars and thinkers. He studied the doctrines of Schleiermacher, and afterward those of Hegel, being assisted by Von Henning and Hinrichs. He completed his university course at Halle, receiving the degree of doctor of philosophy in 1828. In 1833 he married and entered upon the duties of professor of philosophy at Königsberg, having now (1876) occupied for forty-three years the chair held for twenty-four years previously by the celebrated Herbart, and for thirty-four years by the still more celebrated Kant. Rosenkranz is the best living representative of the "centre" of the school of Hegel, and has done much valuable work in rearranging and reclassifying the several parts of the system. His chief works are a *History of German Poetry in the Middle Ages* (1830), a *Handbook of the General History of Poetry* (Halle, 1832), *Encyclopædia of Theological Sciences* (Halle, 1831), *Critique of Schleiermacher's Glaubenslehre* (Königsberg, 1836), *Psychology, or Science of Subjective Mind* (Königsberg, 1837), *Critical Explanations of Hegel's System* (1840), *History of Kant's Philosophy* (Leipsic, 1840), *Life of Hegel* (Berlin, 1844), *Modifications of Logic* (Leipsic, 1846), *Goethe and his Works* (Königsberg, 1847), *Pedagogics as a System* (Königsberg, 1848), *System of Science* (Königsberg, 1850), *Æsthetics of the Ugly* (Königsberg, 1853), *Science of the Logical Idea* (Königsberg, 1859), *On Vera's Translation of Hegel's Philosophy of Nature* (Berlin, 1868), *Hegel as the National Philosopher of Germany* (Leipsic, 1870), *From Magdeburg to Königsberg: Autobiography* (Leipsic, 1873), *New Studies*—vol. i. *The History of Culture;* vol. ii. *The History of Literature* (Leipsic, 1875). WILLIAM T. HARRIS.

Ro'senmüller (Ernst Friederich Karl), b. at Hessberg, near Hildburghausen, Germany, Dec. 10, 1768; studied theology at the University of Leipsic, where he became professor of Oriental languages in 1795. D. Sept. 17, 1835. His principal works are—*Scholia in Vetus Testamentum* (11 vols., 1788–1835), *Scholia in Vetus Testamentum in compendium redacta* (5 vols., 1828–35), *Handbuch der biblischen Alterthumskunde* (4 vols., 1823–31).

Rose of Jericho, or **Rose of the Virgin,** the *Anastatica Hierochuntica*, a cruciferous herb of the Levant and of Arabia. After flowering it dies, the branches incurve, so that the plant assumes a globular form, and becoming detached from the ground, is blown about by the winds. If it rests at last upon a moist place, it expands hygrometrically and sheds its seeds, which there germinate. This curious hygrometric property and this seeming abeyance of life are sometimes protracted for several years. It is fabled that the rose of Jericho first bloomed at the Nativity, and that it remains in flower from Christmas till Easter. Others say that it sprang up wherever the Virgin alighted during the journey to Egypt.

Rose of Sharon, the popular name of the *Hibiscus Syriacus*. (See Hibiscus.)

Rose'ola, a name rather loosely applied to a class of rather unimportant febrile diseases, sometimes contagious, and often simulating scarlatina or measles. Indeed, there is no doubt that mild cases of the two latter diseases are often mistaken for roseola, and severe roseola is not unfrequently taken for one of the more formidable diseases. The infantile disease called rose-rash is one of the roseolas.

Rose Quartz, a fine variety of quartz, sometimes crystallized, and usually translucent or transparent. It is colored of a pink, rose, or flesh tint. It is valued for ornamental work, and is often cut as a gem.

Roses, Attar of. See Attar of Roses.

Rose's Bar, tp., Yuba co., Cal. P. 1191.

Roses, War of the, the name given to the civil war lasting thirty years (1455–85) between the princes of the rival houses of York and Lancaster, each claiming the throne of England by right of descent from Edward III. The Lancastrian family occupied the throne on the death of Richard II. (1399) in the person of Henry IV., son of John of Gaunt, duke of Lancaster, third son of Edward III., to the exclusion of the true heir, Roger Mortimer, earl of March, grandson of Lionel, duke of Clarence, second son of Edward III. The princes of the house of York were fraternally descended from Edmund Langley, duke of York, fourth son of Edward III., but derived their claim to the throne from the marriage of Richard, son of Edmund Langley, to Anne Mortimer, heiress of the duke of Clarence; the contest might therefore with more propriety be described as one between the houses of Clarence and Lancaster. The name given to this war is said to have been derived from the badges worn on either side, and the respective colors may be remembered by the aid of the following stanza addressed to a lady:

"If this white rose offend thy sight,
It in thy bosom bear;
'Twill blush to find itself less white,
And turn *Lancastrian* there."

(See Edward IV., Henry VI. and VII., and Richard III.)

Rose Tree. See Rhododendron.

Roset'ta [Arab. *Rasheed*], a town of Egypt, on the delta of the Nile, on the western branch of the river, in lat. 31° 25′ N. and lon. 30° 28′ E. It was formerly an important commercial city, but has now greatly declined. Here was found the celebrated Rosetta Stone (which see). P. about 15,000.

Roset'ta Stone, a celebrated inscription found in 1799 at Rosetta by M. Boussard, a French officer of engineers, in digging the foundation of a house at Fort St. Julien. It appears to have been originally set up in the temple of Tum or Tomos. When complete it was a tablet of black basalt more than 3 feet 1 inch high, 2 feet 5 inches wide, and 10 inches thick. This tablet is of a trilingual character, and in its present broken condition has 14 lines of hieroglyphs, 32 of cursive Egyptian, the so-called demotic or enchorial writing, and 54 lines of Greek. It appears from the last that it was an act of the priests assembled in synod at Memphis b. c. 196–97 in honor of the King Ptolemy Epiphanes in the ninth year of his reign; and after reciting the events of the period—the birth of the king, the troubles in higher Egypt, the inundation of the Nile, the decease of Ptolemy Philopator, the attack of Antiochus, the suppression of rebellion, the remission of taxation, and the gifts to the bulls Apis and Mnevis and the sacred animals—proceeds to order that a figure of the king should be placed in the temples; that a shrine should be placed with a gilded figure of wood of the monarch in the adyta with the other shrines, and be carried in procession on a special festival in honor of the king on the 30th Mesori, his birthday; and, above all, that a copy of this synodical act should be engraved on a tablet of hard stone and set up in every temple of the first, second, and third rank throughout the country. About one-third of the hieroglyphic portion, and almost the whole of the demotic and Greek inscriptions, have been preserved. The stone at the capitulation of Alexandria was sent to England, and presented by George III. to the British Museum, and on its publication it was at once discovered to be the key to the decipherment of the hieroglyphs. In 1802, Silvestre de Sacy and Akerblad deciphered some of the names and words in the demotic or enchorial, and prepared the way for the subsequent discoveries in the hieroglyphic portion. In 1814, Young commenced the investigation, and in 1818 arrived at the conclusion that the cartouche or oval which contained the name of Ptolemy was composed of hieroglyphs used for *sounds*, not *ideas*, tracing the hieroglyphic name in a peculiar way through the demotic and hieratic, and deciphering on another document the name of Berenice. Subsequently, Champollion (in 1822) deciphered from the Rosetta Stone the name of Ptolemy, and that of Cleopatra from an obelisk removed from Philæ to England in 1822. It was but another step to discover from this inscription that the *phonetic* hieroglyphs, or those used for sounds, entered extensively into the other portions of the text. In the mean time, the principal Greek scholars, Porson, Villoison, and Letronne, had corrected, interpreted, or restored the Greek portion of the inscriptions. The other two versions are not literal translations, but paraphrases of the Greek, in which the original document appears to have been drafted; but it was not till many years after the first attempts that a complete translation of the hieroglyphic text was given by Brugsch-Bey in 1851, and Chabas in 1867, and the demotic text has not up to the present date been entirely translated. Considered as a key, the Rosetta Stone was at the time invaluable, but it has of late been surpassed by the discovery by Lepsius in 1866 of another trilingual inscription at San. This is a synodical decree passed by the priests at Canopus in the ninth year of Ptolemy Euergetes I. (b. c. 238), having 37 lines of hieroglyphs, 76 lines of Greek, and 72 of demotic writing, and is nearly complete, being in an excellent state of preservation. It completes the circle of hieroglyphical discovery, and proves the accuracy of the interpretations previously made. The Rosetta Stone had indeed been the key to the discovery of the meaning of many words, and gave the clue to the phonetic value of the hieroglyphs, and independent of its philological value is an inscription of great historical interest, and one of the most important of the Greek hitherto discovered. It was repeatedly published by the Society of Antiquaries of London, about 1802; by Brugsch-Bey, Lepsius, Young, Salvolini, and others either in part or entirely; while explanations of the hieroglyphical text have been given by M. Brugsch and M. Chabas, and of the demotic by M. Brugsch. Although it is to be regretted that the Rosetta Stone was found so incomplete, its defects are more than supplied by the subsequently discovered inscription of San or decree of Canopus, now in the museum of Boulag at Cairo.

S. Birch.

Rose'ville, p.-v., Franklin co., Ark. P. 92.

Roseville (P. O. name of junction), Placer co., Cal., on Central Pacific R. R., at the junction of Oregon division of the same road. P. 115.

Roseville, p.-v. and tp., Warren co., Ill., on Rockford Rock Island and St. Louis R. R. P. 1153.

Roseville, tp., Monongalia co., Minn. P. 322.

Roseville, p.-v., Clay tp., Muskingum co., O. P. 426.

Rose'wood. (1) The beautiful and fragrant wood of several leguminous Brazilian trees of the genera *Machærium* and *Triptolomea*, highly valued as a veneer for furniture, pianos, etc. (2) The almost equally beautiful wood of *Dalbergia latifolia*, an East Indian leguminous tree. (3) Canary Island rosewood, the fragrant woody root of *Rhodorhiza scoparia* and *florida*. It is a delightful incense, and its powder is mixed with snuff. From it is obtained the oil of rhodium, so much vaunted as a charm for horses and so highly prized by trappers. (4) Burmese and African rosewoods are the timber of species of *Pterocarpus*, leguminous trees.

Rosiclare', p.-v. and tp., Hardin co., Ill., on Ohio River. P. 533.

Rosicru'cians. In 1614 appeared at Cassel an anonymously published book, *Fama Fraternitatis des löblichen Ordens des Rosenkreuzes*, and next year another, *Confession oder Bekandtnuss der Societat und Bruderschaft R. C.*, in which the most wonderful stories were told of a certain

secret society, the Rosicrucians, founded in the fourteenth century, possessed of the deepest wisdom, and most potently at work for the weal of mankind. Concerning the founder of the society, Christian Rosenkreutz—his residence among the Arab and Egyptian magicians, his life in Spain and Germany as head of the new order, his death and burial—the most stirring revelations were made in a third book, *Chymische Hochzeit Christian Rosenkreutz'*, which appeared in 1616. These books made an enormous sensation. People rushed forward—some to become members of the society, others to fight against it. Some theologians considered it a means of salvation, others the organ of a foul scheme. Some physicians thought that it would give the fulfilment of the golden prophecies of Theophrastus Paracelsus concerning an elixir of life; others, that it was only an impudent opposition to Galen. The alchymists crowded around it, sure that it had found the philosopher's stone and could make gold. For several years the secret society of the Rosicrucians was the all-absorbing topic of the day. Nevertheless, there existed no such society. The whole affair was a mystification—by whom and for what purpose is uncertain. Some think that the books were written by Johann Valentin Andreä, and simply as a satire; others have other opinions and offer other explanations. But of the real existence of such a society there never was found the slightest trace. Soon, however, there arose a multitude of Rosicrucian societies, and at the end of the eighteenth century Cagliostro pretended to be a Rosicrucian.

Rosier (JAMES), b. probably at Winston, Norfolk, England, about 1575; graduated at Pembroke Hall, Cambridge, 1593; was engaged by Lord Arundel of Wardour to accompany Captain George Waymouth on his voyage to "Virginia," during which he explored the coast of Maine and Penobscot River, and published on his return *A True Relation of the most prosperous voyage made this present year 1605 by Captain George Waymouth, in the discovery of the land of Virginia, where he discovered sixty miles up a most excellent river; together with a most fertile land.* This rare tract, of which extracts were given by Purchas, was reprinted in the *Collections* of the Massachusetts Historical Society, 3d series, vol. viii.

Rosigna'no Maritti'mo, town of Italy, province of Pisa, situated on the summit of the Livornese Mountains, about 24 miles S. of the city of Pisa. The earliest historical record referring to this town is a Lombard document dated 762 A. D., and for many centuries Rosignano Marittimo formed a part of the territory of Pisa. There are medicinal springs of some reputation in this immediate neighborhood. P. 7000.

Ros'in [Lat. *resina*], or **Col'ophony,** the residue which is obtained by distilling off the water and volatile oil from the crude turpentine from pine trees. The yield is from 70 to 90 per cent. of the whole. (See TURPENTINE.) It is largely manufactured, together with oil of turpentine, at Wilmington, Newberne, and Beaufort, N. C. When entirely freed from water it is translucent. The color depends upon the purity of the original turpentine and the care taken to distil at a low temperature. Rosin was formerly supposed to consist of a mixture of isomeric acids—pinic, sylvic, pimaric, and colopholic ($H_2C_{20}H_{28}O_2$)—but the researches of Maly (*Am. Ch. Pharm.*, cxxix. 94; cxlx. 244; and clxi. 1151) show that it is composed chiefly of abietic acid ($H_2C_{44}H_{62}O_5$), with a small quantity of some other acid, probably of the composition $H_2C_{20}H_{28}O_2$. The conversion of oil of turpentine ($C_{10}H_{16}$) into rosin may occur according to the following equation:

$$5C_{10}H_{16} + O_{25} = H_2C_{44}H_{62}O_5 + 8H_2O + 6CO_2.$$

Colophony is pale yellow and transparent ("virgin rosin," *C. album*), or brownish-yellow and translucent (*C. commune*), according to the care taken in its preparation. It may be obtained nearly colorless by distillation with steam or some inert gas, as H, Co_2, or N, under a pressure of ten atmospheres at a temperature not higher than 600° F. (*Hunt and Pochin's English Patent*, 1858, No. 925.) It has a peculiar lustre, called *resinous*, is brittle when cold, and breaks with a conchoidal fracture; sp. gr. 1.07 to 1.08. It is insoluble in water, soluble in alcohol, ether, wood-spirit, and in fixed and volatile oils; partially soluble in petroleum. Nitric acid dissolves it, forming chiefly isophthalic acid, together with trimellitic acid and a resinous acid. (Schreder, *Deut. Chem. Ges. Ber.*, vi. 413.) It dissolves in caustic alkalies and alkaline carbonates. On adding sodic nitrate to the solution in caustic soda the sodic abietate ($Na_2C_{44}H_{62}O_5$) separates as a snow-white flocculent precipitate. From this various insoluble metallic salts are obtained by double decomposition. Colophony softens at 160° F., and melts at 275° F. At higher temperatures it gives off volatile oils, acquiring a dark color. By continuing the distillation it yields, besides CO, CO_2, a little ethylene, tetrylene, and marsh-gas, and about 74 per cent. of liquid distillate. The first portion of this distillate is a yellow, mobile, strong-smelling liquid, known as essence of rosin, and consists of colophonone ($C_{11}H_{18}O$) and an optically indifferent camphene ($C_{10}H_{16}$), boiling at 338° F. (See *Chem. News*, xx. 38, 39.) Later in the distillation a viscid fluorescent "rosin oil" ("pinolin") passes over. By treating this with quicklime a product is obtained having the composition $C_{30}H_{40}O$, and by rectifying this, and again treating with lime, an oil is obtained having the composition $C_{20}H_{28}O$, which is not fluorescent. (Schiel, *Ann. Ch. Pharm.*, cxv. 96.) By allowing melted rosin to flow into a red-hot retort it is converted into a very rich permanent "rosin-gas," which was at one time used for lighting cities. (See GAS-LIGHTING.)

Colophony is extensively used in making varnishes and cements, in the calking of ships, in the preparation of plasters and ointments, and as a reducing agent in the soldering of metals. Large quantities are consumed in the manufacture of yellow soap. A well-known use of it is for covering the bows of violins to prevent the bow from slipping over the strings without producing vibration. Before the introduction of petroleum, rosin oil was used to some extent for burning in lamps. The rosin spirit is sometimes used as a substitute for oil of turpentine. The viscid oil is used in paints, for the manufacture of printer's ink, in soapmaking, in cheap lubricators, etc.

C. F. CHANDLER.

Rosi'ni (GIOVANNI), b. at Lucignano, Tuscany, June 24, 1776; studied at Leghorn, Florence, and Pisa, where he became professor of Italian literature in 1803. D. May 16, 1855. His works comprise several dramas, 2 vols. of poems, historical romances, *Monaca di Monza* (1829), *Luisa Strozzi* (1833), *Ugolino* (1843), and a *Storia della pittura Italiana* (7 vols.).

Ros'kilde, town of Denmark, island of Sealand, on a hill on a branch of the Isefjord, and received its name, "Roar's Springs," from the numerous springs which burst forth from the sides of the hill. In the early Middle Ages it was a great city, the royal residence, with 100,000 inhabitants, 27 churches and monasteries, but conflagrations, the plague, and the growth of neighboring Copenhagen destroyed its prosperity. It contains a magnificent cathedral, built 1047–84, and containing many splendid monuments; the Danish kings are buried here. P. about 5000.

Ros'lyn, p.-v., North Hempstead tp., Queens co., N. Y. (L. I.), at the head of Hempstead harbor, and on Glen Cove branch of Long Island R. R., has daily communication with New York by steamer, and is largely occupied by the villas of wealthy citizens of that metropolis. Residence of William Cullen Bryant, who named the village and presented it with a public hall. P. 655.

Rosmar'idæ [*Rosmarus*, Latinized from the Norwegian name *rosmar*, "sea-horse"], a family of mammals belonging to the order Pinnipedia, containing the walruses and related to the families Phocidæ, or true seals, and Otariidæ, or eared seals. The form is peculiar, but resembles that of the Phocidæ more than that of the Otariidæ; the hinder legs are flexible forward; no external ears are developed; the skull is oblong and truncated in front; it has strong and salient mastoid processes, whose surfaces are continuous with the auditory bullæ; no post-orbital processes are developed; distinct alisphenoid canals exist; the dentition is very peculiar, the canine teeth of the upper jaw being enormously developed and specialized as tusks, while those of the lower jaw are atrophied; the incisors, except the external of the upper jaw, are early lost; the molar teeth are $\frac{4}{4} \times 2$, but the posterior are generally cast in the adult; the anterior limbs are about as large as the posterior; in the anterior feet the toes decrease in a curved line, and are destitute of claws; in the posterior feet the five digits scarcely increase toward the inner, and all are provided with claws; the skin is very thick. The family is represented by the WALRUSES or MORSES (which see), which are found only in the high northern seas. Two species appear to exist—one (*R. obesus*) inhabiting the northern Atlantic, and the other (*R. Cookii*) the northern Pacific. The species attain a large size, sometimes reaching, or even exceeding, twelve or thirteen feet in length, and their girth is nearly as great; they are, therefore, very obese, and consequently inefficient on land, but in water their movements are easy and not ungraceful. They swim entirely under water, rising only occasionally to breathe, when they blow somewhat like a whale. They feed chiefly upon shellfish—clams, mussels, etc.—but also on the bulbous roots of plants which grow in the lagoons and bays. It is chiefly by means of their tusks that they unearth the clams and drag them from their holes. In former times the eastern walrus extended much farther S. than at present, but now it is rarely found S. of Labrador. The Pacific walrus ap-

pears to have extended still less to the southward: it is, however, abundant on an island of the Prybilov group, which has been called therefrom "Walrus Island." (See MORSE.) THEODORE GILL.

Rosmi'ni (ANTONIO), ABBÉ, b. at Roveredo in 1797; at an early age devoted himself to philosophical studies, and in his first youth wrote an *Esame della Ragione* and a *Classificazione delle Scienze;* after these followed a *Lettera sul Cristiano Insegnamento*, the *Storia dell' Amore, Saggio sulla Felicità, L'Educazione Cristiana, Saggio sulla Providenza, Sull' Unita dell' Educazione, Galateo dei Letterati;* in 1827 formed a friendship with Manzoni, and in 1830 went to Rome to obtain the sanction of the pope to his Instituto dei Preti della Carità, an order founded by himself; in the same year published his principal work, *Nuovo Saggio sull' Origine delle Idee;* in 1834 returned to Roveredo as archdeacon, and there gave himself entirely to philosophy, producing the following works: *Ontologia, Aristotelismo, Pedagogica, Antropologia Sovranaturale,* and many other works, which in all form 30 volumes. The *Cinque Piaghe delle Chiesa, Il Progetto di Costituzione* are applications of his philosophical doctrines to politics. He carried on long polemical controversies with Gioberti and Mamiani. D. at Stresa in 1855.

Rosny', de (LÉON), b. at Loss, department of Le Nord, France, Aug. 5, 1837; studied Oriental languages, history, and geography at Paris; was attached as interpreter to the Japanese embassy which visited Europe in 1863, and became professor of Japanese at Paris in 1868. He published *Dictionnaire japonais-français-anglais* (1858), *Les Écritures figuratives et hiéroglyphiques des Différents Peuples, anciens et modernes* (1860), *Dictionnaire des Signes idéographiques de la Chine* (1864–67), *Études asiatiques de Géographie et d'Histoire* (1864), *Aperçu de la Langue coréenne* (1867).

Rosolic Acid, Coralline, Pseudo-Coralline, or **Aurine.** These names have been applied to red coloring-matters which have been supposed to be identical, but have been recently shown to be distinct. *Rosolic acid* was obtained by Runge in 1834 (*Pogg. Ann.*, xxi. 70) from coal-tar naphtha. He treated coal-tar naphtha with milk of lime, neutralized the solution with an acid, and thus obtained a mixture of phenol and rosolic and brunolic acids. This he distilled with water to remove phenol, obtaining a brown pitchy residue. This he dissolved in alcohol, and treated with milk of lime, obtaining a brown precipitate of calcic brunolate and a rose-colored solution of calcic rosolate. From this solution he precipitated, with the aid of acetic acid, the rosolic acid, containing some brunolic acid. This he continued to treat with alcohol, lime, and acetic as long as calcic brunolate could be separated, and then collected the rosolic acid on a filter, dried it, dissolved it in alcohol, and allowed the solution to evaporate to dryness, obtaining the new acid as a yellowish-red brittle resin. He says that this acid gives, with proper mordants, beautiful red lakes, and dyes fabrics. In 1859, Hugo Müller (*Q. J. Chem. Soc.*, xi. 1) found, on leaving a quantity of crude carbolate of lime in a warm drying chamber for several months, that it was converted into a red calcic rosolate. On boiling this with dilute ammonic carbonate, and evaporating the solution nearly to dryness, the crude rosolic acid separated as a dark resinous body. This he purified by Runge's method, treating the alcoholic solution with lime, filtering, diluting, distilling off the alcohol, and precipitating with acetic acid, repeating this several times. He finally dissolved in alcohol, added a minute quantity of hydrochloric acid, and poured it into a large quantity of water, thus obtaining the acid pure. Tschelnitz (*J. f. pr. Ch.*, lxxi. 416) mixes coal-tar naphtha with slaked lime, exposes the mixture to the air for several months, and then extracts the rosolic acid by Runge's method. R. A. Smith (*Chem. Gaz.*, 1858, 20) dissolves phenol in caustic soda, boils with MnO_2, and precipitates the rosolic acid with an acid. Jourdin (*Rép. Chim. app.*, iii. 217) substitutes HgO for MnO_2. He also obtains rosolic acid by heating phenol with $HgCl_2$. Caro (*Phil. Mag.* [4], xxxii. 126) finds that pure phenol or pure cresol does not yield a trace of rosolic acid with MnO_2, $HgSO_4$, As_2O_5, or iodine, but that some body like cresol, oxalic acid, etc., which contains carbon in the form in which it exists in the fatty series, must be present. A mixture of phenol (C_6H_6O) and cresol ($C_6H_5(CH_3)O$) always yields it with these reagents. Rosolic acid, previously boiled with water, appears as a dark greenish, amorphous substance, with the greenish metallic lustre of cantharides. Its powder is red, and assumes a bright gold-like lustre when rubbed or pressed with a hard body. Thin films are orange-red by transmitted, and metallic by reflected light. When precipitated from alcohol by water, it is a bright-red powder. At 170° F. it cakes together, and in boiling water melts. It is not volatile; dissolves readily in alcohol, ether, wood-naphtha, phenol, creosote, concentrated acetic, hydrochloric, and sulphuric acids. From all of these solvents, which are miscible with water, it is precipitated unchanged when it is added. It is insoluble in chloroform, benzol, bisulphide of carbon, essential and fixed oils. It is not decolorized by sulphurous acid. Its acid properties are very feeble; it is even weaker than carbonic acid. It forms dark-red compounds with ammonia, caustic alkalies, and caustic alkaline earths; soluble in alcohol and in water, with a magnificent red color. Carbonic acid decomposes them, and the prolonged action of air and light destroys the rosolic acid completely. The calcic compound, evaporated *in vacuo* over quicklime, leaves a red crystalline powder resembling carthamine. The magnesia salt is most stable. Rosolates give no precipitates (lakes) with salts of alumina or other oxides, nor with the acetate or basic acetate of lead; this is contrary to Runge. The composition of rosolic acid has not been fixed with certainty. Hugo Müller proposed $C_{23}H_{22}O_4$, R. A. Smith $C_{12}H_{12}O_3$, Dusart $C_6H_6O_2$.

	Müller's analysis.	$C_{23}H_{22}O_4$.	$C_{12}H_{12}O_3$.	C_6H6O_2.
Carbon	75.92	76.27	70.59	65.45
Hydrogen	5.83	6.05	5.88	5.45
Oxygen	18.25	17.68	23.53	29.10

Rosolic acid has been suggested as an indicator in Pettinkofer's process for determining carbonic acid and in nitrogen determinations with standard acid.

Coralline was first prepared by Persoz in 1859, by treating 3 parts of phenol, 2 of oxalic acid, and 2 of sulphuric acid for several hours. The mass effervesces, becomes thick, and acquires a deep-red color. The process is terminated when a drop of the mixture is found to dissolve in dilute ammonia with a deep-red color. The mixture is then poured into hot water. A resinous mass, with the lustre of cantharides, separates. The whole is boiled till the unchanged phenol is expelled. On cooling, orange-red flocks separate from the liquid; these with the resinous mass are separated and washed. Persoz's process was not published till after Kolbe and Schmitt in 1861 announced their discovery of a similar process. They use 3 parts of phenol, 2 of oxalic acid, and 4 of sulphuric acid, and heat to 285°–300° F. four to six hours, in a vessel furnished with a cohobator. The product is treated as in Persoz's process. Fresenius (*J. f. pr. Ch.*, v. 184) purifies coralline by rubbing it with calcined magnesia, extracting with boiling water, and adding to the solution ammonic chloride, by which a brilliant crimson precipitate is obtained. By three or four repetitions of the process the product is obtained pure. The magnesia compound is finally decomposed by hydrochloric acid, and crystallized from alcohol or glacial acetic acid. The sulphuric acid acts merely as a dehydrant, and may be replaced, though not with advantage, by B_2O_3, As_2O_3, or As_2O_5. Fresenius deduces the formula $C_{40}H_{38}O_{11}$, but Kolbe suggests that it is formylated phenol ($C_6H_4(COH)OH = C_7H_6O_2$), produced by the action of carbonic acid on phenol, thus:

$$(\underset{\text{Phenol.}}{C_6H_5OH} + CO = \underset{\text{Coralline.}}{C_6H_4(COH)OH}).$$

	Analysis.	$C_{40}H_{38}O_{11}$.	$C_7H_6O_2$.
Carbon	69.07	69.16	68.85
Hydrogen	5.38	5.48	4.92
Oxygen	25.55	25.36	26.23

Coralline, as purified by Fresenius, crystallizes from alcohol in long, slender, lustrous scarlet needles—from glacial acetic acid, in dark-red rhombic prisms; trimetric. It melts at 313° F., is slightly soluble in cold water, more so in boiling water; is soluble in alcohol, ether, acetic acid, phenol, boiling chloroform, or benzol; insoluble in carbon bisulphide. Alkalies, alkaline earths, or their carbonates, added to water, cause it to dissolve to a beautiful purple-red solution. When ferricyanide of potassium is added to an alkaline solution of the pure coralline, no change occurs; if it be impure, it is darkened. Coralline gives fine red shades in dyeing, which are easily modified by the use of proper reagents. The liability to change renders it somewhat difficult to fix. It may be printed with albumen or lacturine: 8 ounces of coralline solution, 2 pounds of lacturine in 7 pints of water at 80° F., and 1 pint of ammonia give good results. After printing the pieces must be steamed twenty minutes. The calcic carbonate lake of coralline is largely used by paper-stainers.

Red Coralline, Pæonine, or *Pœonine* (J. Persoz, 1859) is obtained by heating 9 parts of crude coralline with 22 parts of concentrated ammonia to 270° F. for three hours in a strong iron vessel. A thick solution with a golden-crimson reflection is obtained, from which acids precipitate the new dye as a deep-red powder, the composition of which is not determined. It is probably an amide or imide of

coralline. It is almost insoluble in water, soluble in alcohol (red), and in alkalies (red, turning brown in the air). Pæonine is much used for dyeing wool, although it has the disadvantage of being changed to yellow by acids. This can be prevented by the use of magnesia, dissolving the dye in alcohol. It produces a rich Turkey red, the intensity of which is retained for years, at a cost of two-thirds that of cochineal, and possesses the advantage of not turning blue on washing in water containing bicarbonate of lime. A bath for dyeing may be prepared by dissolving the dye in alcohol, adding a little caustic soda, pouring into it a large quantity of lukewarm water, and nearly neutralizing with tartaric acid. The goods are worked for one and a half hours. Cotton must be mordanted with tin and sumac or galls. The color obtained is between that of cochineal and magenta. It resists washing, but is affected by soap and by exposure to sunlight. For printing, use a mixture of 320 grammes pæonine in 1 litre of water, 250 gms. glycerine, 560 gms. magnesia in 1 litre of water, and 3 litres gum-water (500 gum per litre). Print, steam, and wash. For printing on cotton use a mixture of the color with starch or albumen and magnesia. To print an orange-red, prepare a lake by dissolving 2000 gms. of pæonine in caustic soda (10° B.) dilute, precipitate with stannic chloride, and heat the mixture. Mix this lake with 100 gms. of magnesia, 260 of oxalic acid, 2000 of gum, and 10 litres of water.

Azuline, or *Phenyl Blue*.—This compound, the first blue obtained from aniline, was discovered by J. Persoz. It was prepared by heating 5 parts of pæonine and 8 parts of aniline for several hours at 356° F. The product is washed with dilute HCl to remove aniline, then with coal-tar naphtha, and finally with dilute caustic soda. It appears as a violet powder with a golden iridescence, is insoluble in water, soluble in alcohol. It is said by Willm to be $C_{12}H_{12}NO_2 = NH_2(C_8H_5O)_2$. It is not now manufactured, having been displaced by triphenyl-rosaniline, etc. (See ANILINE COLORS.)

Aurine, or *Yellow Coralline*, is prepared by heating phenol(commercial), oxalic acid, and sulphuric acid for a long time at 230° F. The product is poured into water, the unchanged phenol distilled off by a current of steam, the aurine dissolved in caustic soda, and reprecipitated. It constitutes a brittle, resinous body, with a beetle-green lustre, and yields a red powder. It may be purified (see Dale and Schorlemmer on aurine in *Am. Chemist*, iv. 142) by adding alcoholic ammonia to a cold concentrated alcoholic solution of crude aurine. A crystalline compound of aurine with ammonia separates out. This is washed with alcohol, and dried, when it appears as a dark-red crystalline powder with a bluish lustre. It loses its ammonia completely on long exposure to the air. By boiling it with dilute acetic, or HCl, it is obtained as a brownish-red crystalline powder with a green lustre. It must be purified by repeated crystallization from strong acetic acid. The crystals obstinately retain acetic and hydrochloric acid. Instead of extracting aurine from the commercial aurine, which is made from phenol containing cresol, it may be made directly from pure crystallized phenol by heating it with oxalic acid five or six days at 230° F., pouring into water, dissolving the precipitate in caustic soda, precipitating with HCl, and crystallizing from alcohol. The crystals are needles or prisms, trimetric, with a greenish-blue lustre; they contain:

	Analysis.	$C_{20}H_{14}O_3$.	$C_{21}H_{16}O_3$.
Carbon	79.73	79.47	79.75
Hydrogen	5.16	4.63	5.06
Oxygen	15.11	15.90	15.19

$C_{20}H_{14}O_3$ is the more probable formula. The formation of aurine is thus explained:

$$\underset{\text{Phenol.}}{3(C_6H_6O)} + 2CO = \underset{\text{Aurine.}}{C_{20}H_{14}O_3} + 2H_2O.$$

Pure aurine does not melt at 428° F.; the crystals assume a darker color, which disappears on cooling, with no apparent change in the substance. At a higher temperature aurine melts, emits an odor of phenol, and solidifies on cooling to an amorphous bottle-green mass. It dissolves in alkalies with a magenta-red color, and is precipitated by acids as a crystalline powder. When sulphur dioxide (SO_2) is passed into a hot concentrated alcoholic solution of aurine, the dark yellowish-red solution assumes a lighter color, and on cooling a compound separates out in brick-red crystalline crusts, or in garnet-red crystals with a bottle-green lustre, containing $C_{20}H_{14}O_3.2SO_2 + 5\frac{1}{2}H_2O$. By adding potassic bisulphite to a solution of aurine, an aurine-potassic-bisulphite was obtained: $C_{20}H_{14}O_3.KHSO_3$. Similar sodium and ammonium compounds can be obtained. On treating aurine with zinc-dust, phenol is obtained. If zinc-dust is added to a hot alkaline solution, it becomes colorless, and hydrochloric acid precipitates a colorless body called *leucaurine* ($C_{20}H_{16}O_3$). Other reducing agents produce the same result. Leucaurine dissolves in alkalies and in acetic acid, and crystallizes readily from the latter. Alkaline solutions absorb oxygen from the air and become red on the addition of ferricyanide of potassium. Leucaurine contains three hydroxyls (OH), the hydrogen of which can be easily replaced by acid radicals. Triacetyl-leucaurine is $C_{20}H_{13}(C_2H_3O)_3O_3$. Aurine yields fine orange shades on wool by printing a lake, prepared by dissolving five pounds of aurine in 2 gallons of caustic soda (10° B.), heating to 140 F., diluting to 20 gallons, and precipitating with $1\frac{1}{4}$ pints of stannic chloride (55° B.), diluted with 1 gallon of water. The lake is drained till it measures 4 gallons. Mix aurine lake, wet, 2 gallons, with powdered gum 4 pounds, oxalic acid 11 ounces, and heat till the gum and acid are dissolved. Print as usual. An orange-red may be obtained by dissolving aurine in dilute ammonia till the solution marks 32° Twd.; mix with 4 pounds of starch paste (14 pounds to the gallon). Print, dry, and steam one hour. With the aid of aniline red, aurine yields good scarlets. A blue color may be obtained from aurine similar to azuline. When aurine is gently boiled with aniline and a little acetic acid, the solution soon assumes a pure blue color. On boiling the product with dilute hydrochloric acid, in order to remove an excess of aniline, a blue resinous substance is obtained, consisting of a mixture of different bodies, which are partly soluble in alcohol and acetic acid, and partly insoluble in them. By heating the above mixture on a water-bath, a blue solution is formed in sixteen to twenty hours, which, however, also contains several bodies. A portion of the product is readily soluble in caustic soda, with a purple color, and precipitated by acid from this solution in blue flakes, which dissolve in alcohol and acetic acid. The portion which is insoluble in alkalies dissolves completely in acetic acid and alcohol, with a fine blue color, but ether takes up only a part of it, forming a dark-red solution, which on evaporation leaves a blue resinous body behind. The portion not dissolving in ether forms a dark-blue powder with a golden reflection.

Pseudo-Coralline.—Caro and Wanklyn in 1866 (*Chem. News*, xiv. 37) obtained a substance from rosaniline which they supposed to be rosolic acid. Fresenius has shown (*J. f. pr. Ch.* [2], v. 184–206) that it is a distinct compound, and has proposed for it the name of "pseudo-coralline." It is prepared by dissolving aniline red in hydrochloric acid, so as to have 3 equivalents of HCl for 1 of the base. On adding potassic nitrate, and boiling as long as nitric oxide is evolved, the rosaniline is converted into azorosaniline. On adding dilute hydrochloric acid in excess, and boiling, nitrogen is evolved, and red flocks separate, which melt together to a brown resinous mass with a golden lustre. Fresenius obtained this body in crystals, and found it to be $C_{26}H_{28}O_{10}$. It differs from coralline in not being decolorized by acid sodic sulphite. It melts at about 316° F. When boiled with aniline and a little benzoic acid, it forms a splendid and very permanent blue dye.

Poisonous Properties of Woollens dyed with Coralline, etc.—Much has been written on this subject, but it appears that the irritation of the skin, etc. which results from wearing red and scarlet flannel dyed with these colors is due not to the coralline, but to the picric acid, phenol, etc., which are often associated with them. Washing removes those substances. (See Guyot, *Comptes Rendus*, Aug. 6, 1869.)

C. F. CHANDLER.

Rosoli'ni, town of Sicily, province of Syracuse, on a hill near the left bank of the torrent Sido, about 10 miles S. W. of Noto. The adjacent country is highly fertile, and, besides the more common products of the island, tobacco and cotton are grown in considerable quantities. P. 6400.

Ross, county of Scotland. See ROSS AND CROMARTY.

Ross, county of S. Ohio, on Scioto River and Paint Creek, intersected by Marietta and Cincinnati R. R. and by Ohio and Erie Canal, has a surface partly level, partly hilly, with fertile soil in the bottom-lands of the valleys. Staples, Indian corn (over 2,000,000 bushels), wheat, butter, and wool. Cattle, sheep, and swine abound. Manufactories of carriages, leather, and saddlery are numerous, and there are several flour and woollen mills. Cap. Chillicothe. Area, 650 sq. m. P. 37,097.

Ross, tp., Edgar co., Ill. P. 731.

Ross, tp., Vermilion co., Ill. P. 1738.

Ross, tp., Clinton co., Ind. P. 1741.

Ross, p.-v. and tp., Lake co., Ind. P. 1625.

Ross, tp., Fremont co., Ia. P. 1314.

Ross, tp., Taylor co., Ia. P. 531.

Ross, tp., Cherokee co., Kan. P. 449.

Ross, tp., Kalamazoo co., Mich. P. 1397.

Ross, p.-v. and tp., Butler co., O., on Great Miami River. P. 1705.

Ross, tp., Greene co., O. P. 1076.

Ross, tp., Jefferson co., O. P. 685.

Ross, tp., Allegheny co., Pa. P. 1623.

Ross, tp., Luzerne co., Pa. P. 990.

Ross, tp., Monroe co., Pa. P. 734.

Ross (Alexander), b. in the parish of Kincardine-O'Neil, Aberdeenshire, Scotland, Apr. 13, 1699; graduated at Marischal College, Aberdeen, about 1716; engaged in teaching, and became in 1732 parish schoolmaster at Lochlee, Forfarshire (or Angus), which humble occupation he followed more than fifty years, until his death at that place May 20, 1784. He wrote verses from his childhood, but was sixty-nine years of age when he first appeared as an author, through the advice of Dr. Beattie, by the publication of *Helenore, or the Fortunate Shepherdess, a Pastoral Tale in the Scottish Dialect, to which are added a few Songs by the Author* (Aberdeen, 1768), a poem which in the N. of Scotland has rivalled in popularity the writings of Burns and Allan Ramsay, and passed through numerous editions, some being on cheap coarse paper. Ross left in MS. 8 vols. of miscellanies, of which an account is given in the new *Life* prefixed to the best edition of *Helenore* (1866), edited by John Longmuir, LL.D. (See also A. Campbell's *Introduction to the History of Poetry in Scotland*, 1799.)

Ross (Alexander), b. in Scotland in 1742; entered the British army as ensign of the 50th Foot Feb., 1760; distinguished himself in the campaigns in Germany; came to America as captain May, 1775; was engaged in the principal battles of the Revolutionary war; became brevet major 1781; was aide-de-camp to Lord Cornwallis and commissioner on his part to arrange the details of the surrender at Yorktown; was subsequently deputy adjutant-general in Scotland; accompanied Lord Cornwallis to India as adjutant-general; became governor of Fort George, Madras, and was distinguished in all the campaigns during the administration of that nobleman, to whom he was closely attached, and became general Jan. 1, 1812. D. at London Nov. 29, 1827.—His son, Charles Ross, edited from family papers the *Correspondence of Charles, First Marquis Cornwallis, with Notes*, etc. (3 vols., 1859), a work which throws much light on the history of America and India during eventful periods.

Ross (Alexander), b. in Scotland early in the nineteenth century; was for fifteen years a resident in the territories of the Hudson's Bay Company. Author of *Adventures of the First Settlers on the Oregon or Columbia River, being a Narrative of the Expedition fitted out by John Jacob Astor to establish the Pacific Fur Company* (London, 1849), *The Fur-Hunters of the Far West, a Narrative of Adventures in the Oregon and Rocky Mountains* (London, 2 vols., 1855), and *The Red River Settlement, its Rise, Progress, and Present State* (1856).

Ross (Alexander Milton), M. D., b. at Belleville, Ontario, Dec. 13, 1832; studied and practised medicine; collected specimens of all the birds of Canada; made an entomological collection of 10,000 species, and a botanical one of similar extent, and is author of *Birds of Canada* (1871) and *Butterflies and Moths of Canada* (1872).

Ross (George), b. at New Castle, Del., in 1730; settled at Lancaster, Pa., as a lawyer 1751; sat in the Pennsylvania assembly 1768–76; was elected a member of the first Continental Congress 1774; signed the Declaration of Independence; resigned his seat Jan. 1, 1777; was afterward commissioner to treat with the Indian tribes, and judge of the court of admiralty. D. at Lancaster in July, 1779.

Ross (James), b. in York co., Pa., July 12, 1762; was admitted to the bar in Philadelphia 1784; was prominent in the State constitutional convention of 1790 as a defender of the lately-formed national Constitution and a leader of the Federalists; was U. S. Senator 1794–1803, and a commissioner from Congress to negotiate with the whisky insurgents. During one session he was president *pro tem.* of the U. S. Senate. D. near Pittsburg Nov. 27, 1847.

Ross (James), an excellent teacher of Greek and Latin, whose early history is unknown; was at the head of schools at Chambersburg, Pa., 1796–1801, subsequently at Lancaster and at Philadelphia, and became professor of classical languages at Dickinson College, Carlisle, Pa. Author of a *Latin Grammar*, published at Chambersburg 1796, at Lancaster 1802, and in several later editions at Philadelphia, revised and enlarged by N. C. Brooks; of a *Greek Grammar* (1813; 2d ed. 1817) in Latin, founded on the Westminster grammar; of editions of the *Colloquies of Erasmus* (1818), *Æsop's Fables, Selectæ e Profanis Scriptoribus Historiæ*, and *Ciceronis Epistolæ;* wrote Latin poems in newspapers, and translated the Presbyterian *Shorter Catechism* into Latin.

Ross (Sir James Clark), b. in London Apr. 15, 1800, nephew of Sir John; entered the navy in 1812, and accompanied his uncle on his first voyage in search of a N. W. passage, and was also with Capt. Parry (1819–27) in the latter's several expeditions having the same object in view, being on one occasion wrecked in the Fury; in 1827 was appointed commander, and in 1829 again sailed with his uncle as second in command, and was absent four years (see Ross, Sir John), during which time he discovered a spot which he believed to be the northern magnetic pole. Promoted to be post-captain on his return, he was engaged in a magnetic survey of Great Britain and Ireland 1835–38; in Apr., 1839, was appointed to the command of the Erebus, and in September of that year, in company with the Terror, sailed for the Antarctic seas for the purposes of magnetic and meteorological observations and investigations, reaching lat. 78° 10′ S. A volcano was discovered in lat. 77° 32′ S., 12,000 feet in height, which was named Mount Erebus, besides which much valuable knowledge was gained of that region. In 1844 the honor of knighthood was conferred upon him, and in 1847 he published *A Narrative of a Voyage in the Antarctic Regions.* He was a fellow of the Linnæan Society, of the Royal Society, of the Royal Astronomical and Geographical societies, and of many foreign scientific bodies. The founder's gold medal of the London Geographical Society was bestowed upon him in 1841, and the gold medal of the Royal Geographical Society in 1842. D. at Aston Abbots House, near Aylesbury, Apr. 30, 1862.

Ross (Sir John), K. C. B., b. at Balsarroch, Wigtonshire, Scotland, June 24, 1777; entered the navy in 1786, midshipman 1799, lieutenant 1805, and in 1806 was wounded four times under the batteries of Bilbao, receiving a pension of £150 per annum; promoted to be commander in 1812, he rendered valuable services in the war of 1812–15; in Jan., 1818, received his commission as commander of the Isabella, and Apr. 25, in company with the Alexander, Lieut. Parry, sailed from London "to ascertain the existence or non-existence of a N. W. passage," returning in Nov., 1818 (see Polar Research); in May, 1829, again sailed in the steamer Victory, equipped by Sir Felix Booth, then sheriff of London, but in Sept., 1830, became ice-bound in the Gulf of Boothia, making but little subsequent advance, and May 29, 1832, the Victory was abandoned. In Aug., 1833, the party was rescued by the Isabella, formerly commanded by Capt. Ross, but then engaged in the whaling business. Arriving in London Sept. 19, 1833, he was knighted the following year, and admitted to the companionship of the Bath. From 1839 to 1845 he was consul at Stockholm; in 1850 departed, in command of the Felix, 90 tons, in search of Sir John Franklin, returning the following year; in July, 1851, attained the rank of rear-admiral. D. at London Aug. 30, 1856. He published (1819) *A Voyage of Discovery, made under the Orders of the Admiralty for the purpose of exploring Baffin's Bay, and inquiring into the probability of a N. W. Passage*, and in 1835 a *Narrative of a Second Voyage, including the Reports of Commander James Clark Ross, and the Discovery of the Northern Magnetic Pole;* also published a treatise on steam navigation and numerous other papers.

Ross (John), a Cherokee chief, b. in Georgia about 1790, was a half-breed; received a good English education; became principal chief of his tribe 1828; successfully conducted an appeal to the U. S. Supreme Court upon the validity of Cherokee land-titles in Georgia as against the government of that State; protested energetically against the treaty of New Echota 1835, but was compelled to remove to the Indian Territory; and was a reluctant ally of the Confederate States during the civil war. D. at Washington, D. C., Aug. 1, 1866. Political questions originating in the sale of the Georgia lands have for many years divided the Cherokees into two parties, between which bitter enmity exists, frequently culminating in a kind of vendetta or blood-feud. One of the factions has always been known as the "Ross party," and is now headed by William P. Ross (son of John), who in Feb., 1876, was nominated by Pres. Grant U. S. agent to the confederated tribes of the Indian Territory.

Ross (Robert), b. at Ross Trevor, Devonshire, England, about 1770; graduated at Trinity College, Dublin; was an officer of the British army in Holland and Egypt; commanded a brigade under Wellington in the Peninsula; headed the British forces which gained the battle of Bladensburg and burned the city of Washington, D. C., Aug. 24, 1814, and was killed at North Point, Md., Sept. 12, 1814.

Ross (Sir William Charles), R. A., b. in London, England, June 3, 1794, son of a miniature-painter and teacher of drawing, from whom he received an early artistic training; was admitted a student at the Royal Academy

at the age of ten; gained a prize from the Society of Arts at the age of thirteen; had equal good fortune for the four years following, and again, in 1817, became an assistant to Andrew Robertson, an eminent miniature-painter, and ultimately stood at the head of that profession; was appointed miniature-painter to Queen Victoria on her accession to the throne 1837; was knighted 1842; was patronized by all the court circle, and occasionally executed historical and imaginative pieces, having obtained a premium of £100 in the great "cartoon competition" for his *Angel Raphael discoursing with Adam* (1842). D. unmarried at London Jan. 20, 1860.

Ross and Crom'arty, county of Northern Scotland, bordering on the German Ocean, comprises an area of 3157 sq. m., with 80,909 inhabitants. The surface is wild and mountainous, but the soil affords good pastures, on which large herds of sheep and cattle are fed; agriculture and fishing are carried on. Chief town, Dingwall.

Rossa'no, town of Southern Italy, province of Cosenza, on a hill near the Gulf of Taranto, which it overlooks. Fish are abundant, and silk and cotton are raised in the vicinity, as well as grain, olives, grapes, etc. The town, still walled and defended by a castle, was once a very strong fortress. Belisarius placed a large garrison here, but the place was a theatre of much bloodshed during the Lower Empire. It is now the seat of an archbishop. P. of commune, 15,000.

Ross'bach, village of Prussia, province of Saxony, celebrated for the brilliant victory which Frederick the Great gained here over the allied French and Austrian armies, Nov. 5, 1757.

Rosse (William Parsons), third Earl of, b. at York June 17, 1800; studied first at Trinity College, Dublin, and then at Magdalen College, Oxford, where he graduated in 1822; sat in the House of Commons as Lord Oxmantown, representing King's county from 1821 to 1831; succeeded to the peerage in 1841, and was elected a representative peer of Ireland in 1845 and chancellor of the University of Dublin in 1862. He took an active part in different social and political movements, and wrote *Letters on the State of Ireland* (1847) and *A Few Words on the Relation of Landlord and Tenant in Ireland* (1866). But it was principally by his scientific researches and discoveries that he made his name famous. From an early age he studied astronomy and optics with great interest, and concentrated his attention more especially on the improvement of the telescope. For several years he was engaged in experiments referring to the construction of fluid lenses, the results of which researches are communicated in the *Philosophical Transactions* (1840); but although he failed in this particular object, he succeeded at last, after a long series of experiments, in constructing a speculum of a reflecting telescope in which the spherical aberration and the absorption of light were reduced to a minimum, at the same time that his process of construction did away with that cracking and warping of the surface of the speculum while cooling after the casting which so often had proved fatal under the old method of operation. In 1842 a monster telescope was successfully constructed on his plan, and mounted at his residence near Parsonstown, and in 1845 no less than 40 nebulæ were reduced by the aid of this powerful instrument into groups of stars, and it became probable that all nebulæ would become reducible in the same manner. D. Nov. 1, 1867.

Rosseau, p.-v., Union tp., Morgan co., O. P. 49.

Rosser (Leonidas), D. D., b. at Petersburg, Va., July 31, 1815; graduated at the Wesleyan University in 1838, and began his ministry in the Virginia M. E. conference, 1841. Author of *Baptism, Experimental Religion, Recognition in Heaven, Reply to Howell's Evils of Infant Baptism, Class-Meetings*, and *Open Communion*. Abel Stevens.

Ross'erville, tp., Sumter co., Ala. P. 1154.

Rosset'ti (Christina Gabriella), sister of D. G. Rossetti, b. in London, England, Dec., 1830; has acquired some popularity as a poetess, having published *Goblin Market* (1862), *The Prince's Progress* (1866), *Commonplace and other Short Stories in Prose* (1870), *Sing-Song, a Nursery Rhymebook* (1872), *Speaking Likenesses*, and *Annus Domini* (1874).

Rossetti (Dante Gabriel), son of Gabriele, b. in London, England, in 1828; educated at King's College, London; early manifested an inclination to art, of which he became an earnest student; was led by the writings of Ruskin and the example of Turner to found, in connection with Holman Hunt, Millais, Madox Brown, and other personal friends, what is known as the "Pre-Raphaelite" school of painting, of which his *Girlhood of the Virgin* (1849) was one of the earliest specimens; has become widely known through his designs for illustrated works, beginning with Tennyson's poems (1848), and has won

approval as a poet by his *Early Italian Poets* (1861), containing translations from Dante and his predecessors; *Dante and his Circle* (1874), a revised edition of the preceding; and a volume of *Poems* (1870). Like his brother William, he is closely connected with Swinburne and Morris as a member of an influential literary circle of poets of the romantic school.

Rossetti (Gabriele), b. at Vasto Mar. 1, 1783; began very young to improvise and to cultivate drawing; in 1804 went to Naples to study painting, and was there employed in the museum; there also began to write *libretti*, sonnets, songs, and musical airs, still continuing to improvise; under Murat was appointed keeper of the Royal Museum; during the political agitations of 1820 distinguished himself as a writer of patriotic songs, and composed the hymn which, commencing with the words, "Sei pur bello con gli astri sul crine," flashed like a meteor through the whole Peninsula. The reaction triumphing, Rossetti hid himself in Naples for three months, until, disguised as a British naval officer, he found refuge on board an English vessel, and thus escaped (1822) to Malta; thence in 1824 went to England; gave Italian lessons, commented upon the *Divina Commedia*, and continued to write poetry; in 1831 was appointed professor of the Italian language and literature in King's College; in 1840 published in 5 vols. *Il Mistero dell' Amor Platonico Svelato;* in 1852 a commentary in 3 vols. on *La Beatrice di Dante.* Several volumes of his poems have appeared under different titles—*Il Salterio, L'Arpa Evangelica*, etc. D. at London Apr. 26, 1854.

Rossetti (Maria Francesca), sister of Christina, b. in London Feb. 17, 1827; was for many years a teacher of languages and history. Authoress of *Idiomatic Italian Exercises* (1867) and *A Shadow of Dante, being an Essay toward studying Himself, his World, and his Pilgrimage* (1871).

Rossetti (William Michael), brother of D. G. Rossetti, b. in London about 1832; known as a poet and art-critic; author of *Dante's Comedy—The Hell, translated into Literal Blank Verse, with Introduction and Notes* (1865), *A Life of Percy Bysshe Shelley, with a Revised Edition of his Poetical Works* (2 vols., 1869), *Poems and Ballads, a Criticism* (upon A. C. Swinburne, 1866), and editor of Walt Whitman's *Poems* (1868).

Ros'si (Ernest), b. at Leghorn in 1829; began to study law at Pisa, but joined in 1846 one of the better Italian troops of actors; played at Milan 1847, at Turin 1852, at Paris, with Madame Ristori, 1855, subsequently at Vienna, especially in the comedies of Goldoni; returned to Paris in 1866; appeared in the *Cid* at the Théâtre Français on the anniversary of the birthday of Corneille; performed several of the principal characters of Shakspeare—Hamlet, Othello, etc.—in Lisbon in 1869, and visited afterward other of the European capitals. He has also written several plays.

Rossi (John Charles Felix), R. A., b. at Nottingham, England, in 1762, son of an Italian physician; was apprenticed in boyhood to a sculptor named Luccatella, with whom he subsequently worked as a journeyman; went to London while still a youth and entered as a student at the Royal Academy; obtained the silver medal of that institution 1781, and the gold one 1784, the latter entitling him to three years' maintenance at Rome, where he studied 1785–88; returning thereafter to London, became A. R. A. 1800, and R. A. 1802; became sculptor to the prince-regent and afterward to William IV.; was employed in decorating Buckingham Palace, and obtained both in classical and monumental sculpture a considerable popularity, which, however, declined toward the close of his career. D. at London Feb. 21, 1839. His best-known works are the monuments of Lords Heathfield, Cornwallis, and Rodney in St. Paul's cathedral, a statue of Thomson the poet, and the figure of *Britannia* at the Liverpool Exchange.

Rossi (Pellegrino), Count, b. at Carrara, grand duchy of Modena, July 13, 1787; studied law, and was appointed professor of jurisprudence at the University of Bologna in 1812, but left Italy in 1815 after the downfall of the French authority, and settled at Geneva, where in 1820 he became professor of jurisprudence, member of the city council, etc. In 1834 he removed to Paris on the invitation of Guizot; was made professor of political economy at the Collége de France, peer in 1839, and sent in 1845 as French ambassador to Rome. In 1848 he lost this position on the outbreak of the February revolution, and he now appeared as an Italian liberal and patriot. Pius IX. made him prime minister, and he promised to save Rome and Itaiy from the revolution without the intervention of foreign powers, but he was assassinated Nov. 15, 1848, on his way to the Parliament. He wrote *Traité de Droit pénal* (3 vols., 1829) and *Cours d'Économie politique* (1840).

Rossi, de' (Giovanni Battista), b. at Rome Feb. 23, 1822; under Father Marchi devoted himself to the study of archæology and of the Christian inscriptions of the first centuries of the Church, and was complimented by being made a member of the Berlin Academy of Sciences and also foreign member of the French Institute. Most of his works are published in the *Annals* and in the *Bulletin* of the Institute for Archæological Correspondence at Rome. The discoveries made by him in the Catacombs are of special importance, particularly those in the cemetery of St. Calixtus. His two great works are—*Inscriptiones Christianæ Urbis Romæ septimo sæculo antiquiores* (Rome, 1857–61), *Roma Sotterranea Cristiana* (Rome, 1864).

Ros'sie, p.-v. and tp., St. Lawrence co., N. Y., on Indian River. P. 149; of tp. 1661.

Rossie'na, town of Russia, government of Kovno, on the Dubitza, has 12,465 inhabitants.

Rossini (Gioacchino), b. at Pesaro, Italy, Feb. 29, 1792; received a rather desultory and superficial musical education. His father blew the first horn in the orchestra, his mother was a tolerable prima donna in the lighter kind of opera buffa, and he himself sang in the chorus or played in the orchestra as circumstances demanded. In 1807 he became a pupil in the musical school of Bologna, studying counterpoint under the Abbate Mattei, and in 1810 he produced his first opera, *La Cambiale di Matrimonio,* which was performed in Venice with some success. Other operas, now forgotten, followed, and in 1813 his *Tancredi* excited an immense enthusiasm, first in Venice, and soon on every stage on which Italian opera was given. In 1815 he went to Naples as director of the opera, and here he composed among other operas—*Elizabetta* (1815), *Otello* (1816), *La Gaza Ladra* (1817), *La Donna del Lago* (1818), and *Zelmira* (1820). But his most celebrated production of this period is *Il Barbieri di Seviglia,* first performed in Rome in 1816, and generally considered the masterpiece of the whole genre of opera buffa—irresistibly gay, and as characteristic as graceful and brilliant. After a visit to Vienna in 1821, the cool reception which was given his *Semiramide* in Venice in 1823 provoked him; he went to London, and next year to Paris, where he was made successively director of the Italian opera, inspector-general of song in France, and first composer to the grand opera. In bringing out his old compositions on the Paris stage he felt compelled to make considerable alterations: the melodies required a greater simplicity and more character, the chorus a deeper connection with the whole organism and a fuller significance, the instrumentation greater variety and elaborateness. He made a penetrating study of his task before he ventured to represent any new composition, but when at last, in 1828, he made the attempt with *Count Ory,* and shortly after with *William Tell,* his success was astonishing. A few days after the performance of the last work he left Paris and retired to his villa near Bologna, where he lived to 1847, declining all offers, even the most tempting, made in order to induce him to compose a new opera. In 1847 he removed to Florence, in 1856 to Paris, where he d. Nov. 13, 1868. In the last forty years of his life he published only a *Stabat Mater,* and a *Messe solennelle,* which latter was performed at his burial. (See Edwards's *Life of Rossini,* 1869.)

Rossiter (Thomas P.), b. at New Haven, Conn., Sept. 29, 1818; studied painting under Nathaniel Jocelyn, and commenced the practice of his profession in his native city in 1838, devoting himself chiefly to portraits; sailed for Europe June, 1840, with Durand, Kensett, and Casilear; studied a few months in London; travelled through England and Scotland; spent a year at Paris in company with Kensett, copying pictures at the Louvre and studying in the life-schools; accompanied Thomas Cole to Italy, passing through Switzerland, in the autumn of 1841; took a studio in the Via Felice, Rome, and passed there five consecutive winters, spending his summers at Florence, Venice, Naples, and other cities notable for their art-treasures. Returning to America in 1846, he established himself in New York, painting portraits occasionally, but chiefly occupied with historical pieces and a series of large scriptural pictures; had a studio on Broadway built expressly for his use and that of Kensett and Lang; again made an extensive European tour 1853, and in December of that year opened a studio at Paris, where he remained three years, taking a gold medal in the Exposition of 1855; returned to the U. S. 1856; resided in New York until 1860, when he removed to Cold Spring, Hudson Highlands, into a house built according to his own designs with a view to artistic convenience. He became an associate of the National Academy of Design 1840, and academician 1849. His last years were devoted to a series of compositions representing the life of Christ. D. at Cold Spring May 17, 1871. He was distinguished as a colorist.

Rosslyn (Alexander Wedderburn), Earl of. See Wedderburn.

Ross'lyn (James St. Clair **Erskine**), Earl of, eldest son of Lieut.-Gen. Sir Henry Erskine, b. in Scotland in 1762; succeeded his father as baronet 1763; entered the army 1778; was elected to Parliament 1782; became major 1783 and lieutenant-colonel of dragoons 1792; served at the siege of Toulon 1793; was subsequently adjutant-general to the British forces in the Mediterranean; became colonel and aide-de-camp to George III. 1795, brigadier-general 1796; served in Portugal as adjutant-general 1796–97; was appointed major-general Jan. 1, 1798; succeeded his uncle, the first earl of Rosslyn (see Wedderburn, Alexander), Jan. 3, 1805; became lieutenant-general in the same year; served again in Portugal 1806; was at the siege of Copenhagen 1807, and in the Zealand expedition 1809; became full general June, 1814; keeper of the privy seal and member of the privy council June, 1829, and lord president of the council during Peel's brief administration 1834–35. D. at Dysart House, Fifeshire, Jan. 18, 1837. He was noted in both houses as one of the firmest partisans of Tory principles, and was for many years the especial friend of the duke of Wellington.

Ross'ville, p.-v., Vermilion co., Ill., on the Chicago Danville and Vincennes R. R., 19 miles N. of Danville, 105 miles S. of Chicago, has 3 churches, good schools, 2 elevators, 1 newspaper, a brewery, 1 hotel, and abundant water-power. Coal deposits exist. P. about 900.

J. H. Moore, Ed. "Observer."

Rossville, p.-v., Ross tp., Clinton co., Ind. P. 389.

Rossville, p.-v., Westfield tp., Richmond co., N. Y., on Staten Island, 2 miles N. W. of Huguenot Station on Staten Island R. R.

Rossville, v., Spring Creek tp., Miami co., O., on Great Miami River, opposite Piqua. P. 91.

Rossville, p.-v. and tp., Chester co., S. C. P. 1600.

Rost (Reinhold), Ph. D., b. at Eisenberg, Germany, Feb. 2, 1822; studied in the gymnasium at Altenburg; graduated in 1847 at Jena, where he devoted himself to theology and Oriental languages; went to England 1847; was appointed Oriental lecturer in St. Augustine's College, Canterbury, 1850, and professor there 1852, giving lessons in ten Oriental languages; became secretary to the Royal Asiatic Society 1863, and succeeded Dr. Fitz-Edward Hall as librarian to the India office June, 1869. He prepared a descriptive catalogue of the palm-leaf MSS. in the Imperial Library of St. Petersburg 1852; edited Dr. H. H. Wilson's *Essays on the Religion of the Hindus and on Sanskrit Literature* (5 vols., 1861–65) and Sir H. M. Elliot's posthumous *Memoirs on the History, Philology, and Ethnic Distribution of the Races of the North-West Provinces of India* (2 vols., 1866), and has contributed largely to the German Oriental reviews and to Prof. Summer's *Chinese and Japanese Repository.*

Rost (Valentine C. F.), b. at Friedrichsroda, near Gotha, Oct. 16, 1790; studied theology and philology at the University of Jena; appointed instructor in 1814 in the gymnasium of Gotha, and director 1842; devoted himself to classical literature; published a Greek grammar (1816; 6th ed. 1841), a Greek-German lexicon (Gotha, 1820, 2 vols. 8vo; 4th ed. 1851), a German-Greek dictionary (Göttingen, 1818; 8th ed. 1860); began a comprehensive lexicon of classical Greek, of which only the first part appeared (Leipsic, 1840, 4to), a smaller German-Greek lexicon; edited Duncan's Damm's lexicon to Homer and Pindar (Leipsic, 1836, 4to); engaged with Fr. Jacobs, in the *Bibliotheca Græca,* a series of Greek classics, in which appeared, among others, Stallbaum's Plato and Wunder's Sophocles; with Palm and Kreussler prepared a much enlarged edition of Passow's Greek lexicon (Leipsic, 1841–57, 2 thick vols. royal 8vo). D. Aug. 6, 1862, in Gotha. H. Drisler.

Rostan' (Louis Léon), b. at St. Maximin, department of Var, France, Mar. 16, 1796; studied medicine, and was appointed professor in 1833; retired in 1864. D. Oct. 3, 1866. Wrote *Récherches sur le Ramollissement du Cerveau* (1819), *Traité élémentaire de Diagnostic* (3 vols., 1825–27), *Cours élémentaire d'Hygiène* (2 vols., 1828), besides a number of valuable essays in the *Journal de Médécine.*

Ros'tock, town of Northern Germany, in Mecklenburg-Schwerin, on the Warnow, 9 miles from its mouth in the Baltic. It has a university, founded in 1419, with a library of 90,000 volumes; many other good educational institutions; manufactures of linen, leather, and tobacco, and a lively trade. Vessels which draw more than 9 feet must load and unload at Varnemünde, its port at the mouth of the Warnow. P. 30,980.

Rostoptchin (Fedor), b. in the government of Orel, Russia, about 1765; was educated at the court as a page

of Catharine II.; became minister of foreign affairs under Paul I., and was governor-general of Moscow in 1812, when Napoleon approached the city. In his *La Vérité sur l'Incendie de Moscow* (Paris, 1823) he denies having planned and prepared the conflagration of the city, but it is nevertheless certain that he put fire to his own palace and made preparations for the burning of the magazines. The rest of his life he spent mostly in travels. D. at Moscow Feb. 12, 1826. (See Schnitzler, *Rostoptchine et Koutousof, ou la Russie en 1812* (Paris, 1863).)

Rostov′, town of European Russia, government of Yaroslaw, has 33 churches and large manufactures of linen and candles, and holds an annual fair from Feb. 21 to Mar. 11, in which transactions to the amount of about 2,000,000 rubles are made. P. 11,157.

Rostov, town of European Russia, government of Yekaterinoslav, on the Don, at the beginning of its delta, was founded in 1749 as a fortress, and is rapidly growing into one of the commercial centres of Southern Russia. Ropes, linen, leather, soap, and tobacco are extensively manufactured. P. 39,129.

Ros′tra [Lat. for "beaks," so called because it was decorated with the beaks of the galleys of Antium, taken in the Latin war], in ancient Rome, a stage for public speaking which stood between the Comitium and the Forum, so that a speaker could be heard in either. Julius Cæsar erected new rostra in the Forum, known afterward as the Julian rostra. Both were adorned with statues of famous Romans.

Rostra′ver, p.-v. and tp., Westmoreland co., Pa. P. 2786.

Ro′ta, town of Spain, province of Cadiz, at the entrance of the Bay of Cadiz, is celebrated for its wines. P. 6972.

Rotary Press. See PRINTING, by W. S. PATERSON.

Rotary Steam-Engine. See STEAM-ENGINE.

Rotation, in agriculture. See AGRICULTURAL CHEMISTRY, by PROF. S. W. JOHNSON, A. M., M. N. A. S.

Rotation, in magnetism. See ELECTRICITY, by PRES. HENRY MORTON, PH. D., M. N. A. S.

Rota′tion [Lat. *rotare*], in mechanics, motion of a solid body about an axis—*i. e.* some geometrically conceived straight line within or without its mass, but which, for the instant at least, is in the relation to the body as an axle to the wheel. Angular velocity (of rotation) is measured by the length of arc described in a unit of time by a point at unit's distance from the axis. All motion of a solid body may be resolved into motion *of translation* (which may be along rectilinear or curved paths) and motion *of rotation;* and any point of its mass may be taken as the centre to which *rotation* is referred, and whose own motion in space is the exponent of the translatory motion. In general, the centre of inertia (or gravity) is taken as the centre of reference. Taking a carriage-wheel as example, its entire motion is made up of the *translation along the road* (which is that of its axle, and this, we know, follows all the ups and downs and crooks of the road itself) and relative *rotation* about this axle. If we scrutinize, however, the wheel's motion more closely, we shall recognize that there is *at each instant* one single element of the wheel which is motionless; *i. e.* the linear element which *touches the ground. For the instant* the *entire* motion of the wheel consists in rotation about *this* line, which constitutes its *instantaneous axis* of rotation. As the wheel turns, and at the same time moves forward, each elemental portion of the tire comes successively in contact with the ground, and *becomes* the instantaneous axis; while on the other hand the *local position* of that axis advances along the road *pari passu* with the centre and axle of the wheel. Should the road make a bend, the shifting of the instantaneous axis involves change of *direction* too. The above may give an idea of what, in mechanics, is meant by the phrase *instantaneous axis.* In general, the motions of whatever character of any solid body are susceptible of like resolution as those presented by the simple case of the wheel, which may either be resolved into a relative rotation and a *translation,* or into rotation alone about shifting *instantaneous axes.* All rotations about any axis may be conceived as made up of component rotations about other arbitrarily chosen axes. This latter conception, due to Euler, is fundamental to the modern analytical treatment of rotation. The "composition of rotary motions" is dealt with by the same rules that apply to the composition of simple forces and of linear velocities (or motions of translation); hence, "if by two distinct causes a body tends to turn about two sides of a parallelogram with two distinct angular velocities, measured by the lengths of those sides, the body will actually turn about the diagonal with an angular velocity measured by the length of that diagonal; . . . and hence, also, rotations about different axes which pass through the same point combine by precisely the same law as simple *forces* applied to that point." While the idea of translatory motions is in the utmost degree simple, and that of rotation about a permanent axis (*e. g.* that of a stationary wheel) scarcely less so, there are few more difficult objects of conception in mechanics than that which the general subject of rotary motion presents—few more obscure problems than those of its manifestations offer.

Though too abstruse for general discussion, a few elementary principles may be here mentioned. Premising that by "moment of inertia," in reference to an axis, is meant the sum of products of the elementary masses into, respectively, the square of their distances from the axis (a function which is the measure of the bodies' "inertia" in reference to rotation), suppose the body to be free to move about any point, supposed fixed; from that point three rectangular axes may be drawn called "principal axes." (The moment of inertia is maximum for one of these three, and minimum for another, in reference to all axes drawn through *this point.*) About each of these axes the mass is so disposed that the CENTRIFUGAL FORCES (which see) developed by rotation generate no "couple" or tilting effect on it, and hence rotation once developed about that axis is permanent; and if the axis chosen be either that of maximum or minimum moment of inertia, it is likewise stable (*i. e.* if diverted from it momentarily by a slight shock, it will tend to *return* to it). If the initial rotation be imparted about any other than these three *principal* axes, such other can only be an *instantaneous* axis; the ensuing rotation-axis continually shifting in space and in the mass of the body in a manner of which M. Poinsot (see work cited below) has enabled us to form a clear geometric conception. If the fixed point chosen be the centre of inertia (or gravity), the centrifugal forces developed by rotation not only balance, but absolutely *destroy,* one another, and that centre is unmoved, requiring no force to hold it *fixed.* A force *now* applied to that centre simply puts it in motion without interfering with existing rotation. Hence, as before remarked, the entire motion of bodies resolves itself into *translation* of the centre of inertia, and *rotation* about "permanent" or "instantaneous" axes through that centre. Motion *of translation* may always, therefore, be computed as if the entire mass were concentrated in the centre, and subjected to the impulse, *of rotation,* as if the mass were held fixed at the centre and rotation alone were communicated by the impulse.*

Bodies projected from the surface of the earth are, after projection, subjected to the disturbing forces of gravity and of the resistance of the air. The resultant of the former passes through the centre of inertia and deflects the path of translation, while it has no influence upon rotation. The latter *checks,* gradually, velocity of translation, and unless the projectile be symmetrical in reference to the direction of its action, deflects it, and at the same time disturbs rotation. Hence the spherical form once so universally given to rifle and cannon balls. When this form gives place to the oblong, the direction of the axis of figure could not be maintained were it not for the artificially-imparted (by the "rifling") rapid rotation about that axis; which is a "principal" one about which rotation is *stable,* as has been stated. (See GYROSCOPE.) Though terrestrial gravity has its resultant through the centre of inertia, *gravitation* in its "universal" sense has it (in general) not so. The sun's and moon's attraction, *not* acting through the centre of inertia of the earth, causes a disturbance in the earth's diurnal rotation which exhibits itself as the PRECESSION OF THE EQUINOXES (which see). The gyroscope affords an interesting study as exhibiting curious phenomena of rotary motion closely allied to the *precession of the equinoxes* in astronomy, and as affording a visible test of the rotation of the earth. (See *Problems of Rotary Motion, Smithsonian Contributions,* vol. xix., and *Théorie nouvelle de la Rotation,* by M. Poinsot.) J. G. BARNARD.

Roth (RUDOLF), b. at Stuttgart Apr. 3, 1821; studied Oriental languages at Tübingen, Berlin, Paris, and London, and was appointed professor at Tübingen in 1848. His principal work is a great *Sanskrit Wörterbuch* (7 vols.), edited in conjunction with Böhtlingk, and published by the Academy of St. Petersburg (1853–67). He also wrote *Zur Literatur und Geschichte des Veda* (1846), *Ueber den Atharva-Veda* (1856), *Ueber den Mythus von den fünf Menschengeschlechtern* (1860), *Ueber die Vorstellung vom Schicksal in der indischen Spruchweisheit* (1866).

Roth′e (RICHARD), b. at Posen Jan. 28, 1799; studied theology at Heidelberg, and was appointed preacher to the

* This is the ordinary phraseology: the qualifications to it cannot here be stated. If by *impulse* be meant a force of given intensity acting a *given* (very minute) time, it is unqualifiedly true.

Prussian embassy at Rome in 1823, professor at Wittenberg in 1828, at Heidelberg in 1837, at Bonn in 1849, and again at Heidelberg in 1854, where he died Aug. 20, 1867. His principal work is *Theologische Ethik* (3 vols., 1845–48), edited, with his posthumous notes, by Holtzman (5 vols., 1867–71). But he also occupied a most prominent place in the historical and dogmatic divisions of his science—*Die Anfänge der christlichen Kirche* (1837) and *Zur Dogmatik* (1863). See his *Life*, by Neppold (Wittenberg, 1873).

Roth'erham, town of England, county of York, on the Don, has manufactures of different kinds of iron goods, and its vicinity is very rich in iron and coal. P. 6325.

Roth'ermel (Peter F.), b. in Luzerne co., Pa., July 8, 1817, of German extraction; was educated in Philadelphia for the profession of land-surveyor; opened a studio as a portrait-painter, but soon adopted historical painting as his branch of art; visited Europe in 1836–37, and painted in Italy. With the exception of his *Columbus before Queen Isabella, The Martyrs of the Colosseum, Cromwell breaking up Service in an English Church,* his best-known pictures are suggested by American themes—*De Soto discovering the Mississippi, Patrick Henry before the Virginia House of Burgesses, The Battle of Gettysburg.* Rothermel belongs to the class of "sensational" artists, but his talent for composition and color gives him a high rank among these. O. B. Frothingham.

Rothe'say, town of Scotland, the capital of the county of Bute, on the eastern coast of the island of Bute, is a favorite watering-place; considerable fishing is carried on. P. 7800.

Rothesay (David Stewart), Duke of. See Stewart.

Roth'schild (Meyer Anselm), b. at Frankfort-on-the-Main 1743, and founder of the family celebrated for their great wealth. He was intended for the Jewish priesthood, but was placed in a counting-house at Hanover, from whence he returned to Frankfort and started in business for himself on a small scale as a banker and broker. Devoting himself closely to his new business, he obtained a reputation for ability and integrity, and was entrusted with the money affairs of William Landgrave, afterward elector of Hesse, who during Napoleon's possession of Germany confided to Rothschild the keeping of his immense private fortune without interest. D. in Sept., 1812, leaving a large fortune to his five sons, Anselm, Solomon, Nathan, Charles, and James, who established themselves respectively in Frankfort, Vienna, London, Naples, and Paris. With the exception of the one at Naples, these houses are still existing.—The third son, Nathan, b. Sept. 16, 1777, went to London in 1800, where he employed the immense sums confided to his father with great judgment, and on the death of the latter became the leader of the house, being consulted by his brothers on all matters involving financial speculation or investment. He introduced the business of negotiating foreign loans in England. An act of denization was passed in his favor in England in 1821, and in 1822 Austria conferred on him the title of baron, which, however, he never adopted, preferring the distinction which he had gained for himself as a financier.—Lionel Nathan (b. Nov. 22, 1808), eldest son of Nathan, succeeded to the title on his father's death July 28, 1836, and was repeatedly elected to Parliament, but declining to take the prescribed oath, "on the true faith of a Christian," was not admitted until the "act for removing the disabilities of the Jews" was passed in 1858, when he took his seat, being the first Jew admitted to Parliament.

Rotif'era [Lat. *rota*, "wheel," and *ferre*, "to carry"], a class of highly-organized infusorial animals of the articulate type, distinguished by ciliated appendages at the anterior part of the body, which seem to move in a rapid rotary manner. They are commonly termed "wheel animalcules."

Rotrou', le (Jean), b. in 1609 at Dreux, department of Eure-et-Loire, France; was civil governor of his native city, and died there in 1650 from the plague. He wrote twenty-three tragedies and comedies, of which the best known are *Venceslav* (1647) and *Chosroes* (1649), and which form a transition in the history of the French drama from Jodelle to Corneille.

Rot'teck, von (Karl), b. at Freiburg, Baden, July 18, 1775; studied law, afterward history; travelled much; was appointed professor of history at the university of his native city; took part with much energy, though with moderation, in the opposition against the political reaction which set in after 1815, and received his share of persecution. D. Nov. 26, 1840. By his *Allgemeine Geschichte* (9 vols., 1813–27) and the minor compendium of it, *Allgemeine Weltgeschichte* (4 vols., 1830–34), he exercised a great and beneficial influence on the German middle classes. The materials are well arranged, the representation vivid and impressive, and the spirit sound and liberal. Both books were often reprinted, and have been translated into several European languages.

Rot'tee, an island of the Malay Archipelago, S. W. of Timor, in lat. 10° 40′ S. and lon. 123° E., is 36 miles long, 11 miles broad, mountainous, though the mountains are not high, and produces millet and maize, ebony and mahogany, sheep, buffaloes, horses, swine, and fowls, edible birds' nests, and wax. P. 35,000, most of whom are Christians. The Netherlands have made a settlement here.

Rot'tenburg, town of Würtemberg, on both sides of the Neckar, on a plain covered with orchards, vineyards, and hop-plantations. It has breweries and distilleries, and manufactures pottery and musical instruments. P. 5996.

Rot'ten Stone, a fine earth or softened aluminous stone, much employed in polishing glass and metals. True rotten stone comes from Wales and Bakewell, Derbyshire. The name is also extended so as to include tripoli and the infusorial earths.

Rot'terdam, the second commercial town in Holland, situated on the right bank of the Maas, about 14 miles from the North Sea and 36 miles S. W. of Amsterdam, occupies a site in the form of a nearly equilateral triangle, the base of which is the Maas and the vertex the Delft Gate. The city is intersected by numerous canals (*grachten* or *havens*), and is traversed by the Rotte, a small stream, at the junction of which with the Maas there is a large dyke or dam; whence the name Rotterdam. The numerous vessels lying in the canals and harbors, which are deep enough to accommodate those of heavy tonnage, and admit of their discharging their cargoes in the very heart of the city, always present a busy and picturesque scene. Along the river, which opposite the town is 30 to 40 feet deep, is a fine quay 1¼ miles long, called the *Boompjes* ("Little Trees"), from a line of elms planted in 1615, now grown to a large size. Here is the birthplace of Erasmus (which see), to whom a bronze statue is erected in the great market-place. Rotterdam is the entrepôt of a large cattle-trade with England, and the point of departure of numerous lines of steamships, and besides being the seat of an extensive commerce with the East Indian possessions of Holland and with Europe and America, has important manufactures. The great railway-route between Belgium and Holland, connecting the cities of Brussels, Antwerp, Rotterdam, the Hague, and Amsterdam, crosses the Holland Deep (*Hollandsche Diep*) by the great bridge at Moerdijk. (See Bridge.) (For the recent improvement of navigable connection with the sea see Harbor; also *Professional Papers Corps of Engineers U. S. A.*, No. 22.) P. in 1871, 121,027. J. G. Barnard.

Rotterdam, tp., Schenectady co., N. Y., on Mohawk River, Erie Canal, and New York Central R. R. P. 2355.

Rott'weil, town of Germany, kingdom of Würtemberg, on the Neckar, has a fine church, several good educational institutions, and manufactures of silk and cotton stuffs, chicory, powder, and tiles. P. 5447.

Rotun'da [Lat. *rotundus*, "round"], the name of any architectural structure which is round and domed. The oldest and most celebrated construction of this kind is the Pantheon of Rome. Generally, a rotunda forms only part of an architectural whole. We give below the measurements of some of the most celebrated domes:

	Internal diameter, feet.	Internal height, feet.
Pantheon at Rome	142.6	143
Baths of Caracalla	112	116
Sta. Maria del Fiore	139	310
St. Peter's	139	330
St. Sophia's, Constantinople	104	201
St. Paul's, London	112	215
Chapel of the Medici	91	199
Baptistery of Florence	86	110
Madonna delle Salute, Venice	70	133
Ste. Geneviève, Paris	67	190
Duomo at Siena	57	148
Duomo at Milan	57	254
Val de Grace at Paris	55	133
St. Mark's, Venice	44	150
Halle aux Blés, Paris	131	150
St. Isaac's, St. Petersburg	96	150
Capitol of Washington	96	300

Roubaix', a large manufacturing town of France, department of Nord, has risen to its present prosperity only within the last thirty years. It has extensive manufactures of woollen and cotton fabrics, furniture cloth, carpets, and twists, large dyeworks and tanneries, and carries on a very active trade. Its working-classes are said to be more intelligent and prosperous than those of any other large manufacturing city. P. 75,987.

Roubidoux, p.-v. and tp., Texas co., Mo., on Roubidoux Creek, a tributary of Gasconade River. P. 617.

Roubiliac′ (Louis François), b. at Lyons, France, about 1695; became a distinguished sculptor; settled in England (probably) during the reign of George I., and executed many important works of art, among which were the celebrated monument of the Nightingale family, that of John, duke of Argyle, and the statue of Handel in Westminster Abbey, the statue of Shakspeare in the British Museum, and of Sir Isaac Newton at Cambridge. He was noted for absence of mind, but was amiable and attained great popularity. D. at London Jan. 11, 1762.

Rou′ble, or **Ru′ble** [Russ. *rubl*, *rublyn*, "cut off," because it was originally cut from a silver bar], the principal Russian silver coin and money of account, now worth 73.4 cents U. S. money. The ruble is equal to 100 kopecks. It was first struck in 1654 at Moscow.

Rouen′ [anc. *Rotomagus*], city of France, the ancient capital of Normandy, at present the capital of the department of Seine Inférieure, on the right bank of the Seine, 67 miles N. W. of Paris, and connected with its suburb, St. Sever, on the opposite bank, by three bridges. The quays along the river and the boulevards occupying the site of the former ramparts are new and elegant; the central part of the city is old and more interesting than beautiful. Of the many remarkable public buildings the most noticeable are the cathedral, a Gothic structure of great beauty, 434 feet long, 103 broad, 89 high at the nave, with a tower and spire over the crossing of the nave and the transept rising 470 feet, and two elegant towers flanking the front, built by Philip Augustus (1200–20), and containing, besides a number of other interesting monuments, the tomb of Richard Cœur de Lion; the church of St. Ouen, of nearly the same dimensions as the cathedral, built in the fourteenth century, and considered one of the finest specimens of Gothic architecture; the Palais de Justice, of the fifteenth century, etc. In the Place de la Pucelle stands a statue of the Maid of Orléans, who was burnt here in 1431. Monuments have also been raised in honor of Corneille and Boieldieu, who were born here. The city has a public library of 120,000 vols., a very valuable collection of pictures, an excellent botanical garden, a theological seminary, an academy of science and art, and numerous other educational and benevolent institutions; and it is one of the most important manufacturing centres of France. The principal manufactured articles are cotton and cotton velvet, mixed silk and woollen fabrics, flannels, blankets, and hosiery, chemicals, paper, etc. Its commerce is also very extensive; the river forms an excellent harbor, and vessels of 400 to 500 tons burden can enter it. P. 102,470.

Rouge [Fr., "red"], a powder used for adding an artificial bloom to the complexion. Rouge is finely powdered talc, colored with safflower by an elaborate process. It is quite harmless to the skin. Much of the so-called rouge is, however, colored with carmine and other pigments. These are considered injurious.—Rouge is also a name given to fine and carefully-prepared peroxide of iron, used by jewellers, glass-workers, and others as a polishing-powder, and sometimes also as a pigment. It is also called English red and colcothar.

Rougé′, de (Olivier Charles Camille Emmanuel), Viscount, b. at Paris Apr. 11, 1811; studied law and prepared himself for a political career, but retired in 1830 to his estates, devoting himself to philological studies, especially Hebrew and Arabic, and concentrated himself finally on the archæology and hieroglyphics of Egypt. He first became known as an Egyptologist in 1846 by his review of Bunsen's work on Egypt; was appointed keeper of the Egyptian collections in the Louvre in 1849; elected a member of the Institute in 1853, and professor of archæology at the Collége de France in 1854; visited Egypt in 1863; translated the *Tale of the Two Brothers*; published a *Chrestomathie égyptienne* (1867–68) and a number of monographs in the *Transactions* of the Institute and in the *Revue archéologique.* D. at Paris Jan. 25, 1873.

Rouge et Noir [Fr. for "red and black"], also called **Trente-et-Un** ("thirty-one"), or **Trente-et-Quarante** ("thirty and forty"), a game of chance played with six packs of cards. The *tailleur* (dealer or banker) deals first for black, and places the cards in a row until the number of pips amounts to more than thirty, the face cards numbering 10 each. He then deals for red in the same manner, and that row whose value is nearest to 31 has won. If the value of the two rows is equal, a *refait* takes place and a new dealing commences. In 1789 this game and roulette were invented in Paris, and superseded faro and biribi, but both were forbidden by law in 1838. In 1873 they were also forbidden in Germany, but they are still very popular in Italy.

Rouget′ (Georges), b. in Paris in 1781; studied painting in the Academy of Art and in the studio of David, in the execution of whose pictures he often assisted; began to exhibit in 1812; achieved great success both by his portraits and historical pictures. D. in 1869. The best known of his works are the *Marriage of Napoleon and Marie Louise* (1838), at Versailles, the *Death of Napoleon* (1846), and the portraits of Napoleon, Marshal Soult, Louis XVIII., and Charles X.

Rouget de Lisle. See Marseillaise.

Rough and Ready, p.-v. and tp., Nevada co., Cal., near S. fork of Feather River. P. 1210.

Rough and Ready, p.-v., Anderson co., Ky., near Kentucky River. P. 160.

Rouher′ (Eugène), b. at Riom, France, Nov. 30, 1814; was admitted to the bar in 1838, and represented the department of Puy-de-Dôme in the Constituent Assembly in 1848 and in the Legislative Assembly in 1849, in which latter year he was made minister of justice by Louis Napoleon. In July, 1851, he resigned, but was reappointed Dec. 2, 1851, the day of the *coup d'état.* Upon the confiscation of the Orleans property (Jan. 22, 1852) he again resigned, but a few days later was made vice-president of the council of state; in Feb., 1855, was appointed minister of agriculture, commerce, and public works, among the important acts of his administration being the negotiation, with Mr. Cobden, of the commercial treaty of 1860, when the grand cross of the Legion of Honor was bestowed upon him. He was raised to the rank of senator in 1856, and in 1863 succeeded M. Billault as minister of state, which position he resigned on the occasion of the celebrated letter of the emperor's of Jan. 19, 1867, announcing a more liberal policy, but was immediately reinstated, when the additional portfolio of minister of finance was confided to his charge. Following the election of May, 1869, the ministry resigned July 13, M. Rouher being nominated president of the senate a week later. During the Franco-German war he was prominent, but on the downfall of the Empire fled to England. Returning to France, he was arrested and held for a brief time, and in that year was returned to the Assembly, of which body he is yet (1877) a member.

Roulers′, town of Belgium, province of West Flanders, has large manufactures of linen and lace, and trade in flax, which is extensively grown in the vicinity. P. 12,433.

Roulette′ [Fr., a "little wheel"], a game of chance played on a table in whose centre is a cavity. The sides of the cavity are firm and painted at equal distances with the first thirty-six numbers, which are repeated along the edge of the table. The bottom of the cavity is movable by the aid of a handle in the form of a cross. When the *tailleur* puts the bottom in motion he throws down in the cavity a small ivory ball, and when the movement stops the ball drops into one of the painted compartments. The number which the ball strikes wins, and is paid thirty-six times the stake which was put on it. (See Rouge et Noir.)

Roulette, p.-v. and tp., Potter co., Pa., near the head of Allegheny River. P. 525.

Roumania. See Romania.

Rouma′nian Rite, a branch of the United Greek (Roman Catholic) Church, found in Austria and parts of Turkey. There is one archbishop (at Fougaras in Transylvania) and three bishops (Szamos-Ujvar, Gran Wardein, Lagos).

Roumelia, or **Roum-Ili.** See Room-Elee.

Round Grove, tp., Livingston co., Ill. P. 640.

Round Grove, tp., White co., Ind. P. 401.

Round Grove, tp., Marion co., Mo. P. 1379.

Round Head, p.-v. and tp., Hardin co., O., on Scioto River. P. of v. 117; of tp. 759.

Round′heads, a nickname applied in 1641 to the London apprentices and their associates of the lower class, who circulated and published a petition against popery and prelates, assaulted the bishops on their way to Parliament, and had daily street-encounters with the gentlemen who had volunteered to form the king's body-guard, hence called "Cavaliers." The "Roundheads" were probably so styled from having their hair clipped closely around the head, and the epithet, having obtained currency, was extended to all the Puritans or supporters of Parliament, who, two years later, undertook the memorable contest with the Crown, usually designated in history as the "Great Rebellion."

Round Pond, p.-v., Bristol tp., Lincoln co., Me.

Round Prairie, tp., Benton co., Ark. P. 3443

Round Prairie, tp., Jefferson co., Ia. P. 1085.

Round Prairie, tp., Todd co., Minn. P. 202.

Round Prairie, tp., Callaway co., Mo., on Jefferson City branch of Chicago and Alton R. R. P. 1211.

Round Table. See Arthur.

Round Towers, a class of remarkable stone towers found chiefly in Ireland, but also seen in Scotland, Switzerland, Corsica, and other countries. It has been customary to assign these structures to the pagan and even the pre-historic period; another opinion is that they were attached to churches and other ecclesiastical buildings of a very remote period.

Round Valley, tp., Mendocino co., Cal. P. 444.

Round Worms. See Nematelmia.

Rouquette′ (Adrien Emmanuel), b. in New Orleans, La., 1813; educated at the College of Nantes, France, where he studied law; was afterward ordained a Roman Catholic priest, and was for many years professor in the Roman Catholic seminary at New Orleans, and subsequently chaplain to that institution, being known as the Abbé Rouquette. He has written with equal elegance in French and English, his chief works being *Les Savanes, Poesies américaines* (Paris and New Orleans, 1841), a book highly praised by Sainte-Beuve; *Wild Flowers, Sacred Poetry* (1848), *La Thébaïde en Amérique* (1852), *L'Antoniade, ou la Solitude avec Dieu* (1860), and *Poëmes patriotiques* (1860).—His brother, François Dominique, b. at New Orleans Jan. 2, 1810, was also educated at Nantes; studied law in the office of William Rawle in Philadelphia; published in Paris two volumes of poems, *Les Meschacébéennes* (1838) and *Fleurs d'Amérique* (1857); has resided much in France, and has written a work in French and English on the Choctaw Indians.

Rouse's Point, p.-v., Champlain tp., Clinton co., N. Y., on Lake Champlain, at the mouth of Richelieu River, at the N. E. extremity of the State of New York, half a mile S. of the Canadian boundary, is the point of junction of a branch of Grand Trunk with Central Vermont R. R., which here crosses Lake Champlain on a floating bridge 5000 feet long, built at a cost of $300,000; is an important port for the lake-commerce with Canada, 2000 vessels arriving and departing annually, and the customs receipts averaging $500,000; is protected by Fort Montgomery, which is situated on the frontier at the outlet to the lake; is divided into upper and lower villages; has 3 churches, a considerable lumber-business, and an extensive publishing-house, situated here for the convenience of the international book-trade with Canada. P. 1266.

Rouse′ville, p.-v., Cornplanter tp., Venango co., Pa., on Oil Creek and Oil Creek and Allegheny River R. R., in a petroleum-producing region, has 1 newspaper. P. about 1500.

Rousseau′ (Jean Baptiste), b. at Paris Apr. 6, 1670, the son of a shoemaker; received a liberal education, and very early attracted attention by his verses, epigrams, and odes, which opened the most brilliant circles of Paris to him. Exceedingly vain, he was ashamed of his humble descent, and when his dramatic attempts were received somewhat coldly, he ascribed their bad success to the intrigues of other dramatists, whom he persecuted with epigrams and satires. Some of these products were full of infamous calumnies, and, although Rousseau denied having written them, he was banished from France in 1712. His authorship has never been proved, but his other works contain religious *cantates* and erotic odes side by side, and the witnesses who testified that the calumnies in question were written by Saurin were bought by Rousseau. He afterward wandered in Switzerland, Vienna, England, Brussels, etc., wherever he could find a princely patron, and d. at Brussels Mar. 17, 1741. He was considered the greatest lyric poet of his age, but since the days of Sainte-Beuve his works are read no more. Complete edition in 5 vols. (1820) by Amar Durivier.

Rousseau (Jean Jacques), b. June 28, 1712, at Geneva. Losing his mother at his birth, he grew up uncared for, eagerly devouring a Bible, a copy of Plutarch, and a number of wretched novels which he found in his father's workshop. While this strange medley filled his immature mind, his feeble health prevented all serious occupation and regular study. Work was distasteful to him, and all control intolerable. A few faint efforts at gaining a livelihood failed; either his masters found him unfit for work or he rebelled against their authority. He fled, abjured his faith to become a Roman Catholic, wandered restlessly through Switzerland and Northern Italy, became a servant, an interpreter, a seminarist, and the favorite of a charitable but ill-advised lady, Madame de Warens. Thirty years old, he went to Paris, hoping to succeed there by his fair musical talents; he failed, and supported himself by copying music and collecting plants for botanists. In 1750, through a chance acquaintance with some Encyclopédistes, he learnt that the academy at Dijon had offered a prize for the best answer to the question, Has the revival of science and art helped to corrupt or to purify morals? He wrote an essay proving that men had been demoralized by science and art, obtained the reward, and, elated by this unexpected success of his first sophism, devoted himself henceforth to literature. The startling boldness of his opinions and the almost magic beauty of his style won for him great admiration and ready access to leading men in Paris. In 1753 he published his famous *Discourse on the Inequality among Men,* in which he made the first violent attack upon the throne and the altar, thus striking the keynote of his whole literary career. His propositions—that all men are born equal; that property is a crime; that the soil belonged to no one, and the fruits of the soil to all men alike; that monarchy means tyranny and religion superstition—became very popular among certain classes of men and powerfully prepared the Revolution. Between his greater works he published several musical works, of which a pastoral opera, *The Village Prophet,* written and composed by him, was the most successful. His reputation rose rapidly; the first men of France sought his society, although he affected lofty contempt for such signs of higher civilization as becoming dress, courteous manners, or even respect for the decencies of life. Having no home and no family ties, he lived now with one and now with another of his friends. In 1759 appeared his *New Héloïse,* the most generally known of his works, which has done incalculable harm, for here also the beauty of his diction and the eloquence of his style serve to teach doctrines subversive alike of morality and religion. It is a novel in letters, written after the model of the famous letters of Abelard and Héloïse, full of glowing descriptions of the beautiful scenery on the Lake of Geneva, and abounding in graphic and most seductive appeals to the passions. The *Social Contract,* a political work, became the catechism of the French Revolution, and his *Émile,* published in 1762, the leading handbook on education. Its moral tone and excellent lessons stand in striking contrast with the life led by the author in the company of an unlettered, ignorant servant-woman, whose children he regularly handed over to the foundling hospital. At last public indignation became clamorous; his *Émile* was burnt by order of the government, and Rousseau banished from France. His native land refused to shelter him; for years he wandered as a fugitive from town to town, and when Hume took him to England and gave him a home at Wootton, he showed such ingratitude and groundless suspicion that his friends sought an excuse for his eccentricities in the plea of partial insanity. In 1770 he returned to Paris, being tacitly allowed to live there, and supported himself, as of old, by copying music and publishing botanical works. Here he began his *Confessions,* an autobiography, in which fact and fiction are strangely mixed. Kind friends procured for him a quiet home in the forests near Paris, and here he died (July 3, 1778), so suddenly as to give rise to suspicions that he had committed suicide. His matchless style and masterly eloquence, his ardent love of nature, and his powerful instincts in favor of liberty,—all these gifts, as all his genius, were misapplied for want of moral principle and religious faith. He stands indisputably in the front rank of the classic writers of France, but the influence of his works has been baneful and destructive in proportion to their beauty and attractiveness. See *Œuvres de J. J. Rousseau* (Firmin Didot, Paris); *Rousseau, sa Vie et ses Ouvrages,* par St. Marc Girardin (*Revue des Deux Mondes,* 1856); Brougham, *Voltaire and Rousseau* (1845); Zeller, *Pestalozzi and Rousseau* (1851); Morley, *Rousseau* (1873). Schele de Vere.

Rousseau (Lovell H.), b. in Lincoln co., Ky., Aug. 4, 1818; received but little early education, but subsequently studied law at Louisville and at Bloomfield, Ind.; admitted to the bar in 1841; member of the Indiana legislature 1844–45, and of the State senate 1847. In the war with Mexico, as captain in the 2d Indiana Vols., he served with gallantry at Buena Vista; returned to Louisville in 1849; became a successful criminal lawyer, and in 1860 was a member of the State senate, where he boldly stood by the government, and on the outbreak of war raised the 5th Kentucky Infantry, of which he became colonel Sept., 1861; appointed brigadier-general U. S. volunteers Oct. 1, 1861, he was distinguished at the battle of Shiloh Apr. 7, 1862; in command of division and conspicuous for gallantry at Perryville, Ky., Oct. 8, 1862, for which he was made major-general of volunteers; participated in the battle of Murfreesboro', Dec. 31, 1862; commanded the district of Tennessee from Nov., 1863, till the close of the war. Resigned Nov. 30, 1865; member of Congress 1865, and in Mar., 1867, was appointed a brigadier-general in the regular army and brevetted major-general. Assigned to command the department of Louisiana July 28, 1868, he died at New Orleans Jan. 7, 1869.

Rousseau (PHILIPPE), b. at Paris about 1808; studied painting under Gros and Victor Bertin; began to exhibit in 1831, and acquired a great reputation as a painter of animals and still life. His *Rat de Ville* (1845), *Chevreau broutant* (1855), and *Singe photographe* (1866) became most widely known.

Rousseau (THÉODORE), b. at Paris in 1812; studied painting; began to exhibit in 1834; painted mostly landscapes, which were much appreciated, such as *Après la Pluie* (1852), *Groupes de Chênes* (1855), *Le Chêne de Roche* (1861), *Clairière dans la haute Futaie* (1863). D. in 1867.

Rousset' (CAMILLE FÉLIX MICHEL), b. at Paris Feb. 15, 1821; was appointed professor of history at Grenoble in 1843, at the Lycée Bonaparte in 1845, and historiographer to the ministry of war and keeper of its library in 1864. His *Histoire de Louvois* (4 vols., 1861–63) was crowned by the Academy. In 1865 he edited the *Correspondance de Louis XV. et du Maréchal de Noailles* (2 vols.).

Rout [O. Fr. *route*, "troop"]. This offence consists in an unlawful assembly of three or more persons with a common intent to accomplish a purpose which if carried out would constitute a riot, and their actually making a motion toward the execution of this design. It closely resembles a riot, and in fact agrees with that higher grade of crime in all its features except the final one of executing and accomplishing the intended object of the assemblage. (See RIOT.) JOHN NORTON POMEROY.

Routh (MARTIN JOSEPH), D. D., b. at South Elmham, Suffolk, England, Sept. 15, 1755; graduated at Oxford 1774; became a fellow 1776, college librarian 1781, senior proctor 1783, college bursar 1791, and in the same year president of Magdalen College, which post he retained nearly sixty-four years, dying at Oxford in his one hundredth year, Dec. 22, 1854. In 1810 he was presented to the living of Tylehurst, Berkshire. He published an edition of Plato's *Euthydemus et Gorgias* (1784); edited Burnet's *History of his Own Times* (1823) and a volume of *Scriptorum Ecclesiasticorum Opuscula* (1832; 2d ed. 1840), but was best known by his valuable collection of the fragmentary writings of the Christian Fathers of the second and third century under the title *Reliquiæ Sacræ, sive Auctorum fere jam perditorum secundi tertiique Sæculi Fragmenta quæ supersunt; accedunt Epistolæ Synodicæ et Canonicæ Nicæno Concilio antiquiores* (4 vols., 1814–18; new ed., 5 vols., 1846–48). He bequeathed his library of 20,000 volumes to the University of Durham.

Rouville', county of Quebec, Canada, which extends S. E. from the river Richelieu. It is generally productive. It is traversed by Grand Trunk and Stanstead Shefford and Chambly railways. Cap. Marieville. P. 17,634.

Rova'ni (GIUSEPPE), b. at Milan 1818; d. there in 1874. His critical essays in the *Gazzetta di Milano* had a wide currency, and among his romances, which contain some magnificent pages, may be mentioned *Lamberto Malatesta*, *Valenzia Candiano*, *Manfredo Pallavicino*, and his two best works, *I Cento Anni* and *La Giovanezza di Giulio Cesare*. Lombard *Bohemian* literature acknowledges Rovani as its head.

Rova'to, town of Italy, province of Brescia, at the foot of Mont' Orfano, about 5 miles N. E. of Chiari. It is a well-built town, and the ancient castle, to which five turrets were added in 1470, is still standing. The churches contain old pictures of much interest. In the chapel of the ex-convent on the summit of Mont' Orfano, which commands one of the finest views in Italy, there are two pictures said to be by Mantegna, and the old church adjoining contains some very good frescoes of the fourteenth and fifteenth centuries. The neighborhood abounds in Roman antiquities. The inhabitants are chiefly occupied with agriculture, and the wine made here, known as Monte Santo, stands high among Italian wines. P. 7400.

Rove Beetles, the Staphylinidæ, a family of coleopterous insects, of which there are many species. They are generally small, and inhabit wet moss, leaves, dung-heaps, etc. They are often found in ant-heaps and under stones. They devour vegetable and decaying animal matter, often exhale a strong odor, and some are popularly believed to have a poisonous bite. There are many American species.

Ro'ver, p.-v., Yell co., Ark. P. 394.

Rovere'do, town of Austria, in the Tyrol, is picturesquely situated on the Leno near its junction with the Adige. It is the chief seat of the Tyrolean silk manufactures, and carries on an extensive transit-trade. P. 8110.

Rovi'gno, town of Austria, in Istria, on a rocky promontory in the Adriatic, has two harbors, shipbuilding yards, ropewalks, manufactures of sailcloth, tunny fisheries, and an active trade in wine and oil. P. 10,500.

Rovi'go, town of Italy, province of the same name, lying between the Po and the Adige on the Adigetta, an emissary of the Adige. Hygienic considerations have compelled the demolition of three out of six picturesque gates, but the town is well built, with broad, regular streets, fine churches containing works of art of some interest, and other imposing public and private edifices. Rovigo was harshly governed by Austria, but still made some progress during the latter years of her dominion. The neighboring district, commonly known as the Polesine, was once entirely covered with water, and cannot now be said to be healthy, but it produces good crops of grain, especially of rice, and the grape thrives well, though sometimes injured by dampness. Mediæval Rovigo belonged sometimes to Venice, sometimes to the house of Este. P. 10,800.

Rowan', county of N. E. Kentucky, bounded S. W. by Licking River, drained by Triplett's Creek and other streams, and has a mountainous surface, largely covered with forests. The staples are Indian corn and dairy products. Cap. Morehead. Area, 500 sq. m. P. 2991.

Rowan, county of Central North Carolina, bounded N. E. by Yadkin River and drained by its tributaries, has a broken surface and a productive soil; is traversed by Richmond and Danville and the Western R. Rs. of North Carolina, which intersect at Salisbury; produces Indian corn, wheat, oats, tobacco, wool, and butter. There are several manufactories, including 1 of railroad cars. Cap. Salisbury. Area, about 700 sq. m. P. 16,810.

Rowan (JOHN), b. in Pennsylvania in 1773; went with his parents to Kentucky 1783; was educated at Bardstown; became a lawyer; was a member of the State constitutional convention 1799; secretary of state 1804; sat for many years in the legislature, distinguished himself by his extensive fund of information, his eloquence, and his readiness in debate; was the acknowledged leader of the Kentucky bar in criminal jurisprudence; sat in Congress 1807–09; was judge of the court of appeals 1819–21; U. S. Senator 1825–31, making notable speeches on the judiciary system and on imprisonment for debt; was commissioner of claims against Mexico under the treaty of Apr. 11, 1839, and president of the Kentucky Historical Society from 1838 to his death, at Louisville July 13, 1843.

Row'an (STEPHEN C.), b. Dec. 25, 1808, in Ireland; entered the navy as a midshipman Feb. 1, 1826; became a passed midshipman in 1832, a lieutenant in 1837, a commander in 1855, a captain in 1862, a rear-admiral in 1866; distinguished for capacity, conduct, and courage during the civil war in the rivers of Virginia, the sounds of North Carolina, and at Charleston, S. C.; and for his long, honorable, and gallant service made vice-admiral of the navy Aug. 15, 1870. FOXHALL A. PARKER.

Rowan Tree. See MOUNTAIN-ASH.

Rowanty, tp., Dinwiddie co., Va., on Petersburg R. R. P. 3274.

Rowe, p.-v. and tp., Franklin co., Mass., on Deerfield River, adjacent to the Hoosac Tunnel, is a mountainous farming town, with beautiful scenery. P. 581.

Rowe (NICHOLAS), b. at Little Barford, England, in 1673; was educated at Westminster School; studied law; became a successful courtier and politician, but is best known as a dramatic author and as translator of Lucan's *Pharsalia* (1718). He published an edition of Shakspeare (1709), preceded by the first biography of that poet; became under-secretary of state under Queen Anne (1708–11), and was made poet-laureate by George I. D. Dec. 6, 1718, and was buried in Westminster Abbey. Among his plays the most successful were the tragedies *Tamerlane* (1702), *The Fair Penitent* (1703), *Jane Shore* (1714), and *Lady Jane Grey* (1715).

Row'ell, tp., Marion co., S. C. P. 891.

Row'ing [Ang.-Sax. *rówan*], "to impel a boat or vessel in water by oars at the sides." (*Worcester.*) In the more strict application of the word, the verb to "row" is used only where each oarsman works a single oar; where two are used, one in each hand, the oars are properly called *sculls*, and the oarsman becomes a *sculler*. (See SCULLING.) The oar is known to exact science as a lever of the second order, the work being performed at a point between the fulcrum and the power. It is of course merely a more highly-organized paddle, naturally enough evolved, and has been known for thousands of years in every maritime nation that has emerged from barbarism. For large craft it has long been abandoned, and it is in the galleys of the ancients that rowing attained its most important practical development. It is, however, only within a very recent period, and as an amusement in the Anglo-Saxon countries, that the art of rowing has come to be thoroughly understood. Its progress dates, in England, from about 1829, the

year of the first Oxford and Cambridge match; in America, from a few years later. Since then the continued stimulus of frequent boat-races in an inventive and scientific age has induced the most careful study of methods and materials, until at the present day it may be safely said that the art of rowing can no further go. After years of discussion and experiment and careful observation, the authorities are substantially agreed upon the best make of boats and oars and the true style of rowing. The canons of that style are derived from the immutable principles of mechanics and anatomy; they are the empirical solution of the problem, how to apply human strength in a given way so as to effect the greatest amount of work in the shortest possible time with the least possible distress. It is essential to dismiss at the outset the idea, so common among the public, of an "English stroke," an "American stroke," a "Yale stroke," a "Harvard stroke," and so on, *ad nauseam*, whose respective merits are still open to debate. There is one universal "stroke," which we proceed briefly to explain.

The oarsman in the modern racing-craft sits upon a seat elevated some 6 or 7 inches from the floor, his feet strapped up against a board or "stretcher," which is solidly fixed to the main timbers of the boat. The seat itself is a mere square of wood, fitted upon its lower surface with grooves which slide upon two rails about 18 inches in length running parallel with the keel of the boat. At the beginning of the stroke, just before the oar enters the water, the oarsman is in the position represented in Fig. 1. The legs are

FIG. 1.

bent to about a right angle at the knee, with the knees well apart to admit of the free movement of the trunk, the feet pressed firmly against the stretcher, the body reaching forward from the hips, with the vertebral column perfectly straight and rigid, the head erect, the shoulders back, chest open, arms straight, and hands grasping the oar about four inches apart. The blade of the oar is of course perpendicular to the plane of the water. The essential points to be observed in this position are, *first*, the long forward reach from the hips; *second*, the entire rigidity of every muscle. The oarsman being in the position indicated, the hands are quickly thrown upward, driving the oar-blade like a knife into the water. This motion is accomplished solely from the shoulder, the arms remaining, as before, perfectly straight and rigid, though moving freely at the shoulder-joints. The instant the blade is covered, the great muscles of the back, the strongest lifting muscles of the body, come into play, dashing back the head, shoulders, and trunk until the body is nearly erect. The power of the stroke depends chiefly upon the sudden nervous energy of this "catch of the water." The legs still remain in precisely the same position. The arms, during this portion of the stroke, answer solely the purpose of connecting ropes between the shoulders and hands, and still remain perfectly straight, but turn slightly in the shoulder-joints, so that the hands preserve a uniform level and the blade continues at a uniform depth in the water. As the body reaches the perpendicular, the legs straighten, the knees still remaining well apart, driving the seat back upon its slides; at the same time the arms are bent downward at the elbow, the hands being still kept at the uniform height, until the thumbs touch the chest. The oarsman is now in the position represented in Fig. 2, and the oar is ready to be taken out of the water for a new stroke. The "finish," or the taking of the oar from the water, is perhaps the most difficult and important part of the stroke, for on it depend the ease and precision of the forward swing of the body, and the consequent power of endurance. It is an apparent paradox, but an unquestionable truth, that the greatest exertion and distress in rowing a fast stroke are incurred while the oar is *out* of the water. The reasons are, that the powerful contraction of the stomach muscles, which is essential to a long reach, is an extremely fatiguing movement, and also that the forward rush of the body necessarily tends to empty, and so distress, the lungs. Therefore it is most important to attain a steady *slow* movement forward of the trunk, contrasting strongly with the backward dash while the oar is in the water. Now, as the trunk cannot conveniently swing forward until the hands are away, it is necessary that the hands should be instantly shot away from the body when the stroke is ended, thus securing without exertion the two minor advantages of leaving the legs free to bend up at the proper time, and of allowing the hands to be kept at a uniform height with the oar-blade clear of the water. The hands, then, are dropped vertically downward, still touching the body, from the position shown in Fig. 2 until they nearly reach the lap, thus throw-

FIG. 2.

ing the oar-blade—which still remains perpendicular to the plane of the water—clean out into the air. As the hands reach their lowest point, the wrists are dropped, so that the oar-blade, revolving through a right angle, is turned parallel with the plane of the water, or "feathered." The arms are then instantaneously straightened and stiffened. All three motions—dropping the hands, turning the wrists, and shooting out the arms—should be so rapid as to appear simultaneous. We repeat, that in the machine-like regularity and rapidity of this movement lies the secret of all good rowing. Having got the hands out of the way, the body now reaches steadily forward with a uniform rotation from the hips, until the proper angle is attained for the beginning of a new stroke. The legs at the same time are bent upward and the seat slides forward, partly under the pull of the legs, partly under the forward impetus acquired by shooting out the hands. Body, legs, and arms are now again in the position of Fig. 1.

The important elements of a good style are therefore, *first*, a long, slow reach forward with the body; *second*, a rapid dash of the oar through the water; *third*, a neat and extremely quick finish with the hands. The first point is one too seldom seen in America, owing solely to the prevalent neglect of a sharp finish. The Oxford crew that rowed against Harvard in 1869 were particularly noticeable for their reach—the more so from the marked inferiority in this respect of the Americans. The dash through the water is a less uncommon merit. The Cornell and Yale crews of 1875 were conspicuous examples—the former of excellence, the latter of lamentable deficiency in this respect. A sharp finish, as it is the most difficult and important, so it is the rarest accomplishment. The Columbia College crew of 1874, though far from perfect, finished better than any American crew we can recall.

The art of rowing can only be acquired by the most patient and assiduous practice under the direction of a competent instructor. It can never be taught in a gymnasium or learned from a book; to excel in it requires not only sound health and strong limbs, but care and attention and experience; it is an art, like another, to be mastered only by those who unite to a natural aptitude the capability of taking infinite pains.

To those who wish to examine the theory further we can recommend but two books, the rest being wholly trash—*Boat-Racing*, by E. D. Brickwood (London, 1876), and Woodgate's *Oars and Sculls* (London and New York, 1874). To these we may add Macmichael's *Oxford and Cambridge Boat-Races* (London, 1870), which contains an admirable account of the actual preparation of some very famous crews. G. L. RIVES.

Rowlandson (MARY **White**), b. about 1636. She was the wife of Rev. Joseph Rowlandson, first minister of Lancaster, Mass.; on Feb. 10, 1676, the Indians surprised the town of Lancaster, burned it, and carried her and her

children into captivity, which lasted nearly three months. She was finally ransomed by some ladies of Boston, and in 1682, four years after the death of her husband, published a pathetic *Narrative of the Captivity and Removes of Mrs. Mary Rowlandson among the Indians*, which has been several times reprinted, last in 1828.

Rowles'burg, p.-v., Preston co., West Va., on Cheat River and Baltimore and Ohio R. R.

Row'ley, p.-v. and tp., Essex co., Mass., on the Atlantic Ocean and Eastern R. R. P. 1157.

Rowley (William), b. in England early in the reign of Elizabeth; was a dramatic author of little merit, but was associated with Middleton, Decker, Ford, Massinger, and Heywood in the authorship of some of their dramas. D. about 1625.

Row'no, or **Rovno,** town of Russian Poland, government of Volhynia, on the Ustja, has some manufactures. P. 5406.

Row'son (Susanna **Haswell**), b. at Portsmouth, England, in 1762; came to Massachusetts with her father, a British naval officer, in 1767, when they were wrecked on Lovell's Island in Boston harbor; resided at Nantasket until 1776; returned to England; married William Rowson, a musician, 1786; became an actress; performed successfully in Baltimore and Boston 1795–96; taught school at Medford, Newton, and Boston; published several educational works and comedies, and many novels, among which *Charlotte Temple* was very popular. D. at Boston Mar. 2, 1824. (See her *Memoirs*, by Rev. E. Nason, 1870.)

Roxana. See Alexander.

Roxa'na, p.-v., Baltimore hundred, Sussex co., Del. P. 114.

Roxana, p.-v. and tp., Eaton co., Mich. P. 1144.

Rox'borough, p.-v., cap. of Person co., N. C., near the source of the Neuse River. P. 1117.

Rox'burgh, county of Scotland, bounded S. by the English counties of Northumberland and Cumberland, comprises an area of 715 sq. m., with 53,965 inhabitants. Its southern and western parts are hilly, covered with the Cheviots and Lauriston Hills; in the northern and eastern parts the surface is generally level, and the fertile and productive soil is cultivated with the utmost care. Large herds of sheep are kept on the pastures of the hills; manufactures of woollens are carried on; coal, lime, marl, and freestone are found. Principal towns, Jedburgh and Kelso.

Roxburgh (William), M. D., b. at Underwood, Ayrshire, Scotland, June 29, 1759; received a medical education at Edinburgh; settled as a surgeon at Madras, India, where he devoted himself to botany, and afterward at Calcutta, where he was associated with Sir William Jones as a leading member of the Asiatic Society and contributor to its publications; became keeper of the botanical garden at Calcutta, and received three gold medals from the Society of Arts for important discoveries, especially those in regard to the coloring-matter of the lacca insect and the cultivation of hemp in Bengal. D. at Edinburgh Apr. 10, 1815. His chief work is the *Plants of the Coast of Coromandel* (3 vols. folio, 1795–1819).

Roxburghe (John **Ker**), Duke of, b. at Bristol, England, in 1746; succeeded to the title 1755, and d. at London Mar. 19, 1811. He spent a large fortune in accumulating an immense collection of rare and curious books, which was sold by auction 1812, some of them bringing enormous prices. In memory of the event the "Roxburghe Club" was formed in that year for reprinting rare books.

Roxburghe Club, an association of gentlemen in Great Britain, organized in 1812, for the purpose of printing valuable MSS. and reprinting rare books. The number of copies of any one book from the Roxburghe Club is always small, and none are put into the market. The club was named in honor of John, duke of Roxburghe (1746–1811), a famous bibliophile.

Rox'bury, p.-v. and tp., Litchfield co., Conn., on Housatonic River and Shepaug R. R. P. 919.

Roxbury, p.-v. and tp., Oxford co., Me. P. 162.

Roxbury, formerly a city of Norfolk co., Mass., now a part of Boston, situated 3 miles from State street, Boston, was the earliest settlement inland, the only communication to Boston by land being through it. It was settled in 1630, and had such famous men among its first inhabitants as John Eliot, the Indian apostle, Thomas and Joseph Dudley, afterward governor, and Robert Williams, the progenitor of the race bearing his name. In Revolutionary times it contributed much to our country's history, being the birthplace of Gens. Warren and Heath. The patriot army occupied the heights of the town to invest Boston, and Gen. Washington moved at its head on their march into the city on Evacuation Day, Mar. 17, 1776, a century ago. It founded a free school in 1642, endowed afterward with money and lands by Thomas Bell in 1645, and others. It is now one of the first Latin schools for the preparation of boys for college, and is supported by the income of its funds. In 1846, Roxbury was made a city, with a population of 17,000. It had but 3 churches till 1820; now it has 36, of which 6 are Roman Catholic; 1 nunnery, and 5 institutions for the reformation of wayward and orphan Roman Catholic children; a charitable society, which has an invested fund of $150,000, the income of which is dispensed to the poor; 2 national banks, 2 savings banks, 2 weekly newspapers, 1 musical society, 2 Masonic lodges and a commandery. Its manufactures embrace soap and candles, beef-packing, rubber-making (which received such an impetus from the inventions of its townsman, Goodyear), rope and cordage, organs, locomotives, painted floor-carpets, woollens, watches, lead, and fire-engines; the phosphate-works, the Roxbury gasworks, the Whittier Machine Co.; the extensive breweries have acquired great distinction for their excellence. On its streams are established mills, tanneries, and foundries. The salt water is navigable, and hundreds of cargoes of coal, wood, hay, etc. are landed annually on its wharves. Here the first omnibus line was run, and the first horse railroad in New England in 1855, between Roxbury and Boston, now an immense corporation. The original territory now embraces a population of 60,000, but a portion was set off in 1851 as a new town. In 1868 the whole was annexed to Boston. Absorbed in one great city, its identity is lost. Multitudes doing business in the city find its hillsides a pleasant abiding-place, abounding in beautiful drives, and from among its citizens the last chief magistrates, Mayors Gaston and Cobb, were taken. It has always been noted for the patriotism and public spirit of its citizens, and measures are on foot to erect a monument to Gen. Joseph Warren.

F. Williams, late Ed. "Suffolk Co. Journal."

Roxbury, tp., Cheshire co., N. H. P. 174.

Roxbury, tp., Morris co., N. J. P. 3320.

Roxbury, p.-v. and tp., Delaware co., N. Y., on New York Kingston and Syracuse R. R. P. 2188.

Roxbury, p.-v. and tp., Washington co., Vt., on Central Vermont R. R. P. 916.

Roxbury, p.-v. and tp., Dane co., Wis., on Wisconsin River. P. 1207.

Rox'obel, p.-v., Bertie co., N. C. P. 1384.

Rox'ton Falls, p.-v. of Shefford co., Quebec, Canada, 60 miles E. of Montreal, has manufactures of leather and dyestuffs, and a fine stone church. It is on Black River. P. 992.

Roy (William), R. A., F. R. S., b. near Lanark, Scotland, May 4, 1726; was employed as colonel in the army in a military survey of the Scottish Highlands 1746–55; rose to the rank of major-general, and made the first trigonometrical survey in Great Britain, being the line from Dover to Greenwich, 1783–88—a work which proved the germ of the Ordnance Survey. D. in London July 1, 1790.

Roy'al, tp., White co., Ark. P. 732.

Royal Academy. See Academy, by Prof. J. Thomas, M. D., LL.D.; and Society, by Porter C. Bliss, A. M.

Royal Centre, p.-v., Boone tp., Cass co., Ind., on Indianapolis and Chicago division of Pittsburg Cincinnati and St. Louis R. R. P. 306.

Royal Geographical Society. See Society, by Porter C. Bliss, A. M.

Royal Geological Society. See Society, by Porter C. Bliss, A. M.

Royal Oak, p.-v. and tp., Oakland co., Mich., on Detroit and Milwaukee R. R. P. 1520.

Roy'all (Isaac), b. in Massachusetts early in the eighteenth century; was a wealthy resident of Medford, which town he long represented in the general court; was for twenty-two years a member of the executive council; took part in the French war; was appointed brigadier-general 1761, being the first resident of New England who bore that title; adhered to the Crown in the preliminaries of the Revolutionary contest, for which reason he left the country Apr. 16, 1775; was proscribed and his estate confiscated 1778, and d. in England Oct., 1781, taking a noble revenge upon his persecutors by leaving 2000 acres of land in Worcester county as the endowment of a law professorship in Harvard College, now known by his name. There were other bequests equally liberal and patriotic. The town of Royalston, Worcester co., of which he had been one of the original proprietors (1752), commemorates his name. One

of his daughters married Sir William Pepperell, the younger.

Royal Society. See ACADEMY, by PROF. J. THOMAS, M. D., LL.D.; and SOCIETY, by PORTER C. BLISS, A. M.

Roy'alston, p.-v. and tp., Worcester co., Mass., on Miller River and Vermont and Massachusetts R. R. P. 1354.

Roy'alton, p.-v. and tp., Berrien co., Mich., on Lake Michigan and Chicago and Michigan Lake Shore R. R. P. 1040.

Royalton, p.-v. and tp., Niagara co., N. Y., on Tonawanda Creek and New York Central R. R. P. 4726.

Royalton, tp., Cuyahoga co., O., on Rocky River. P. 1089.

Royalton, p.-v., Amanda tp., Fairfield co., O. P. 158.

Royalton, tp., Fulton co., O. P. 871.

Royalton, p.-v. and tp., Windsor co., Vt., on Vermont Central R. R. P. 1679.

Royalton, p.-v. and tp., Waupaca co., Wis., on Wolf River. P. 953.

Royer-Collard' (PIERRE PAUL), b. at Sompuis, department of Marne, France, June 21, 1763; studied law, and practised as an advocate in Paris when the Revolution broke out. In the beginning he took part with enthusiasm in the political movements, but being a moderate and a royalist, his position soon became dangerous, and after the fall of the monarchy (Aug. 10, 1792) he fled from Paris, and lived concealed at Sompuis during the Reign of Terror. Elected a deputy from the department of Marne, he took his seat in 1797 in the Council of Five Hundred, but in the same year, by the revolution of Sept. 4, he was expelled from the Assembly as a royalist. He still remained in Paris, participating in the various schemes of the royalists, but after the crowning of Napoleon as emperor he retired from political life, returned again to Sompuis, and devoted himself wholly to the study of philosophy. From 1811 to 1814 he was professor of philosophy at the University of Paris, and in spite of the short duration of his term he exercised a decisive influence. He had studied and partially adopted the system of the Scottish philosophers, and from this standpoint he raised a successful opposition to the sensualism of Condillac. Jouffroy, Cousin, Guizot, etc. became his disciples. After the Restoration he was made director of the Royal Library and president of the department of public education, in which position he developed great activity; but when, in 1820, the ultra-royalist party came into power, he resigned his office and became the leader of the liberal opposition in the Legislative Assembly, the creator of a new party, the *Doctrinaires*, comprising the moneyed and educated middle class of the people, and the champion of the constitutional monarchy in France. He was exceedingly popular, and contributed, no doubt, more than any other person to the revolution of July, 1830, which may be considered as a realization of his ideas. Nevertheless, after that period he took part less and less in public life, and it was no secret that he felt disappointed at his party and his disciples, including Guizot. D. at Châteauvieux, Loir-et-Cher, Sept. 4, 1845. His philosophical writings remained mere fragments. His *Life* has been written by Barante (1861) and Lacombe (1863).

Roy'er's Ford, p.-v., Upper Providence tp., Montgomery co., Pa., on Schuylkill Canal and Philadelphia and Reading R. R.

Royle (JOHN FORBES), M. D., F. R. S., b. in England in 1800; acquired a fondness for botany while studying medicine; became a physician in the service of the East India Company; spent much time in the Himalayas, where he was superintendent of the company's botanic garden at Seharunpoor; published his great work, *Illustrations of the Botany and other branches of the Natural History of the Himalaya Mountains* (1833–40); wrote many valuable scientific papers upon India; was one of the promoters of the culture of tea, cotton, and other foreign plants in India; became lecturer on materia medica at King's College, London, secretary of the British Association, and took an active part in the preliminaries of the Universal Exposition of 1851. D. at Acton, near London, Jan. 2, 1858.

Rshev, or **Rzhev,** town of Russia, government of Tver, on both sides of the Volga, is well built, has many educational and benevolent institutions, and carries on a lively trade in fish, hemp, and linens. P. 19,660.

Ruatan', or **Roatan,** an island of the Caribbean Sea, in the Bay of Honduras, belongs to the republic of Honduras. It is 30 miles long, 9 miles broad, and has about 2000 inhabitants, employed in the cultivation of the soil and catching the fine turtles which abound along the coasts.

Rubasse, a variety of crystallized quartz, charged with specks of iron oxide, which give it a fine red color. It is very handsome, and quite valuable when really perfect. There are artificial rubasses of all colors made from rock-crystal.

Rubefa'cients [Lat. *rubefacere*, "to make red"], in medicine, agents capable of producing congestion, and thus *redness* of the skin, by local contact. Such irritant applications have in some unknown way often the power of relieving congestion, pain, spasm, or undue irritability of deep-seated organs, and are much used for the purpose in therapeutics. Very many drugs have the property of reddening the skin, all blistering agents producing simple hyperæmia as the initial effect of their irritation, but the means most employed strictly as rubefacients are the following: *heat*, by means of hot baths, cloths wrung out in hot water, bottles of hot water, or heated solids, as earthen platters, bricks, bags of sand, etc.; *mustard*, in the form of prepared mustard-paper moistened or thick poultices of mustard-meal mixed with *cold* water; *oil of turpentine*, applied by means of flannels first wrung out in hot water and then in the oil previously warmed; *capsicum* (cayenne pepper), in the form of poultice, or, better, as a lotion mixed with hot spirits; and *ammonia*, in the form of liniment of ammonia (volatile liniment). Plaster of Burgundy pitch and resin cerate are also feebly rubefacient.

EDWARD CURTIS.

Ru'bens (PETER PAUL), b. at Siegen, Westphalia, June 29, 1577. His father, a wealthy citizen of Antwerp, who had left his native country on account of the political and religious troubles under which it suffered, settled in Cologne, where he died in 1587. The widow returned to Antwerp, and here young Rubens received his first instruction in the art of painting from the landscape-painter Verhaagt and the historical painters Van Noort and Van Veen. In 1600 he went to Italy with letters of recommendation from the viceroy of the Netherlands, the archduke Albert and his wife, the infanta Isabelle; and Vicenzio di Gonzaga, the duke of Mantua, invited him to his court and appointed him court-painter. He stayed here eight years, making frequent journeys to Rome and Naples, studying the Italian masters with energy and success, and painting several fine pictures himself, which made him quite famous. On the death of his mother, in 1608, he returned to his native country, and was appointed court-painter by the viceroy. He settled in Antwerp, built an elegant mansion, and lived in great style. His masterpieces, the *Descent from the Cross* and the *Elevation of the Cross*, belong to this period. The duke of Mantua sent him on a diplomatic mission to the Spanish court, and in Madrid he not only painted the portraits of the king and many of the grandees, but he won their esteem and fulfilled his mission with success. The infanta also employed him in diplomatic negotiations, and it was actually he who brought about and concluded the treaty of peace between Philip IV. of Spain and Charles I. of England. His fame as a painter was, of course, vastly increased by his success as a diplomatist, and he was soon unable to fill all the orders he received. He worked very rapidly, and his talent was as rich and energetic in execution as in conception. But he has left over 1800 pictures, most of which are very large, and even the quickest eye and the swiftest hand could not have performed such a task unaided. In many of his works, executed after 1620, only the outlines and the finishing touches are his; the rest is by some of his pupils, of whom he gathered a great number around him, and among whom many became great painters themselves; as, for instance, Van Dyck, Jordaens, and Van Thulden. In his last days he could not paint at all, suffering very severely from the gout. D. at Antwerp May 30, 1640. He was immensely rich, and left large and valuable art-collections, which were sold partly to Spain, partly to England. He worked in all the different branches of the art. He painted Madonnas, historical, mythological, and allegorical subjects, landscapes, animals, genre pieces, portraits; he painted everything. And in most branches he not only excelled, but exercised a considerable influence. His ideas are often coarse, but they are always powerful; his execution is often mannered, but it is always brilliant. The exuberant animal spirits, the passion for stirring action and full enjoyment, which characterized his time, characterize also him. The general tone of his pictures is vigorous and joyful. But not a few of his characters represent that stage of mental development in which voluptuousness ceases and cruelty begins, and instances of that shy tenderness and unconscious dignity which are traits of human beauty belonging to its highest ideal are exceedingly rare in his pictures. Of the technicalities of his art he was a perfect master, and the effect of his coloring is generally very exhilarating and joyful on account of the strong and

powerful contrasts which he blends into harmony. But sometimes these brilliant contrasts, this vigorous harmony, are exceedingly untrue, and there are pictures of his which make rather a puerile impression, solely on account of the reckless audacity with which forms and colors are used. CLEMENS PETERSEN.

Ruberyth'ric [Lat. *rubia*, "madder," and ἐρυθρός, "red"] **Acid** ($C_{20}H_{22}O_{11}$), a crystalline glucoside found in madder-root by Rochleder. It forms yellow prisms having a silky lustre. It has a faint taste; is sparingly soluble in cold, readily in hot water; gives a golden-yellow solution in alcohol and in ether, and a blood-red solution in alkalies. It gives red precipitates with baryta-water, with an alum solution after the addition of ammonia, and with basic acetate of lead after addition of a little alcohol. Schunck did not find this acid in madder, and considers it a product of the decomposition of rubian. Rochleder considers rubian to be impure ruberythric acid. He obtained from 25 pounds of madder only 1 gramme of this acid. This acid is converted by acids, alkalies, and *erythrozyne* (madder ferment) into alizarine and glucose.

$$\underset{\text{Ruberythric acid.}}{C_{20}H_{22}O_{11}} = \underset{\text{Alizarine.}}{C_{14}H_8O_4} + \underset{\text{Glucose.}}{C_6H_{12}O_6} + H_2O.$$

(See RUBIAN, ALIZARINE, MADDER, etc.)

C. F. CHANDLER.

Rubia'ceæ [from *Rubia*, the madder genus, so named on account of the red roots], a large natural order of exogenous gamopetalous plants, herbs, shrubs, and trees found in all parts of the world, but largely tropical. It is briefly defined by having opposite entire stipulate leaves, and regular flowers with an inferior ovary, and stamens borne on the corolla, as many as its lobes, and alternate with them. The exceptions to this relate to a tribe most numerously representing the order in temperate regions, the Stellatæ, to which *Rubia* itself belongs, and in which the leaves are in whorls without stipules; but here the accessory leaves are supposed to represent the latter. The order is rich in medicinal and economical products, furnishing as it does Peruvian bark (*Cinchona*), ipecac, one kind of catechu (or gambier), madder, and coffee. One or two tropical trees of the family yield edible fruits. A. GRAY.

Rubian [Lat. *rubia*, "madder"] ($C_{16}H_{16}O_8$), a glucoside discovered in madder-root by Schunck in 1847. It is obtained by treating a hot decoction of madder with boneblack, washing this to remove chlorogenine, extracting it repeatedly with boiling alcohol, and evaporating to dryness. It is then dissolved in water, precipitated with acetate of lead; the lead compound is decomposed by sulphuretted hydrogen, and the filtrate is evaporated to dryness. As thus obtained, it is a brittle, amorphous mass, resembling gum-arabic, deep yellow in thin layers, dark brown in masses. It is very soluble in water, less soluble in alcohol, and insoluble in ether, which precipitates it from alcohol in brown drops. It is very bitter. Boiled with dilute acids or caustic alkalies, or treated with *erythrozyne* (madder ferment), it is resolved into glucose, alizarine, and perhaps other products:

$$\underset{\text{Rubian.}}{2C_{16}H_{16}O_8} + 6H_2O = \underset{\text{Alizarine.}}{C_{14}H_8O_4} + \underset{\text{Glucose.}}{3C_6H_{12}O_6}.$$

Others consider the reaction as follows:

$$\underset{\text{Rubian.}}{C_{26}H_{32}O_{16}} = \underset{\text{Alizarine.}}{C_{14}H_8O_4} + \underset{\text{Glucose.}}{2C_6H_{12}O_6}.$$

It is not yet determined whether there are several glucosides in madder which are decomposed by the ferment, one yielding alizarine, another purpurine, etc., or whether there is but one, from which all the coloring-matters are developed. Schunck favors the former view, while the investigations of Kopp, Schützenberger, and Bolley favor the latter. (See ALIZARINE, MADDER, RUBERYTHRIC ACID, etc.) C. F. CHANDLER.

Ru'bicon, a small river of Italy, flows into the Adriatic, and formed in the time of the Roman republic the boundary between Italy and Gallia Cisalpina. Thus, it became actually a declaration of war when Cæsar, who was proconsul of Gallia, marched his army beyond the Rubicon. When he arrived at its banks he hesitated, and the exclamation with which he then passed the river and pushed forward, *Jacta est alea*, has since become a common expression whenever an important decision is made.

Rubicon, tp., Huron co., Mich., on Lake Huron. P. 746.

Rubicon, p.-v. and tp., Dodge co., Wis., on Northern division of Milwaukee and St. Paul R. R. P. 1995.

Rubid'ium [Lat. *rubidus*, "red"], one of the alkalimetals, discovered by Kirchhoff and Bunsen in 1860 as one of the first fruits of spectroscopic investigation. It occurs in extremely minute proportions in some saline mineral waters, in association with LITHIUM and CÆSIUM (which see). The water of Bourbonne-les-Bains contains in 1,000,000 parts 19 parts of chloride of rubidium. Some lepidolites contain it, associated with lithium and cæsium. Among these are the lepidolite of Hebron in Maine, which contains about $\frac{1}{500}$th of its weight. The ashes of some plants show it, the tea and the coffee plant being among these. It is a white metal with a yellowish tinge and silvery lustre. Density = 1.52. It is as soft as wax, melts at 101.5° F., and yields even below a red heat a vapor of a greenish-blue color. It is more easily oxidized by the air than potassium, and is more electro-positive than the latter. It kindles on water, and burns just like potassium. Rubidium has much the largest *molecular volume* of any known metal, though in this respect it might be surpassed by cæsium, whose density has not yet been discovered. The molecular volume of metallic rubidium is 55.921, that of potassium, which ranks next to it in this respect, being but 45.22. (See VOLUMES, MOLECULAR.) HENRY WURTZ.

Ru'binstein (ANTON), b. at Vechvotynez, village in the Russian province of Bessarabia, near the Roumenian frontier, Nov. 30, 1830, of Jewish descent; was educated at Moscow in the Greek faith; received his first musical instruction from his mother; studied in Paris 1840, and in Berlin, under Dehn, 1845; settled in 1848 at St. Petersburg, where he produced his first compositions and founded in 1850 a conservatory of music, of which he was the director to 1860; afterward made extensive concert-tours in Europe and America. As a pianist he ranks among the first. His compositions comprise several operas—*The Demon* (St. Petersburg, 1875), *Kinder der Haide* (Vienna, 1861), *Die Maccabäer* (Berlin, 1875); several symphonies, of which the *Ocean Symphony* has become very celebrated; and a number of minor compositions.

Ruble. See ROUBLE.

Ru'bric [Lat. *rubrica*, as being originally written with red earth], any writing or printing in red ink. In MS. and printed missals the directions to the prayers and offices were usually in red ink; hence rubric commonly signifies the order of the liturgy in church services. As the date and place on a titlepage were sometimes printed in red ink, and the place where the book was sold was given instead of that where printed, the word "rubric" has also come to signify the false name, as many books printed at Paris bear the *rubric* of Genoa, London, etc.

Ruby. See PRECIOUS STONES, by PROF. H. B. CORNWALL. E. M.

Ru'by Valley, p.-v., Elko co., Nev. P. 153.

Ruck'ersville, p.-v. and tp., Greene co., Va. P. 1514.

Rück'ert (FRIEDRICH), b. at Schweinfurt, Bavaria, May 16, 1788; studied philology and belles-lettres at Jena; engaged in journalism at Stuttgart 1815–17; spent a year in Rome 1818; settled for several years at Coburg, occupied in philological and poetical pursuits; was appointed professor of Oriental languages at Erlangen in 1826, at Berlin in 1841, and retired in 1849 to his estate, Neuses, near Coburg, where he d. Jan. 31, 1866. He is generally considered as one of the greatest lyrical poets of Germany, and his lyrical poems, *Deutsche Gedichte* (1814), *Kranz der Zeit* (1817), *Oestliche Rosen* (1822), *Gesammelte Gedichte* (6 vols., 1834–38), are often very impressive, though rather on account of their gorgeous imagery and brilliant reflections than their sympathetic power. But their most striking characteristic is the astonishing power over the German language which they exhibit. There is hardly any metrical form ever employed in any literature which is not represented in these volumes by some masterly specimens; and the more difficult, entangled, and artificial the verse-form becomes, the more delicate, easy, and natural becomes the poet. His translations from Arabic, Persian, Sanskrit, etc., *Die Verwandlungen des Abu-Seid* (2 vols., 1826), *Nal und Damajanti* (1828), *Hamasa* (2 vols., 1846), *Amrilkais* (1847), *Sakuntala* (posthumous), are also considered masterpieces. His large didactic poem, on the contrary, *Die Weisheit des Brahmanen* (6 vols., 1836–39), is somewhat cold, and his dramas have no interest. A complete edition of his poetical works was published in 15 vols. (Frankfort, 1867 *seq.*). His *Life* has been written by Fortlage (1867) and by Beyer (1868).

Rud'dell, tp., Independence co., Ark. P. 1656.

Rud'der [Ang.-Sax. *rōther*], in boats and ships, is that part of the helm or steering apparatus which is in immediate contact with the water, is hung to the stern-post by pintle and brace hinges, and is governed by the tiller. (See HELM.)

Rud'diman (THOMAS), b. at Raggel, Banffshire, Scotland, Oct., 1674; graduated at King's College, Aberdeen; was tutor in a private family and parish schoolmaster at Laurencekirk until Dr. A. Pitcairne procured him the post of assistant keeper of the Advocates' Library at Edinburgh, when he turned his attention to philology and prepared his

Rudiments of the Latin Tongue (1714)—a work which still keeps its place in the Scottish schools, and entitles its author to be considered the greatest of Scotch grammarians. He published a fine edition of Buchanan's works (2 vols., folio, 1715); afterward became himself a publisher and printer to the University of Edinburgh; issued his *Grammaticæ Latinæ Institutiones* (part i., Etymology, 1725; part ii., Syntax, 1732); brought out a magnificent edition of Anderson's *Diplomata et Numismata Scotiæ* (folio, 1739); and produced his celebrated "immaculate" edition of Livy (4 vols. 12mo, 1751), in which no typographical error could be detected. D. at Edinburgh Jan. 19, 1757.

Ru'dolph, the name of two German emperors. RUDOLPH I., OF HAPSBURG, founder of the house of Austria, German emperor 1273–91, b. May 1, 1218, was the oldest son of Albert IV., count of Hapsburg and landgrave of Alsace, which countries he inherited after the death of his father in 1240. He was successful in enlarging his possessions, but it was, nevertheless, not the importance of his political position, but the righteousness and valor of his personal character, which gained for him the imperial crown, Sept. 30, 1273. In order to strengthen his authority among his vassals and procure the necessary support, he married his daughters to the two most powerful among them, the count-palatine, Louis, and Duke Albert of Saxony, and then marched against two others who refused to do homage, King Ottocar of Bohemia and Duke Henry of Bavaria. The latter was easily defeated; the former too, but Ottocar broke the truce concluded in 1276, and in the new war he was killed in the battle of the Marchfield, Aug. 26, 1273. Of his possessions, Rudolph gave Bohemia and Moravia to his sons, but Austria, Styria, Carinthia, and Carniola he separated from the heritage and gave to his own son, Albert, thus founding the state of Austria. Against his external enemies, the count of Savoy, the duke of Burgundy, etc., he was also successful, and his internal government was distinguished by justice and love of order and peace. He travelled from place to place in the empire, and sat in court on all important occasions, for which reason his people called him the living law—*lex animata.* D. Sept. 30, 1291, and was buried at Spires. His *Life* has been written by Lichnowski (1836) and Schönhuth (1843). —RUDOLPH II. (1576–1612), b. July 18, 1552, a son of the emperor Maximilian II. and Marie, daughter of Charles V., was educated at the Spanish court; crowned king of Hungary in 1572, of Bohemia in 1575, and elected emperor of Germany after his father's death, Oct. 12, 1576. He was superstitious, weak, and entirely in the hands of the Jesuits. Immediately after his accession to the throne the Protestant worship was forbidden throughout his Austrian dominions, the Protestant schools were closed, and the preachers and teachers banished. In the empire he espoused the cause of the Roman Catholic Church with violence, and the formation of the Protestant Union (May 4, 1608) and the Roman Catholic League (July 10, 1609) brought Germany to the very verge of civil war. Meanwhile, the Hungarians arose and Bohemia revolted. The house of Austria seemed near its ruin when Matthias, a younger brother of the emperor, took the lead in the affairs of the family, and compelled Rudolph to cede to him all his hereditary possessions (1611). Unable to maintain his authority in the empire, and embittered by his misfortunes, the emperor retired into private life, and d. at Prague Jan. 20, 1612. He felt some interest in science and literature, and several great scholars and scientists—as, for instance, Tycho Brahe—lived at his court. His *Life* has been written by Gindely (1863).

Rudolph, p.-v. and tp., Wood co., Wis., on Wisconsin River. P. 317.

Ru'dolstadt, town of Germany, capital of the principality of Schwarzburg-Rudolstadt, is beautifully situated on the Saale, and has a fine palace with a picture-gallery and a library, and manufactures of woollens, porcelain, and dyestuffs. P. 7084.

Rud'ra, in the Vedic mythology of India, was the name of the father of the Maruts or Storm-gods, and subsequently extended to embrace the Maruts themselves as a collective appellation. In the Puranas (see SANSKRIT LITERATURE) the conception had become so modified that Rudra was identified with Siva, the Destroyer, a non-Aryan divinity adopted into the Hindoo pantheon from the indigenous black races of India.

Rue, the *Ruta graveolens*, an herb of the Old World (order Rutaceæ), having a strong smell and powerful stimulant, and even poisonous qualities. It was once used as an aspergil for sprinkling holy water. It was believed by the superstitious to be a powerful charm against witches. It is used in some places for flavoring food.

Ruff (*Philomachus pugnax*), a wading bird of the subfamily Tringinæ, or sand-pipers, formerly very common in the fens and marshes of England, but which has nearly disappeared since its favorite haunts have been so largely reclaimed and cultivated. It is still found throughout Northern Europe and Asia, migrates southward in winter, has recently been introduced into the U. S., being found chiefly on the Atlantic coast in New Jersey and Long Island, and feeds on worms and insects. The ruff derives its name from a circlet of long, closely-set feathers upon the neck of the adult male, which he raises or lowers at pleasure. The male ruff is polygamous, courageous, and pugnacious, is about ten inches in length, with the head and shoulders of a dark purple, barred with chestnut, the back chestnut spotted with black, the wings brownish-black, each feather having a white shaft, and the tail brown mottled with black. No two male birds are colored exactly alike. They are taken alive in great numbers in Holland with a net, are fattened for market, feeding on bread and milk with bruised hempseed, and esteemed a great delicacy for the table. The female is called a reeve.

Ruffed Grouse (*Bonasa umbellus*), a species of the family Tetraonidæ, recognizable at once among all the other grouse by the absence of feathers on the lower half of the tarsi; it has also, on the sides of the neck, a ruff of soft, broad, and truncate feathers, to which the name refers; the tail is somewhat convex, and about as long as the wings; the color of the cervical tufts is a glossy black or brown, with a semi-metallic steel-blue or greenish border; the tail has two bands of gray, and between them a broad black one. The species, as understood by Messrs. Baird, Brewer, and Ridgway, is generally distributed throughout the N. temperate parts of North America, but is differentiated into several varieties—viz. (1) *Umbellus,* inhabiting the country E. of the Rocky Mountains; (2) *umbelloides,* inhabiting the Rocky Mountains and the interior of British America up to Yukon River; and (3) *Sabini,* found in Oregon, Washington Territory, British Columbia, etc.; these are distinguished by slight differences of color. The species in some sections (New England and the West) is known under the name of partridge; in others (the Middle States) as the pheasant; and in some of the British provinces as the birch partridge. It is chiefly found in hilly and woody countries and along the borders of water-courses, but also in the lowlands and canebrakes, as in Kentucky, rarely or never, however, on open plains. Its movements when walking are quite graceful and stately. When disturbed it runs into the bushes, squats, and remains close to the ground. It is difficult to shoot on the wing, on account of its unsteady flight. It rarely wanders far from its nest and abiding-place during the nuptial season. THEODORE GILL.

Ruf'fin (EDMUND), b. in Prince Edward co., Va., in 1794; was for many years president of the Virginia Agricultural Society; edited the *Farmer's Register* 1833–42, and other agricultural papers; published several treatises on scientific methods of agriculture; was the editor of Col. William Byrd's *Westover Manuscripts* (1841); was an ardent secessionist; fired the first gun at Fort Sumter, Apr. 14, 1861, and committed suicide near Danville, Va., June 17, 1865, because he was unwilling to live under the U. S. government.

Ruffi'ni (GIOVANNI), b. at Tagia, in Liguria, in the second decade of this century; lived some time in Switzerland, then in England, and afterward for many years in Paris, occasionally visiting his native place. While an exile in London he gave lessons in Italian, wrote for journals, and published his romance, *Lorenzo Benoni.* After this followed his *Doctor Antonio,* and these two works are still considered his *chefs-d'œuvre.* His novels have been translated from English into German and Italian. In 1848 his fellow-citizens elected him deputy to the Subalpine Parliament.

Ruff'ner (HENRY), D. D., LL.D., b. in Virginia about 1788; became a Presbyterian clergyman, and was president of Lexington College, Va., 1837, and for many years thereafter. D. at Kanawha Dec. 17, 1861. Author of *Judith Bensaddi*, a romance, *The Fathers of the Desert, or an Account of the Origin and Practice of Monkery* (2 vols., 1850), a work of great research, and of many miscellaneous addresses and essays, the latest (1860) being an argument against the continuance of slavery in Virginia.

Rug'by, town of England, county of Warwick, on the Avon, 83 miles N. W. of London, has important horse, cattle, wool, and cheese fairs. Its celebrated grammar school, founded in 1567 by Lawrence Sheriff, of which Dr. Thomas Arnold was head-master 1828–42, has 14 teachers and about 500 students, and an income from endowment of nearly £5000. P. 8385.

Ru'ge (ARNOLD), b. at Bergen, island of Rügen, Sept. 13, 1803; studied philology and philosophy at Halle, Jena, and Heidelberg, but was sentenced in 1824 to five years'

imprisonment in the fortress of Colberg as a member of a secret political society; published in 1830 a translation of *Œdipus Coloneus*, a tragedy, *Schill und die Seinen*; was appointed professor of æsthetics at the University of Halle in 1831, and attracted much attention as a philosophical critic in the *Hallischen Jahrbücher* (1838–43); joined Karl Marx in Paris, and published with him the *Deutsch-französische Jahrbücher* (1843–45); published in 1845 *Zwei Jahre in Paris*; at Zurich and Leipsic published *Poetische Bilder* (2 vols.) and *Politische Bilder* (2 vols., 1847); was elected a member of the German Parliament in 1848, and founded in the same year the *Reform* at Berlin. This paper was soon suppressed, however, and, after some attempts at revolutionary intrigue in Dresden and Carlsruhe, he went in 1849 to London, where he formed a revolutionary committee with Ledru-Rollin and Mazzini. He has published *Unser System* (1850), *Aus früherer Zeit* (4 vols., 1862–67), *Manifest an das deutsche Volk* (1866), etc.

Rü'gen, an island in the Baltic, 1 mile off the coast of Pomerania, comprises an area of 361 sq. m., with 47,539 inhabitants, and belongs to Prussia. The soil is fertile, and the fisheries along the coasts very rich. Cap. Bergen.

Ru'ger (Thomas H.), b. in New York in 1833; graduated at the U. S. Military Academy 1854; practised law at Janesville, Wis., 1856–61; in June, 1861, entered the army; was appointed brigadier-general U. S. vols. 1863, and at the battle of Franklin, in command of a division, he won the brevet of major-general; in command of department of North Carolina until June, 1866; appointed col. 33d Infantry July, 1866; transferred to the 18th in 1869; supt. of the U. S. Military Academy at West Point 1871–76.

Rug'gles, p.-v. and tp., Ashland co., O. P. 758.

Ruggles (Daniel), b. in Barre, Mass., Jan. 31, 1810; graduated at West Point 1833; served in the Seminole and Mexican wars; was brevetted major and lieutenant-colonel for gallantry at Churubusco and Chapultepec, and served in the Confederate army, becoming major-general.

Ruggles (Samuel Bulkley), LL.D., b. in Conn. in 1800; grad. at Yale Coll. 1814; studied law; admitted to the bar in N. Y. City 1821; elected to State legislature 1838; canal com. 1839; pres. of canal board 1840 and 1858; was U. S. com. to the Paris Exposition 1866, to the international monetary conference at Paris 1867, and to the international statistical conference at the Hague 1869; and has published since 1831 a long series of pamphlets on subjects of political economy, law, and education. He has served upon many honorable public commissions, and is a member of numerous scientific organizations.

Ruggles (Timothy), b. in Rochester, Mass., Oct. 11, 1711; grad. at Harvard 1732; became a lawyer at Sandwich and Hardwick; was brig.-gen. and second in command at the battle of Lake George, 1755; judge of common pleas 1756; chief-justice 1762; Speaker of assembly 1762–63; delegate to Stamp Act congress at New York 1765; accompanied British troops to Nova Scotia, and was a founder of town of Digby. D. at Wilmot, N. S., Aug. 4, 1795.

Ruhmkorf (———), b. in Hanover, Germany, in 1803; went to Paris in 1819; porter in Chevalier's laboratory; constructed physical apparatus; brought out a convenient form of thermo-battery in 1844; in 1851 produced his famous "Ruhmkorf coil," which gave sparks 18 inches long and pierced glass 2 inches thick; in 1858 received government prize of 50,000 francs for his discovery. D. at Paris Dec. 20, 1877.

Ruhr'ort, town of Rhenish Prussia, at the influx of the Ruhr in the Rhine, has a large trade in coal, timber, corn, shipbuilding, and shipping business. P. 7773.

Rule Britannia, a British national song or hymn, the words of which were composed by David Mallet (1700–65), and the music by Arne. It was first performed in 1740 as part of *Alfred* by Mallet and James Thomson.

Rule Ni'si, in law, is an order made by a court, generally on the *ex parte* application of one party to a pending suit, directing the other party to show cause against the granting of some relief specified therein. It is served upon or notice of it is given to the party against whom it was obtained, and it is then argued before the court like any other motion. The one showing cause is entitled to begin and to reply. The court in rendering its decision "makes the rule absolute"—*i. e.* grants the relief—unless (*nisi*) good cause has been shown, and in that case the rule is "discharged"—*i. e.* the relief is refused. In the English practice the term is principally used to designate the order which a party against whom a verdict has been given obtains from the court in bank, calling upon the successful party to show cause why such verdict should not be set aside for some error at the trial or because it is contrary to the evidence. John Norton Pomeroy.

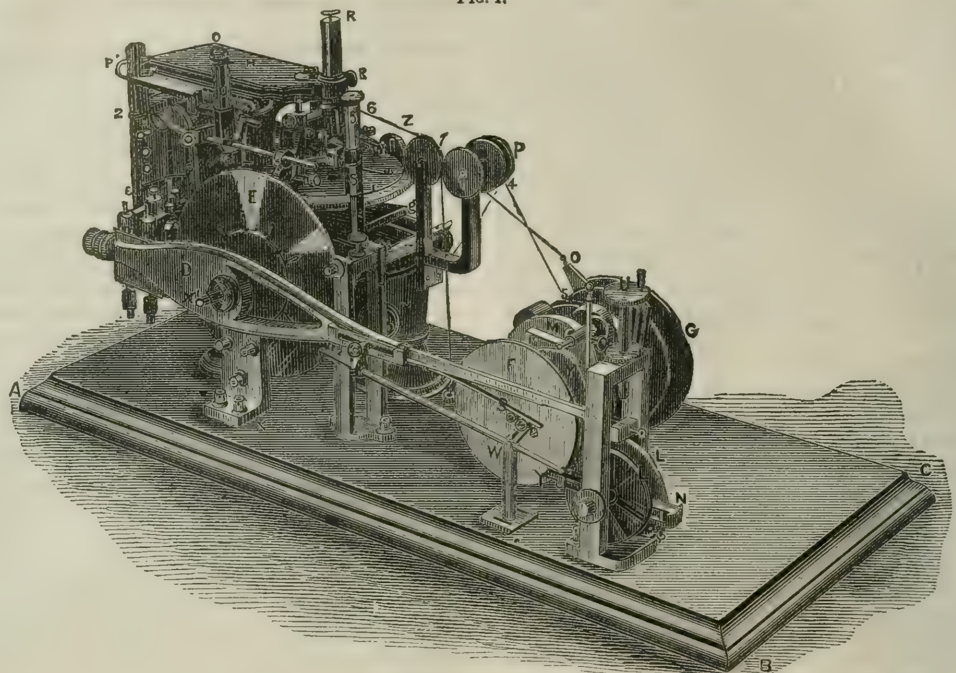
Rules of Practice. See Procedure, by Prof. J. N. Pomeroy, LL.D.

Rule to Show Cause, in law, is an order made by a court, usually upon an *ex parte* application, directing the party against whom it is obtained to appear at a time designated before the court and show cause why some particular thing should not be done or relief granted. In this country it is chiefly used as one method of making a litigated motion, the moving party supporting his application, and the other showing cause against it, by means of affidavits. John Norton Pomeroy.

Rul'ing-Machine. Of late years the art of ruling lines upon glass or metal, which shall be parallel, equidistant, and at the same time shall present sufficient uniformity of tint and breadth, when viewed with powerful optical means, to suffice either for delicate measurements, or the diffraction of a ray of light to obtain a spectrum, or to serve as test-objects for microscopes, has received considerable attention. Among the most successful attempts may be mentioned those made by F. A. Nobert of Barth in Pomeranian Prussia, who has ruled lines of exquisite beauty which have been resolved up to 112,600 lines to the inch. Nobert has ruled, he says, one band which is so fine as to contain 240,000 lines to the inch; but our present optical power is not sufficient to enable these lines to be counted by microscopists. Specimens of these plates are in possession of Dr. F. A. P. Barnard of Columbia College, New York, and of Col. Dr. J. J. Woodward of the Army Medical Museum, Washington, D. C. L. M. Rutherfurd of New York has ruled a number of diffraction gratings, both in speculum metal and on glass, varying in fineness, with the end in view of lines equally spaced and uniform in width for diffraction-gratings. These gratings are justly celebrated for the fine definition they give to the spectrum formed by their means and the extreme precision of the spacing. Still more recently, W. A. Rogers of the Harvard College Observatory, whose aim has been to produce lines of extreme fineness for reticules in optical instruments, and for the more delicate tests for microscopic objectives, has been able to rule lines 60,000, 80,000, and even 120,000 to the inch. Mr. Fred. Habirshaw of New York has in his possession two plates of this last degree of fineness. The following is a brief description of the machine used by Mr. Rogers in his rulings.

It consists essentially of the following parts: (1) A mahogany base, A B C, on which the metallic parts of the machine rest. (2) A steel screw 10 inches long and $\frac{3}{4}$ of an inch in diameter, which is cut with 24 threads to the inch. This screw has a circle 11 inches in diameter, and graduated into 100 equal parts on its circumference for its head. The graduated circle is shown at E, and the screw itself is concealed under the horizontal circle I. This screw carries a nut which is attached to the under side of a plate, to which is affixed the centre around which the horizontal circle I may be made to move. The circle E is read by the microscope O O', which contains in its field of view a scale divided into 100 equal parts, whose terminal points are made to coincide with two of the consecutive divisions in the circumference of the circle E, and since this circumference is divided into 100 equal parts, it is obvious that by revolving this circumference so that one of its divisions shall pass over the space included between two divisions in the reticule of the microscope O O', we shall have turned the screw $\frac{1}{10000}$th of an entire revolution, and consequently have moved the nut which carries the horizontal circle I a space equal to $\frac{1}{240000}$th of an inch. By estimating fractional parts of the distance between two consecutive divisions of the scale in the field of view of the microscope, the circle E might be revolved through even a smaller portion of its own circumference than the $\frac{1}{10000}$th part. (3) A heavy iron plate H supported on two ways, which are carefully ground, and permit the plate to move in a direction perpendicular to the axis of the screw before described. This iron plate carries an upright bar R R', to the lower extremity of which is attached the mechanism for holding the diamond used in ruling. At R' and at 1 cords are attached acting over pulleys at 2 and 7, and carrying weights at their other ends, so that if one of these weights be lifted, the other weight will act to move the iron plate H with its attachments in one direction, and the plate H may be made to move in the opposite direction by lifting the second weight. Thus, it will be seen that the plate H may be made to move forward and backward in the most equable manner, provided there are some means of causing these two weights to be alternately lifted at the proper times. This is accomplished by belting the wheel G to a small water-motor engine. Two eccentrics, placed 180° apart, revolve with the wheel G, and by an ingenious arrangement, of which the pulleys at 7, 4, 9 are a part, the weights which move the plate H are alternately lifted

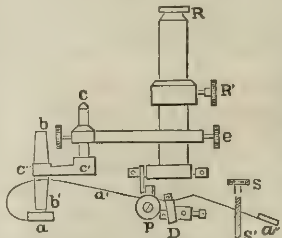
Fig. 1.



Rogers's Ruling-machine.

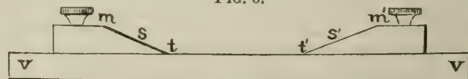
at the proper times. Instead of the water-motor engine applied at G, there is an arrangement by which magneto-electricity may be used through the revolving magnets shown at 5 M. Below E small spokes are shown by which the circle E may be moved by hand, but in the nicest ruling it is desirable that the screw should be moved automatically. (4) An arm D*d* moving on a centre at X′, and carrying at J two electro magnets swinging on pivots, so that their motion is in the direction of the arm D*d*, and consequently the magnets may be swung close against the circumference of the circle E, whose outer edge is made of soft iron, and constitutes the armature to the electro magnets. If now we pass an electric current through the magnets at J*z*, the magnets will swing upon their pivots, owing to their attraction of the soft iron in the rim of the circle, and will, by their pressure against the rim, produce enough friction to hold the rim immovably against the magnets while the bar D*d* is moved through any desired distance. Thus, a means is provided of moving the circle E a distance which may be made uniform for any consecutive number of times by simply allowing the end *d* of the arm D*d* to move between limits, the upper limit being the end of the screw whose head is shown at U, and the lower limit being a wheel L so arranged as to have one entire revolution in the same time as the large circle E. A revolving wheel is chosen in order to permit the screw to correct its own errors in the following manner: The electro magnets J receive the current through a wheel F S W, which revolves with the wheel G. Half its circumference is covered with ebonite, and the circuit is only complete when the projecting arm M, to which is attached the battery wire, is in contact with the *metal* half of the circumference of the wheel F S W; consequently, during one half a revolution of the wheel F S W the electro magnets J are attracting the soft iron circumference of the wheel E, and therefore the wheel E is firmly attached to, and may be moved by, the arm D*d* during one-half of the revolution of the wheel F S W. When the projecting arm M is no longer in contact with the metallic surface, but has broken the circuit by coming in contact with the ebonite half of the circumference, the eccentric *e* touches the spring S, and completes the circuit from a second battery through the wheel F S W, the spring S, the arm D*d*, and another electro magnet J′. This magnet now acts as did the former magnets J; but being attached to the base A B C by metal uprights, and swinging on horizontal pivots, it acts to hold the wheel E firmly during the half revolution of the wheel F S W when the magnets J are not exerting their power. Connected to the arm D*d* at V is a bar V W, pivoted at W, and as the point V is raised and lowered, the point Y′ is also moved, and in its motion carries a disconnected arm *down*, which is connected with the wheel L′ by an arrangement which permits the arm to move the wheel L′ in one direction, but not in the opposite one. The wheel L′ is permanently fixed to the same axis as the wheel L. The wheel L supports on its circumference the lower side of the arm D*d*. It will be seen from what has been stated that the screw should carry the plate which supports the circle I, and consequently the plate to be ruled, which is firmly held upon the circle I, a distance exactly proportional to the space between the lower end of the screw U and the uppermost point of the circumference of the wheel at L, provided that the revolution of the circle E through the same arc has the same value in the movement of the plate which carries the circle I in a direction parallel to the axis of the screw; but owing to various causes it is found that this value is not the same for different parts of the screw. To compensate for this irregularity, the amount of motion of D*d* for various positions of the circle E is found by observation, and the circumference of the wheel L is then so filed that its form will be such that the distance between the lowest point of the screw U and the upper surface of the wheel's circumference will be such that the arm D*d* shall be made to move through varying distances, which shall be so adjusted that a greater movement of the arm will compensate an irregularity of the screw which tends to shorten the value of a particular part of the circumference of E, and *vice versâ*. (5) A graduated circle I, which may be rotated, and its position noted by means of the microscope *ss*′. This circle carries the plate to be ruled, and it is made to rotate so that lines may be ruled making any desired angle with each other. (6) An apparatus for carrying the diamond while the line is being cut, and for raising it from the plate during the motion of the plate H in the opposite direction.

Fig. 2.



This apparatus is partly sketched in Fig. 2, where R R′ is the upright piece shown in Fig. 1, which is connected to the movable plate H by a collar and binding-screw R′. *a a′ a″* is a spring about 7 inches long, pivoted at *p*, so as to swing freely and to raise or lower the diamond held in any position by the screws at D. At *a* and *a′* two cups are fixed to hold any small weights added to give greater depth to the diamond cut. As this whole apparatus is carried

Fig. 3.

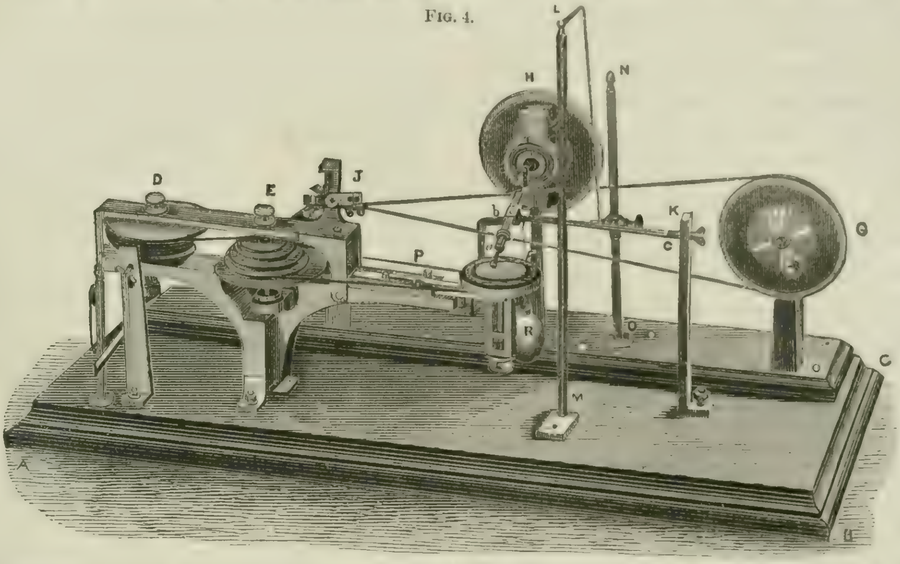


by the plate H in the direction A B, the slender screw *s s*′ moves down an inclined plane shown at *s t* (Fig. 3) until it

reaches the point t, when the screw glides into a channel cut in the bar $v\ v$, and the diamond is thus let fall gently upon the glass surface contiguous to the piece $v\ v$ on the circle I. So too the diamond is as gently raised from the glass by the surface $t'\ s'$. To prevent the diamond cutting as it is carried back to its first position for the next line, when the screw $s\ s'$ (Fig. 2) has just reached the upper surface of the plane m', a screw presses against the top b of an arm pivoted at c'' (Fig. 2), so that the lower end of the arm b' presses against the spring and holds it in the position in which it is when the diamond is lifted from the glass, until it reaches the point from which it started, and then another screw presses against b', and so releases the spring $a\ a'\ a''$, which now has the screw $s\ s'$ resting upon the plane m (Fig. 3), ready to be carried down the inclined plane $s\ t$, and thus rule the next line.

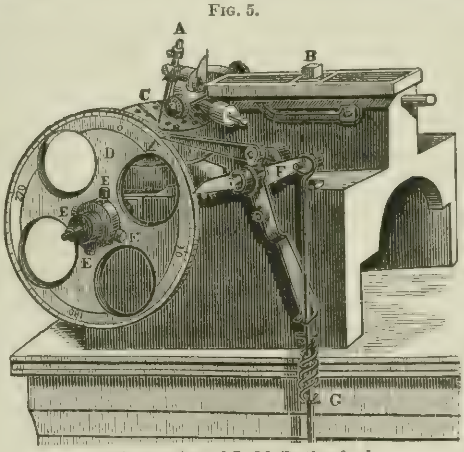
One of the greatest impediments to fine ruling is the difficulty of getting a diamond point which shall present a cutting edge sufficiently sharp. The following figure shows the arrangement in use by Mr. Rogers. The diamond to be ground is held by an arm $a\ a'$ upon the hard iron surface at F. By a system of pulleys at J, and belts, shown in the drawing, which connect two eccentrics at D and E, the diamond may be ground either to a conical point or to a knife edge, or to a point which shall have any desired number of faces. The diamond rests upon the plate F by simple gravity, but any additional pressure may be given to it by simply suspending a weight R from the arm which carries the diamond. This arm has a combination of a ball-and-socket and a hook joint, which permits motion in every direction.

Fig. 4.



The ruling-engine of Mr. Rutherfurd, referred to above, is simpler in construction than that just described, but performs its work with a truly wonderful precision. It is represented in Fig. 5. In this figure C represents a plate carrying the glass or speculum plate to be ruled, which is made to advance in short successive steps in a direction parallel to the axis of a screw with 48 threads to the inch. The head of this screw is formed of a circular plate D whose rim is notched with 360 equally-spaced teeth. In the drawing the pawl is shown pressing against one of these notches at X. The oscillating motion of the lever F causes the pawl to fall into a notch of the wheel D, and by its push to rotate the wheel by a definite fraction of its circumference, then to lift the pawl, and to retract it for another forward motion on the wheel D. While the screw is thus advancing the plate C, the diamond-pointed tool A is raised and carried forward above the surface of the glass or speculum plate. After the screw has ceased its rotation, the diamond point falls gently upon the glass or speculum plate on C, and then retracts and cuts a line. The above reciprocating motion of the tool A is caused by the action of the vertical arm of a lever which is attached to the same shaft which carries the lever F. A driving-wheel, revolved by a small turbine from which leads a cord, carries a crank-pin, which is jointed to the rod below G. The errors in the thrust of the screw caused by its eccentricity, or want of coincidence of the axis of figure of the screw and its axis of rotation, are corrected by giving to the feed-wheel D an eccentricity opposed to that existing in the screw. The screws at E E E E serve to alter the position of the centre of the feed-wheel D, and thus to give it the required eccentricity. L. Waldo.

Fig. 5.



Ruling-engine of L. M. Rutherfurd.

Ru'lo, p.-v. and tp., Richardson co., Neb., on Missouri River and Atchison and Nebraska R. R., has 1 newspaper. P. of v. 611; of tp. 1326.

Rülsk, town of Russia, government of Kursk, on the Seine, has several educational and benevolent institutions and some manufactures. P. 7029.

Rum, a spirituous liquor distilled from molasses. It is largely produced on the sugar-plantations in the West Indies, that from Jamaica being considered the best. The wort is prepared by mixing about 100 gallons of molasses, 300 gallons of skimmings from the clarifiers, 200 gallons of lees from previous fermentations, called *dunder*, and 400 gallons of water. This mixture averages about 15 per cent. of sugar. The fermentation is complete in from nine to fifteen days. It is then distilled, and molasses or caramel is added to color and flavor it. The peculiar flavor of rum is chiefly due to butyric ether, produced during the fermentation. Acetic and other ethers are also present. Pine-apples and guavas are often thrown into the still. Rum is greatly improved by age. Rum was formerly largely manufactured in New England, especially at Newport, R. I., and was a prominent article of exportation to Africa in connection with the slave-trade. Great quantities of rum are produced by flavoring and coloring rectified proof spirit. C. F. Chandler.

Ru'ma, town of Austria, in the Serbian waywodeship, on an affluent of the Save, has fine horses. P. 7800.

Rum'beke, town of Belgium, province of West Flanders, manufactures linen, lace, and chicory. P. 5625.

Rum'ford, p.-v. and tp., Oxford co., Me., on Androscoggin River. P. 1212.

Rumford (Benjamin **Thompson**), Count, b. at Woburn, Mass., Mar. 26, 1753; received a common-school ed-

ucation at Woburn and Medford; became a merchant's clerk at Salem 1766, and subsequently at Boston; devoted his leisure to the study of natural science, attending the lectures of Prof. Winthrop of Harvard; taught an academical school at Rumford (now Concord), N. H., 1771–72; married there a wealthy widow lady, Mrs. Rolfe; was appointed by the royal governor major of New Hampshire militia; sympathized with the early movements for resistance to British oppression, but was soon involved in rivalries and jealousies on the part of some of his brother-officers, who accused him of lack of patriotism; was unsuccessful in an application for a commission in the Continental service; found it expedient to leave Rumford, and afterward Woburn, on account of charges of disaffection; went within the British lines around Boston Oct. 10, 1775; went to England with Lord Howe's despatches after the fall of Boston 1776; obtained a position in the colonial office under Lord George Germaine; continued his scientific researches; was chosen F. R. S. 1778; became under-secretary 1780; went to New York 1781; raised a regiment of loyalists called "the King's American Dragoons," of which he became lieutenant-colonel; served in the Carolina campaign against Marion 1782; returned to England 1783; entered the service of the elector of Bavaria the same year; settled at Munich as aide-de-camp and chamberlain, and was knighted 1784; reorganized the Bavarian military service; acquired great influence with the elector, who took his advice on nearly every subject, made him major-general, councillor of state, lieutenant-general, commander-in-chief of the general staff, minister of war, and count of the Holy Roman empire 1790, on which occasion he chose as his title the name of the town in New Hampshire where he had resided and married. Many vigorous reforms were effected by Count Rumford in the Bavarian administration, as well as improvements in military training, in methods of agriculture, in the practice of mechanic arts, and in the introduction of improved breeds of stock; beggary was extirpated, and a handsome park improvised for the people of Munich out of an old hunting-ground in the vicinity. He travelled in Italy and England 1795; became president of the Bavarian council of regency 1796; published in separate pamphlets accounts of a large number of scientific experiments, which he collected under the title *Essays, Political, Economical, and Philosophical* (London, 3 vols. 8vo, 1796), which were reprinted in Boston (3 vols., 1798), and soon passed through 5 eds.; left the Bavarian service on the elector's death, 1799; was chiefly instrumental in founding the Royal Institution at London in that year; settled at Paris and published his *Philosophical Papers* (vol. iv. of his *Essays*, 1802); married the widow of Lavoisier 1804, and spent the remainder of his life in quiet prosecution of his scientific studies at his wife's villa at Auteuil, near Paris, where he d. Aug. 21, 1814. He contributed to science a considerable number of valuable observations and discoveries, especially upon his favorite subject, that of heat, of which he came near discovering the mechanical equivalent; made a series of experiments which directly conducted at a later period to the discovery of the correlation of forces; was also one of the pioneers of modern researches in optics and magnetism; left prizes to be awarded by the Royal Society of London and the American Academy of Sciences at Boston for discoveries on light and heat, and was himself the recipient of the first Rumford prize from the Royal Society; and endowed in Harvard College the Rumford professorship of the "physical and mathematical sciences as applied to the useful arts." (See his *Life*, by Rev. Dr. George E. Ellis, 1871, and his *Works*, edited by the same gentleman, London, 4 vols., 1876.) PORTER C. BLISS.

Rum'ley, tp., Harrison co., O., on Pittsburg Cincinnati and St. Louis R. R. P. 1158.

Rum'ney, p.-v. and tp., Grafton co., N. H., on Boston Concord and Montreal R. R. P. 1165.

Rump Parliament, the popular name applied in English history to a remnant of the Long Parliament, consisting of 60 members, who, after the expulsion of three-fourths of that body, Dec. 6, 1648 (known as "Pride's Purge"), were allowed by Cromwell to represent the farce of legislation, and co-operated with him and with the army in effecting the trial and condemnation of Charles I. The Rump, having attempted to resist certain encroachments of the army, was dissolved by Cromwell Apr. 20, 1653; was restored by a military movement during the protectorate of Richard Cromwell; was a second time expelled by the army Oct. 13, 1659; reassembled on the advance of Gen. Monk from Scotland 1660, and decreed its own dissolution Mar. 16, 1660.

Rum'sey, p.-v., McLean co., Ky., on Green River. P. 216.

Rumsey (JAMES), b. at Bohemia Manor, Cecil co., Md., about 1743; became a machinist; made several improvements in the mechanism of mills, and in Sept., 1784, exhibited on the Potomac River, in the presence of Gen. Washington, a boat which ascended the stream by mechanical appliances. Two years later he introduced a steam-engine of his own construction into his boat on the Potomac; obtained a patent for steam navigation from the State of Virginia 1787; published at Philadelphia his *Short Treatise on the Application of Steam,* which involved him in a controversy with John Fitch; organized at Philadelphia a "Rumsey Society" for the promotion of steam navigation 1788; went to England soon afterward; organized there a similar society; built a new steamboat; obtained patents in England, France, and Holland, and made a successful trip on the Thames Dec., 1792. D. suddenly a few days later at London, Dec. 23, 1792. The legislature of Kentucky presented in 1839 a gold medal to a son of Rumsey, "commemorative of his father's services and high agency in giving to the world the benefit of the steamboat."

Run'corn, town of England, county of Chester, on the estuary of the Mersey, has extensive shipbuilding yards, collieries, and quarries of slate and freestone. P. 10,434.

Ru'neberg (JOHAN LUDWIG), b. at Jakobstad, in Finland, Feb. 5, 1804, and studied, supported by a public subscription, at the University of Åbo from 1822 to 1827. In 1830 he became lector of æsthetics at the University of Helsingfors, but removed in 1837 to Borgo, and in 1842 became professor of Greek literature at that gymnasium. Although he was born in Finland and spent his whole life in that country, he wrote Swedish; and although he was liberally supported by the Russian government, he sung the valor and perseverance of his countrymen in resisting the invading and conquering Russians. These peculiarities of his position contributed, of course, their part to the immense popularity which his poems acquired both in Finland and Sweden, but his success was principally due to his talent. His genius was essentially lyrical; in that respect he resembled all other Swedish poets. But his lyrical faculty was delicately harmonious, not loud and exuberant, and it was accompanied by considerable plastic power. His numerous minor poems evinced a strong sense of reality. His idyls, *Hanna* (1836) and *Julquällen* (1841), and his tales in verse, *Elgskytterne* (1832) and *Nadeschda* (1841), are true epics, only with a lyrical swing in the outlines. His dramas, of which *Kungarne pa Salamis* (1863), a tragedy in antique form, is the most remarkable, contain real characterization. The most celebrated of his works is *Fänrik Ståls Sägner* (1844), a collection of ballads treating subjects taken from the war between Sweden and Russia, when Finland was conquered by the latter. The tone of these ballads is very varied, ranging from the highest pathos to an almost gossiping humor. But the rhythm is always harmonious and delicate, the picture striking and impressive, the feeling sound and strong. The book is read in Denmark, Norway, and Sweden by all who read books, and it contains some of the highest ideals which modern literature has created, in some of the simplest forms which modern art has produced. D. at Helsingfors May 6, 1877. CLEMENS PETERSEN.

Runes [Ang.-Sax. *rûn,* "secret letter"], the alphabet used by the Teutonic races of Northern Europe before their intercourse with the Romans and adoption of the Roman characters. The word *runa* means "a secret," and the name signifies the use to which in the earliest days the runic letters were chiefly applied—namely, as a depository of secrets. There existed three different systems—the Scandinavian, comprising 16 characters, the German, 22, and the Anglo-Saxon, more than 30—but they resemble each other so closely that they evidently were simple developments of the same original type. At what time this primitive alphabet first came into use is not known. The Scandinavian myths say that Odin was the inventor of the runes. But a similarity which exists between some of the runic characters and the corresponding ones of the Phœnician alphabet has occasioned the hypothesis that the runes were first brought to the peoples around the Baltic by Phœnician merchants. The runes were never used for literary purposes. In the earliest times they were cut on swords, utensils, ornaments, etc. as mystical—or, rather, magical—signs, and they were generally believed to exercise a latent but powerful influence. Later, they were much used for inscriptions on sepulchral monuments. They were, however, also used as a means of communication; a man would cut a message on a stick in runic characters and send it round to his friends. Still more extensive was the use which was made of the runic characters for the direct purpose of witchcraft. Tacitus tells us that the old Germans cut runes on sticks, mixed them together on a cloth, and endeavored to make discoveries or extract

revelations from the accidental combinations which the runes might form; and the old popular songs contain many stories of the magical power which runes exercised over the hearts and minds of men. With the introduction of Christianity the Roman alphabet was generally adopted and the runes fell into desuetude—in Scandinavia and England about the year 1000; in Spain they were condemned by the Council of Toledo in 1115. The most prominent among those who have studied the runes and written about them are the Icelanders Bynjulfsen and Finn Magnusen, the Swede Liljengren, the Danes Worsaae and Thortsen, the Englishmen Kemble and Stephens, and in Germany Wilhelm Grimme.

Rungpoor′, district of British India, presidency of Bengal, between 25° 16′ and 26° 21′ N., and bounded E. by the Brahmapootra. Area, 4112 sq. m. Pop. 2,559,000. The surface is very low, and in the wet season entirely inundated. Cotton does not succeed. Indigo is the principal product; 50 large factories are in operation.

Runjeet′ Singh, maharajah of the Punjaub, commonly known as the king of Lahore, b. at Gugaranwalla Nov. 2, 1780; lost his father, who was chief of one of the military organizations of the Sikhs, when he was only twelve years old. His mother, who governed during his minority, endeavored to spoil him and make him effeminate, but she failed, and when he was seventeen years old he poisoned her and assumed the reins of government himself. He was energetic and ambitious, and, although entirely uneducated, developed great tact and insight in all his undertakings. Unlike other Hindoo chiefs, he was faithful to treaties, and, unlike other Asiatic despots, he was bent not only on conquest, but also on raising his people to a higher standard of civilization. By the aid of French officers he organized and disciplined his army and subjugated the neighboring Sikh chiefs. Those, however, whose dominions were situated between the Sutlej and the Jumna asked for help from the British East India Company in 1809, and obtained it. An English army was sent against Runjeet Singh, but a friendly agreement was concluded by which the Sutlej was established as the boundary of his dominions. He then attacked the Afghans, conquered Cashmere in 1819 and Peshawer in 1829, and at his death at Lahore (June 27, 1839) he left an empire comprising more than 20,000,000 inhabitants and a disciplined army of 70,000 men. (See H. T. Prinsep, *Origin of the Sikh Power in the Punjaub, and Political Life of Runjeet Singh* (1839), and W. L. Macgregor, *Runjeet Singh*.)

Run′kle (John Daniel), LL.D., b. at Root, Montgomery co., N. Y., Oct. 11, 1822; graduated at the Lawrence Scientific School at Cambridge, Mass., 1851; developed a remarkable talent for mathematics and astronomy; was employed in 1849, while still a student, to assist in preparing the *American Ephemeris and Nautical Almanac;* has continued to take part in editing succeeding editions of that work; edited the *Mathematical Monthly* (1869–71); became professor of mathematics in the Massachusetts Institute of Technology 1865, and president of that institute 1870. Author of *New Tables for determining the Values of the Coefficients in the Perturbative Function of Planetary Motion* (*Smithsonian Contrib.*, 1856).

Run′nels, county of W. Texas, on N. fork of Colorado River, had no inhabitants in 1870. Area, about 750 sq. m.

Run′nymede, a long slip of green meadow stretching along the right bank of the river Thames, near Egham, in Surrey, England, memorable as the spot where the signature of King John to Magna Charta was extorted by the insurgent barons June 19, 1215. Charter Island, in the river close at hand, is sometimes claimed as the locality of this event, it being alleged that the river has since then changed its channel. Runnymede has also been from times immemorial noted for the annual Egham horse-races in August, whence some authorities derive the name (*i. e.* "Running-mead").

Rupee′ [Skr. *rûpya*], a silver coin current in India, usually estimated as equivalent to 2*s*. English. There have been a large number of rupees struck by different Indian princes, varying considerably in weight and value. The best known are the Sicca, Dacca, Furruckabad, Bombay, Madras, and East India Company's rupees.

Ru′pert, p.-v. and tp., Bennington co., Vt., on Rutland and Washington branch of Rensselaer and Saratoga R. R. P. 1017.

Rupert, or **Robert,** Prince, b. at Prague, Bohemia, Dec. 17, 1619, son of Frederick V., elector palatine and king of Bohemia, by his wife, Elizabeth, daughter of James I. of England; took part in the Thirty Years' war from childhood, having become a colonel of cavalry in active command at the age of eighteen years; was placed in command of a regiment of cavalry at the beginning of the civil war in England, and distinguished himself in nearly all the battles as the most dashing leader of the royalists. At the Restoration he was made a privy councillor and admiral of the fleet; was one of the founders of the Royal Society; first governor of the Hudson's Bay Company 1670; governor of Windsor Castle during the later years of his life; spent much of his time in painting and engraving, in experiments in mechanics, chemistry, and alchemy, and has been credited with the invention of mezzotint, of pinchbeck or "prince's metal," and of the glass bubbles called "Rupert's drops." D. at Spring Gardens, London, Nov. 29, 1682, and was buried in Westminster Abbey.

Rupert's Drops. See Prince Rupert's Drops.

Rupert's Land. See North-west Territories.

Ruphia, or **Rouphia,** river of Greece. See Alpheus.

Ru′pia [from the Gr. ῥύπος, "filth"], a severe and chronic skin disease, usually, but not always, syphilitic in its origin. It generally begins in blebs filled with a sanious fluid. These finally become ulcers covered by a thick scab. The disease appears in broken-down patients, and is to be met with tonics, good food, cleanliness, the use of iodide of potassium, etc. Locally, the ulcers may be poulticed and then touched with caustic.

Rupp (Isaac Daniel), b. near Harrisburg, Pa., July 10, 1803; author of *History of the Religious Denominations of the U. S.* (1844), *Early History of Pennsylvania and the West* (1846), and histories of nearly all the counties of Eastern Pennsylvania, in 6 vols. (1844–47).

Rüp′pell (Wilhelm Eduard Peter Simon), b. at Frankfort Nov. 20, 1794; visited Egypt in 1817, Nubia, Kordofan, and parts of Arabia 1822–27, Abyssinia 1833–34, and communicated the results of his researches in his *Fundgruben des Orients* (5 vols., 1818), *Reise in Nubien, etc.* (1829), *Neue Wirbelthiere zur Fauna Abyssiniens gehörig* (1835–40), *Reise in Abyssinien* (2 vols., 1838–40), *Systematische Uebersicht der Vögel Nord- und Ostafrikas* (1845). His collections of coins, antiquities, manuscripts, etc. he sold to the city of Frankfort.

Ruppin′, Neu, town of Prussia, province of Brandenburg, has tanneries, spinning-mills, manufactures of cloth and chicory, and several large cattle-markets. P. 10,303.

Rupture. See Hernia, by E. J. Bermingham, M. D.

Ru′ral, tp., Shelby co., Ill. P. 909.

Rural, v., Franklin tp., Clermont co., O., on Ohio River. P. 119.

Ruremonde. See Roermond.

Ru′rik, founder of the first Russian dynasty. See Russia.

Ru′schenberger (William S. W.), b. in Cumberland co., N. J., Sept. 4, 1807; educated at New York and Philadelphia; became a surgeon in the U. S. navy about 1826; made repeated voyages in the Pacific and the East Indies; was fleet surgeon 1835–37; director of the U. S. naval hospital, Brooklyn, 1843–47; wrote much on medical, scientific, naval, and literary topics, and retired from the service with the rank of commodore Sept. 4, 1869. Author of *Three Years in the Pacific* (1834), *A Voyage round the World* (1838), *Elements of Natural History* (1850), *A Lexicon of Terms used in Natural History* (1850), and *Notes and Commentaries during a Voyage to Brazil and China* (1854).

Rus′cumb Man′or, tp., Berks co., Pa. P. 1408.

Rush [Lat. *ruscum*], a common name for the Juncaceæ, a natural order of endogenous herbs, of which the genus *Juncus* is the type, and of various Cyperaceæ (mostly species of *Scirpus*), with naked, tough, and flexible stems. There are many species, mostly in wet and cold regions. They are employed in making chair-bottoms, mats, etc. Rushes are used in Europe for strewing the floors of cottages, instead of carpets. The pith of some kinds is used sometimes for a candlewick; hence the name "rushlight." Most of our numerous U. S. species are also European and Asiatic. *Juncus bulbosus* is the black grass of the salt marshes. This makes excellent hay. *Scirpus lacustris* and some nearly-related species are the bulrushes, of which the tule of California, Peru, etc. is one of the most important.

Rush, county of E. Indiana, watered by Big Blue, Little Blue, and Flat Rock rivers, and traversed by Cincinnati Hamilton and Dayton R. R., which intersects Columbus branch of Jeffersonville Madison and Indianapolis R. R. at Rushville. The surface is broken, consisting largely of table-land. The chief industries are agriculture, stock-raising, and lumbering, the staple products being Indian corn, wheat, wool, butter, maple-sugar, and sorghum-molasses. There are 3 woollen-mills, 5 flour-mills,

10 brick-kilns, and 15 wagon manufactories. Cap. Rushville. Area, 410 sq. m. P. 17,626.

Rush, a new county of Central Kansas, intersected by Big Timber and Walnut creeks, tributaries respectively of Smoky Hill Fork and Arkansas rivers, consists of fertile rolling prairies. Area, 720 sq. m.

Rush, p.-v. and tp., Jo Daviess co., Ill. P. 1036.

Rush, tp., Shiawassee co., Mich., on Shiawassee River and on Saginaw division of Michigan Central R. R. P. 683.

Rush, tp., Buchanan co., Mo. P. 1629.

Rush, p.-v. and tp., Monroe co., N. Y., on Genesee River and New York Central R. R. P. 1654.

Rush, tp., Champaign co., O., on Atlantic and Great Western R. R. P. 1789.

Rush, tp., Scioto co., O., on Scioto River. P. 638.

Rush, p.-v. and tp., Tuscarawas co., O., on Stillwater Creek. P. 977.

Rush, tp., Centre co., Pa., on Moshannon Creek and Pennsylvania R. R. P. 1963.

Rush, tp., Dauphin co., Pa., on Schuylkill and Susquehanna R. R. P. 105.

Rush, tp., Northumberland co., Pa., on Susquehanna River. P. 1324.

Rush, tp., Schuylkill co., Pa., in the Lehigh coal-basin, and on Lehigh Valley and Philadelphia and Reading R. Rs. P. 2291.

Rush, p.-v. and tp., Susquehanna co., Pa. P. 1418.

Rush (Benjamin), M. D., LL.D., b. at Byberry, near Philadelphia, Pa., Jan. 4, 1746 (N. S.); graduated at Princeton 1760; studied medicine at Philadelphia, Edinburgh, London, and Paris; commenced practice at Philadelphia Aug., 1769, being at the same time chosen professor of chemistry in the medical college of that city; was a member of the provincial conference of Pennsylvania 1776, in which he moved the resolution to consider the expediency of a declaration of independence; was chairman of the committee thereupon appointed, and as such presented a report in favor of the measure; was chosen to the Continental Congress to fill a vacancy in June, and was one of the signers of the Declaration of July 4, 1776. In the same year he married Julia, daughter of Richard Stockton of New Jersey, one of his fellow-"signers;" was appointed in Apr., 1777, surgeon-general, and in July physician-general, of the military hospitals for the middle department, in which capacity he attended the wounded after the battles of Princeton and Brandywine; resigned that post Feb., 1778, on account of dissatisfaction with the mismanagement of the hospital stores; established in 1785 the first dispensatory in the U. S.; was a member of the Pennsylvania convention of 1787 for the ratification of the Federal Constitution; published four letters to the people of Pennsylvania pointing out the defects of the State constitution of 1776, and sat in the convention which formed the constitution of 1780; exchanged his professorship for that of the theory and practice of medicine on the death of Dr. John Morgan, Oct., 1789, to which he added that of clinical practice on the change of title of the medical college in 1791 to that of the University of Pennsylvania, and that of the practice of physic 1796; rendered eminent services to humanity during the yellow-fever epidemic of 1793, which were subsequently recognized by testimonials from the king of Prussia (1805), the queen of Etruria (1807), and the emperor of Russia (1811); participated in the professional education of above 2000 medical students; attended to a wide private practice; was one of the founders of Dickinson College, vice-president of the Philadelphia Bible Society and of the American Philosophical Society, president of the Philadelphia Medical Society and of the Society for the Abolition of Slavery, and was treasurer of the U. S. mint from 1799 until his death, at Philadelphia Apr. 19, 1813. From his nineteenth year he was a frequent writer upon professional, scientific, political, religious, social, and ethical topics. Selections from his productions were republished under the title *Medical Inquiries and Observations* (5 vols., 1789–98; 2d ed., 4 vols., 1804; 3d ed., 4 vols., 1809), and the best of his other miscellaneous works were collected by himself into three vols., *Medical Inquiries and Observations upon the Diseases of the Mind* (1812; 5th ed. 1835), *Sixteen Introductory Lectures to Courses of Medicine* (1811), and *Essays, Literary, Moral, and Philosophical* (1798; 2d ed. 1806). He had published an early volume of *Medical Tracts*, and left unfinished a treatise on *The Medicine of the Bible*. Porter C. Bliss.

Rush (James), M. D., son of Dr. Benjamin, b. at Philadelphia, Pa., Mar. 1, 1786; graduated at Princeton 1805; studied medicine with his father, also at the University of Pennsylvania, and in Edinburgh; practised his profession some years; acquired by marriage a large fortune; published his valuable *Philosophy of the Human Voice* (1827), *Hamlet, a Dramatic Prelude* (1834), *An Analysis of the Human Intellect* (1865), and *Rhymes of Contrast on Wisdom and Folly* (1869). D. at Philadelphia May 26, 1869. By will he bequeathed above $1,000,000 to found the "Ridgway Branch of the Philadelphia Library," upon certain eccentric conditions, one of them being that no bound volumes or other collections of newspapers should ever form part of the library.

Rush (Richard), son of Dr. Benjamin, b. at Philadelphia, Pa., Aug. 29, 1780; graduated at Princeton 1797; studied law with William Lewis; was admitted to the Philadelphia bar 1800; quickly gained a leading position; became attorney-general of Pennsylvania Jan., 1811; comptroller of the State treasury Nov., 1811; was attorney-general of the U. S. Feb. 10, 1814–Dec. 15, 1817, having temporarily acted as secretary of state in the latter year; was minister to England 1817–25; negotiated treaties respecting the fisheries (1818), the N. E. boundary, the Oregon question, and the slaves carried from the U. S. in British vessels after the Treaty of Ghent; was secretary of the treasury under Pres. J. Q. Adams 1825–29; was a candidate for the Vice-Presidency on the ticket with Adams 1828; negotiated in Holland a loan for the corporations of the District of Columbia 1829; was a commissioner to adjust the boundary between Ohio and Michigan 1836; went to Great Britain in 1836 as commissioner to lay claim in the chancery court to the Smithsonian legacy (see Smithson, James); returned with the money Aug., 1838; was minister in France 1847–49, after which he spent his closing years in retirement at Sydenham, near Philadelphia, where he d. July 30, 1859. He wrote much in periodicals in support of the war of 1812 and against the U. S. Bank and on other subjects; superintended the publication of an edition of the laws of the U. S. (5 vols., 1815); wrote a *Narrative of a Residence at the Court of London from 1817 to 1825* (vol. i. 1833; vol. ii. 1845; new ed. of both vols. 1873), and edited a pamphlet, *Washington in Domestic Life, from Original Letters and Manuscripts* (1857). His sons published in 1860 his *Occasional Productions, Political, Diplomatic, and Miscellaneous.*

Rush Creek, tp., Fairfield co., O., on Pittsburg Cincinnati and St. Louis R. R. P. 1752.

Rush Creek, tp., Logan co., O., on Cleveland Columbus Cincinnati and Indianapolis R. R. P. 2044.

Rusheba, tp., Chisago co., Minn., on St. Croix River and on Lake Superior and Mississippi R. R. P. 706.

Rush'ford, p.-v. and tp., Fillmore co., Minn., at the confluence of Root River and Rush Creek, on Southern Minnesota R. R., has fine water-power on both streams, utilized for important manufactories of iron, machinery, woollen goods, and carriages, and for flouring and saw mills. There is 1 weekly newspaper. P. of v. 1245; of tp. 1973.

Rushford, p.-v. and tp., Allegany co., N. Y., on Caneadea Creek, has 4 churches, an academy, and several flouring-mills and manufactories. Several sulphur springs are found within the town. P. of v. 543; of tp. 1636.

Rushford, tp., Winnebago co., Wis. P. 2019.

Rush Lake, tp., Palo Alto co., Ia., near W. fork of Des Moines River. P. 245.

Rush Lake, p.-v. and tp., Otter Tail co., Minn., near Northern Pacific R. R. P. 167.

Rush River, tp., St. Croix co., Wis., on West Wisconsin R. R. P. 549.

Rushsylva'nia, p.-v., Rush Creek tp., Logan co., O., on Indiana division of Cleveland Columbus Cincinnati and Indianapolis R. R. P. 310.

Rush'ville, p.-v. and tp., cap. of Schuyler co., Ill., at the S. terminus of Buda and Rushville branch of Chicago Burlington and Quincy R. R., has 2 newspapers, several manufactories, and is the centre of an agricultural and grain-growing region. P. 1539; of tp. 3021.

Rushville, p.-v. and tp., cap. of Rush co., Ind., at the crossing of the Jeffersonville Madison and Indianapolis and the Cincinnati Hamilton and Indianapolis R. Rs., contains a large woollen-factory, 2 newspapers, 2 hardware and agricultural implement stores, a furniture-factory, and 2 planing-mills. It is situated in the most fertile section of the State. P. of v. 1696; of tp. 3327.

F. T. Drebert, Ed. "Republican."

Rushville, p.-v., Potter tp., Yates co., N. Y. Part of the v. is in Gorham, Ontario co.

Rush'worth (John), b. in Northumberland, England, about 1607; educated at Oxford; studied law at Lincoln's Inn; began in 1630 to take notes of proceedings in the

higher courts and in Parliament; was assistant clerk to the Long Parliament; became secretary to Lord Fairfax; took an active part in negotiations during the civil war; was for many years a member of Parliament, and afterward secretary to Lord Keeper Bridgman, but becoming involved in debt spent his last years (from 1684) in the King's Bench prison, London, where he d. May 12, 1690. In 1659 he commenced the publication of *Historical Collections of Private Passages of State, Weighty Matters in Law, and Remarkable Proceedings in Five Parliaments* (from 1618 to 1648); issued vols. ii. and iii. in 1680, and in the same year his *Tryall of Thomas, Earl of Strafford.* He left in MS. the materials for vols. iv. and v., which were issued in 1692, and for vols. vi. and vii., completing the work, which appeared in 1701. A new and better edition of the whole, together with the *Tryall*, was reprinted in 1721 (7 vols. folio). Rushworth's *Collections* are among the principal sources of information for the reigns of James I. and Charles I., but must be received with caution on account of his partisanship in behalf of the Long Parliament.

Rusk, new county of W. Central Dakota, on Missouri River, intersected by Moreau River, has Elk Ridge on the W., and consists largely of prairie. Area, about 1600 sq. m.

Rusk, county of E. Texas, bounded N. by Sabine River, and traversed in its N. part by the International R. R., has an undulating surface and a highly productive soil. There are several mineral springs and deposits of iron ore. Cattle and swine are numerous. The staple products are Indian corn, cotton, sweet potatoes, and butter. Cap. Henderson. Area, 500 sq. m. P. 16,916.

Rusk, p.-v., cap. of Cherokee co., Tex., has 1 weekly newspaper. P. 545.

Rusk (Thomas Jefferson), b. in South Carolina in 1802; became a lawyer in Georgia; went to Texas 1835; was a member of the convention that declared Texan independence Mar., 1836; was the first secretary of war; took command of the army at San Jacinto after Gen. Houston was wounded; became chief-justice of Texas; was president of the convention which effected annexation to the U. S. 1845, and U. S. Senator 1846–56. D. at Nacogdoches July 29, 1856.

Rus'kin (John), LL.D., b. in London, England, in Feb., 1819, only son of a wealthy wine-merchant, from whom he derived in childhood a fondness for art; gained the Newdegate prize for English poetry at Oxford 1839; graduated from Christ Church 1842; wrote while an undergraduate a series of articles in a London magazine on *The Poetry of Architecture* (1837–38) under the signature "Kata Phusin;" devoted himself to art, taking lessons in water-color painting from Copley, Fielding, and J. D. Harding; issued in 1842 an anonymous pamphlet in defence of Turner and his school, under the title *Modern Painters, their Superiority in the Art of Landscape Painting to all the Ancient Masters*, signed "A Graduate of Oxford," which was much admired for the brilliancy of its style and provoked great controversy by the novelty of its ideas. In 1846 a new and much enlarged edition appeared in 2 vols., entitled simply *Modern Painters*, the second volume being a new treatise, *Of the Imaginative and Theoretic Faculties*, which exhibited the results of a lengthened residence in Italy in the form of an elaborate survey of the works of the "old masters" and discussion of their respective merits. The third and fourth volumes of the series, entitled, respectively, *Of Many Things* and *Mountain Beauty*, were published in 1856; the fifth and last volume (composed of treatises, *Of Leaf Beauty, Of Cloud Beauty, Of Ideas of Relation, etc.*), in 1860, the last 3 volumes containing many illustrations by the author. The seventeen years which elapsed between the first and last volumes were spent in an industrious study of art, including a long residence in Venice and visits to the principal European capitals. As the result of a careful study of mediæval architecture, Ruskin published *The Seven Lamps of Architecture* (1849) and *The Stones of Venice* (vol. i., 1851; vols. ii. and iii., 1853), a pamphlet on *Pre-Raphaelitism* (1851), *Lectures on Architecture and Painting* (1854), *Giotto and his Works in Padua* (1854–55), *The Political Economy of Art* (1857), *The Elements of Drawing* (1857), several series of *Notes* on the exhibitions of the Royal Academy and the Society of Painters in Water-Colors (1855–59), *Notes on the Turner Gallery at Marlborough House* (1856–57), and several other little books, all of which were collected into the edition of his *Complete Works* published at New York in 15 vols. He delivered lectures on Gothic architecture at Edinburgh 1853; was appointed professor at the Cambridge School of Art 1858; became Rede lecturer at Cambridge 1867; was elected to the Slade professorship of fine arts at Oxford 1869, and re-elected Mar., 1876; and gave £5000 for the endowment of a mastership of drawing in the Taylor Galleries, Oxford, 1871. The artistic movement known as "Pre-Raphaelitism," which was developed among British artists, such as Millais, Holman Hunt, and the Rossettis about 1850, was largely due to the study of Ruskin's earlier works. He issued a revised edition of his *Modern Painters* (5 vols.) in 1860–67, and has since published a large number of pamphlets and small books under fanciful titles, many of which are professedly addressed to workingmen and advocate peculiar theories in political economy and ethics, but have apparently not attracted the notice of the class of readers for which they were designed. In 1871 he commenced the publication of a monthly letter, *Fors Clavigera*, also addressed to workingmen, inviting them to join him in establishing a fund for rescuing English country-life from the tyranny and defilement of machinery, and devoted a tithe of his fortune (about £7000) for that purpose, forming the "St. George's Company," of which he was to be grand master. The monthly letters are still issued (1876), but in the latest numbers Mr. Ruskin complains bitterly of lack of appreciation and co-operation. He possesses a picturesque Saxon style, which is justly considered one of the glories of modern English literature, and describes himself (justly enough) as a "violent Illiberal" in politics. Several entertaining volumes of selections from his works have been published, the latest being *Frondes Agrestes* (1875), under his own editorship.

Porter C. Bliss.

Russ (John Denison), M. D., b. at Chebacco (now Essex), Mass., Sept. 1, 1801; graduated at Yale College 1823; studied medicine in Europe; began to practise in New York 1826; went to Greece with a cargo of provisions for the patriots 1827, and resided there until 1830, rendering medical services to the insurgent army; devoted himself in New York to the instruction of the blind, for whose use he invented a phonetic alphabet of 41 characters with 22 prefixes, suffixes, etc., and devised several other educational expedients; became superintendent of the New York institution for the blind 1832; was one of the founders of the New York Prison Reform Association, superintendent of a juvenile asylum 1851–58, and an active promoter of other benevolent associations.

Rus'sell, county of E. Ontario, Canada, bounded N. by the river Ottawa. Area, 360 sq. m. It is connected with Prescott co. for judicial purposes, and the courts are held at L'Original in the latter county. P. 8666.

Russell, county of S. E. Alabama, bounded E. by Chattahoochee River, which separates it from Georgia, and drained by its tributaries; has an undulating surface, partly consisting of sandy ridges and barren plains, and is traversed by Mobile and Girard R. R. The staple products are Indian corn, cotton, and sweet potatoes. Cap. Seale's Station. Area, 650 sq. m. P. 21,636.

Russell, county of Central Kansas, watered by Smoky Hill Fork and Saline rivers and their numerous affluents, and traversed by Kansas Pacific R. R., has a level surface and a fertile soil. Cap. Russell. Area, 900 sq. m. P. 156.

Russell, county of S. Kentucky, traversed in its S. part by Cumberland River and drained by its branches, has a rugged surface and little soil available for agriculture, which is nevertheless the leading industry, the staples being Indian corn, tobacco, oats, sorghum-molasses, wool, and butter. Swine and sheep are reared to some extent. Cap. Jamestown. Area, 244 sq. m. P. 5809.

Russell, county of S. W. Virginia, bounded S. E. by the Clinch Mountains and traversed by the upper Clinch River, has a mountainous surface, with several deposits of iron ore, coal, and marble. The staples are Indian corn, wheat, oats, tobacco, maple-sugar, sorghum-molasses, butter, and wool. Cap. Lebanon. Area, 500 sq. m. P. 11,103.

Russell, tp., Lawrence co., Ill., on Wabash River. P. 1181.

Russell, tp., Putnam co., Ind., on Raccoon Creek. P. 1246.

Russell, p.-v., Washington tp., Lucas co., Ia., on Burlington and Missouri River R. R. P. 175.

Russell, p.-v., cap. of Russell co., Kan., on Kansas Pacific R. R., 263 miles W. of Kansas City, has several business-houses and 2 newspapers. The surrounding country is fitted for agriculture and stock-raising. P. about 500.

A. B. Cornell, Ed. "Plainsman."

Russell, p.-v. and tp., Hampden co., Mass., on Westfield River and Boston and Albany R. R. P. 635.

Russell, tp., Camden co., Mo., near Osage River. P. 1141.

Russell, tp., Macon co., Mo. P. 1658.

Russell, p.-v. and tp., St. Lawrence co., N. Y., on Grass River. P. 335; of tp. 2688.

Russell, p.-v. and tp., Geauga co., O. P. 805.

Russell, tp., Sheboygan co., Wis. P. 623.

Russell (Alexander Jamieson), b. in Glasgow, Scotland, Apr. 29, 1807. With his parents he settled in Megantic co., Canada, in 1822, where his father was crown-lands agent. In 1829 he became deputy provincial surveyor, and in 1830 entered the commissariat department, serving two years on the Rideau Canal during its construction, when he was called to head-quarters, Quebec, where he was engaged for eight years in the extra staff of that department. In 1841 he resigned and entered the service of the provincial government as civil engineer in charge of public works in the eastern or maritime counties of Lower Canada, being engaged for five years in projecting and constructing roads and bridges, etc. In 1846 he was transferred to the crown timber office at Ottawa to settle difficulties between lumbermen and to grant licenses to cut timber on Ottawa River and its tributaries, to which has been added the collection of the timber revenues from them and the inspection of the other crown timber agencies in Lower and Upper Canada.

Russell (Benjamin), b. at Boston, Mass., Sept. 13, 1761; learned the printing trade under Isaiah Thomas; was a soldier in the Revolutionary war; established at Boston, Mar. 24, 1784, a semi-weekly newspaper, *The Columbian Centinel,* to which many eminent writers contributed, and which became an influential political organ of Federalist doctrines; was twenty-four years representative of Boston in the general court; was several years member of the State senate and of the executive council. He retained the editorship of the *Centinel* until Nov. 1, 1828. D. at Boston Jan. 4, 1845.

Russell (David Allen), b. at Salem, N. Y., Dec. 10, 1820; graduated at the U. S. Military Academy, and entered the infantry in 1845; served in the war with Mexico, and brevetted first lieutenant for gallantry; was subsequently actively engaged on the frontier against the Indians; in Jan., 1862, accepted the colonelcy of the 7th Massachusetts Vols., which he led through the Virginia peninsular campaign of 1862, gaining the brevet of lieutenant-colonel, and in the battle of Antietam; appointed brigadier-general U. S. volunteers Nov., 1862, he commanded a brigade in the 6th corps at the battles of Fredericksburg and Chancellorsville, at Gettysburg, and minor actions of that corps. In the Richmond campaign of 1864, in command of a division (6th corps), he participated in all the battles of that corps from the Wilderness to Petersburg; in July, 1864, his corps was called to Washington to resist the threatened attack of Early upon the capital, and in the subsequent pursuit of Early he was killed at the battle of Opequan, Sept. 19, 1864. At the time of his death he held the rank of major in the 8th Infantry, brevet colonel, brigadier-general, and major-general for gallantry.

Russell (John), Earl, third son of the sixth duke of Bedford, b. in London, England, Aug. 18, 1792; educated at Westminster School and at the University of Edinburgh; travelled in Spain and Portugal during the Peninsular war 1809–10; entered Parliament as a Whig 1813, representing the family borough of Tavistock; displayed great zeal in his opposition to the Tory ministry and in advocacy of Roman Catholic emancipation and parliamentary reform; became intimate with the literary men of the time; published *Lives* of his ancestors, William Lord Russell (1819) and Lady Rachel Russell (1820), *An Essay on the History of the English Government and Constitution* (1821), *The Nun of Arronca, a Tale* (1822), *Don Carlos, a Tragedy* (1822), *Memoirs of the Affairs of Europe from the Peace of Utrecht* (2 vols., 1824–29), of which the first volume was republished with the title *History of the Principal States of Europe, from the Peace of Utrecht* (2 vols., 1826), *The Establishment of the Turks in Europe* (1827), and *Causes of the French Revolution* (1832), with many other occasional literary productions; was the parliamentary leader of the great movement which effected in 1828 the repeal of the Test and Corporation acts, in 1829 the emancipation of the Roman Catholics, and in 1832 laid the foundation of the modern era of English history by the long-delayed victory of the Reform bill. In 1830–34, Lord John Russell was paymaster of the forces in the Grey administration; was secretary of state for the home department 1835–39, and afterward for war and the colonies (1839–41) in the second Melbourne ministry, of which he was the leader in the House of Commons, and carried several important measures of reform in regard to ecclesiastical and municipal affairs, education, marriage, and civil and criminal law; was returned to Parliament in the election of 1841 for the city of London, which he continued to represent for many years; was the leader of the opposition to the Peel ministry 1841–45; declared in favor of the immediate repeal of the Corn laws Nov., 1845, upon which basis he was invited to form a ministry Dec., 1845, but failed through the dissensions of Earl Grey and Lord Palmerston, and had to yield to Sir Robert Peel the honor of procuring the enactment of the repeal. Upon the dissolution of the old Tory party in 1846, Lord John Russell became prime minister and first lord of the treasury, and conducted the affairs of state through the difficult period embracing the Irish famine, the Chartist agitations, and the continental revolutions of 1848–49. His ministry was overthrown in Feb., 1852, but Earl Derby having been unsuccessful in his attempt to carry on the government, the Aberdeen cabinet was formed Dec., 1852, in which Lord John Russell accepted the position of secretary of foreign affairs. He introduced a new Reform bill 1854; became colonial secretary in the first Palmerston ministry Feb., 1855, and soon afterward went as commissioner to the Vienna Conference, intended to put an end to the Crimean war, but lost public favor by his support of the Austrian programme, and retired from the cabinet July 16. In June, 1859, he returned to office as secretary of foreign affairs in the second Palmerston ministry; was elevated to the peerage as Earl Russell of Kingston-Russell July, 1861; incurred severe criticism by his unfriendly course toward the U. S. during the civil war, especially in the Trent and Alabama affairs, as also by his fruitless manifestations of sympathy for Poland and Denmark in their struggles with Russia and Germany. On the death of Lord Palmerston, Earl Russell again became prime minister, Oct., 1865, Mr. Gladstone being, however, the real leader of the cabinet, which resigned in June, 1866. After that period he accepted no office, but took an active part in the debates of the House of Lords and devoted himself anew to literature. He edited the *Correspondence of John, Fourth Duke of Bedford* (3 vols., 1842–46), the *Memorials and Correspondence of C. J. Fox* (4 vols., 1853–57), the *Memoirs, Journal, and Correspondence of Thomas Moore* (8 vols., 1852–56), and selections from his own *Speeches and Despatches* (2 vols., 1870), and wrote the *Life and Times of C. J. Fox* (3 vols., 1859–66), *The Rise and Progress of the Christian Religion in the West of Europe* (1873), and an autobiographical work, *Recollections and Suggestions 1815–73* (1875). D. May 28, 1878.

Russell (Rev. John Fuller), b. in England about 1817; graduated S. C. L. at St. Peter's College, Cambridge, 1837, and B. C. L. 1838; rector of St. James's, Enfield, and since 1856 of Greenhithe, Kent; wrote works on the doctrine and discipline of the Church of England; among them, *Exclusive Power of an Episcopal Ordained Clergy to Administer the Sacraments,* etc. (1834), *Strict Observance of the Rubric recommended* (1839), and *Anglican Ordinations Valid* (1846); also *Life of Dr. Johnson* (1847), articles in the *Encyclopædia Metropolitana;* edited *Hierurgia Anglicana* (1848), being documents illustrative of the ritual; and was co-editor with Dr. Hook of *Selections from the Writings of Anglican Divines* (1840), and with Dr. Irons, of *Tracts of the Anglican Fathers.* He was examined as expert by the royal commissioners on ritual in 1867.

Russell (John R.), b. Jan. 4, 1827, in Maryland; entered the navy as a midshipman Sept. 14, 1841; became a passed midshipman in 1847, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1867, a captain in 1874; commanded the boat expedition which succeeded in burning the Confederate privateer Judith alongside the navy-yard at Pensacola Sept. 14, 1861, and the gunboat Kennebec at the bombardment of Forts Jackson and St. Philip in 1862. Commended for "gallantry."

Foxhall A. Parker.

Russell (John Scott), F. R. S., b. in the Vale of Clyde, Scotland, in 1808; studied at the universities of Edinburgh, St. Andrew's, and Glasgow, graduating at the latter 1824; devoted himself to applied mechanics, engineering, and natural philosophy; delivered a course of lectures on the latter subject in the University of Edinburgh in 1832 upon the death of Prof. Leslie; engaged at Edinburgh in the construction of small steamboats for canal and river navigation, and of steam carriages which ran upon the common roads between Paisley and Glasgow; introduced the "wave system" into the construction of ocean steamships 1835; was for some years manager at Greenock of one of the largest shipbuilding yards in Scotland; presented memoirs on the "wave system" to the British Association 1835, and to the Royal Society of Edinburgh 1837, being honored with a gold medal by the latter body; established himself in London 1844 as a builder of the largest class of steamships, including the Great Eastern, which was designed by Brunel upon his system; read in 1857 to the British Association a paper upon *The Mechanical Structure of the Great Ship;* was one of the nine original promoters of the great exhibition of 1851, and joint secretary of the royal commissioners for the management of that enterprise;

was one of the founders of the Institution of Naval Architects, of which he is vice-president, and has contributed largely to its *Transactions;* is also vice-president of the Institution of Civil Engineers, and an active member of several scientific societies. Author of an elaborate and costly illustrated work, *The Modern System of Naval Architecture for Commerce and War* (1864) and of *Systematic and Technical Education for the English People* (1869). He is well known as a philanthropist, and in 1871 brought forward an unsuccessful scheme for founding a "New Social Alliance" for the improvement of the condition of the working-classes by facilitating their means of access to the legislative and executive departments of the government.

Russell (JONATHAN), LL.D., b. at Providence, R. I., in 1771; graduated at Brown University 1791; studied law, but exchanged its practice for commercial pursuits; was an accomplished and effective writer and an active politician; was several years U. S. minister to Sweden; signed the Treaty of Ghent 1814 as one of the five American commissioners, and was member of Congress 1821–23. D. at Milton, Mass., Feb. 16, 1832.

Russell (MICHAEL), LL.D., D. C. L., b. at Edinburgh, Scotland, in 1781; educated at Glasgow College; was ordained in the Episcopalian Church; became minister of St. James's chapel, Leith, 1809, a post he retained through life, adding to it in 1837 the bishopric of Glasgow and Galloway. D. at Leith Apr. 2, 1848. He possessed extensive erudition; was for twenty-five years one of the principal contributors to the *Encyclopædia Metropolitana,* and author of several valuable works on education, history, sacred and profane, and polity, and doctrinal subjects. His best work was *The Connection of Sacred and Profane History, from the Death of Joshua until the Decline of the Kingdoms of Israel and Judah* (3 vols., 1827–37).

Russell (WILLIAM), LORD, son of the fifth earl of Bedford, b. in England Sept. 29, 1639; educated at Cambridge and at Augsburg; entered Parliament 1660; married Lady Rachel, daughter of Thomas Wriothesley, earl of Southampton, and widow of Lord Francis Vaughan, 1669; first became prominent in 1673 as one of the leaders of the Protestant or "country party," which carried on a vigorous opposition to the unscrupulous measures of the court; proposed in Nov., 1678, the removal of the duke of York from the royal councils, and on June 16, 1680, appeared before the king's bench in Westminster to present that prince as a recusant, and headed the deputation of 200 members of the House of Commons which carried up to the House of Lords the bill for the exclusion of James as a papist from the succession. When a reaction had set in against the Protestant alarmists the court determined to be revenged upon Russell, Sidney, and other prominent Whigs, who were accordingly accused by suborned witnesses of participation in the "Rye-house Plot." Arraigned for treason at the Old Bailey July 13, 1683, Russell was refused counsel, but his wife was permitted to act as his secretary during the trial; was condemned to death and attainted July 14, and beheaded in Lincoln's Inn Fields July 21, 1683. His attainder was reversed after the revolution of 1688, and in 1694 his father was made duke of Bedford, to which title Lord William's son, Wriothesley, succeeded. Lady Russell, b. 1636, survived her husband forty years, and d. at Southampton House Sept. 29, 1723. Her *Letters* to her husband were published 1773, became widely popular, and have been often reprinted. (See *Life of Lord Russell,* by Lord John Russell, 1819.)

Russell (WILLIAM), LL.D., b. in Selkirkshire, Scotland, in 1741; learned the printing trade; was corrector of the Strachan press at London 1767–87, after which he settled on a farm in Dumfriesshire, where he d. Dec. 25, 1793. Author, among other works, of a *History of America* (2 vols., 1779), a *History of Modern Europe* (4 vols., 1779–84; frequently reprinted), and a *History of Ancient Europe* (2 vols., 1793). He left unfinished a *History of England from the beginning of the Reign of George III.*

Russell (WILLIAM), b. at Glasgow, Scotland, Apr. 28, 1798; was educated at the university of his native city; settled at Savannah, Ga., 1817; became principal of an academy there 1819; was instructor in the New Haven Grammar School 1822–28; taught classes in elocution at Andover, Cambridge, and Boston; edited the *American Journal of Education* 1826–29; was at the head of schools for young ladies at Germantown, Pa., and afterward at Boston and Andover; founded a seminary for teachers in New Hampshire 1840, and removed it in 1853 to Lancaster, Mass., where he subsequently became director of the normal institute. Author of many treatises on educational subjects and of several textbooks in reading and elocution.

Russell (WILLIAM HOWARD), LL.D., b. at Lily Vale, co. Dublin, Ireland, Mar. 28, 1821; studied at Trinity College, Dublin; became a lawyer at London, but is best known as a correspondent of the London *Times,* in which capacity he obtained a considerable reputation during the Crimean war, the Indian mutiny, the American civil war, the Austro-Prussian war of 1866, and the Franco-German war of 1870–71. He founded in 1858 the *Army and Navy Gazette,* which he still conducts. He has republished his letters to the *Times* descriptive of the military operations above mentioned, and written several other works.

Russell's, tp., Fayette co., Ala. P. 247.

Rus'sellsburg, p.-v., Pine Grove tp., Warren co., Pa., on Conewango River.

Rus'sellville, p.-v. and tp., cap. of Franklin co., Ala., on Cedar Creek. P. 180; of tp. 1484.

Russellville, p.-v., Pope co., Ark., on Little Rock and Fort Smith R. R., has 1 newspaper and some manufactures.

Russellville, p.-v., Russell tp., Lawrence co., Ill., on Wabash River. P. 311.

Russellville, p.-v., cap. of Logan co., Ky., on Louisville Nashville and Great Southern R. R., has 1 newspaper. P. 1843.

Russellville, p.-v., Jefferson tp., Brown co., O. P. 359.

Russi, town of Italy, province of Ravenna, about 10 miles W. S. W. of the city of Ravenna. It is a pretty town, surrounded by a wall, with castle and citadel still in good condition. Russi was long an object of bitter contention between the lords of Ravenna and Ferrara. P. 7700.

Rus'sia, the largest empire of the world, occupying about one-sixth of the firm land of our globe, extends in Europe and Asia from lat. 38° 20′ to lat. 77° 30′ N., and from lon. 17° 38′ E. to lon. 170° W.; bounded N. by the Arctic Ocean; E. by the Pacific; S. by China, Independent Toorkistan, Persia, Asiatic Turkey, the Black Sea, and Roumania; and W. by Austria, Prussia, the Baltic, and the Scandinavian peninsula. Area, 8,351,004 sq. m. Pop. 85,685,945, of which Asiatic Russia, consisting of Caucasus (area, 172,837 sq. m.; pop. 4,893,332), Siberia (area, 4,826,329 sq. m.; pop. 3,428,867), Kirgheez territories (area, 868,793 sq. m.; pop. 1,803,708), and Toorkistan (area, 408,408 sq. m.; pop. 1,996,920), comprises 6,279,352 sq. m., with 12,122,827 inhabitants; while European Russia, consisting of Russia proper (area, 1,881,216 sq. m.; pop. 65,704,559), Poland (area, 49,157 sq. m.; pop. 6,026,421), and Finland (area, 144,269 sq. m.; pop. 1,832,138), comprises 2,071,642 sq. m., with 73,563,118 inhabitants. European Russia is divided for administrative purposes into the following governments:

Russia Proper.

	Area.	Population.
Archangel	331,503	281,112
Astrakhan	86,668	601,514
Bessarabia	14,046	1,078,932
Courland	10,537	619,154
Don Cossack Territory	61,911	1,086,264
Esthonia	7,818	323,961
Grodno	14,965	1,008,521
Kaluga	11,938	996,252
Kazan	24,600	1,704,624
Kharkov	21,040	1,698,015
Kherson	27,522	1,596,809
Kiev	19,686	2,175,132
Kostroma	32,700	1,176,097
Kovno	15,692	1,156,041
Kursk	17,936	1,954,807
Livonia	18,158	1,000,876
Minsk	35,272	1,182,230
Moheelev	18,550	947,625
Moscow	12,857	1,772,624
Nizhnee-Novgorod	19,795	1,271,564
Novgorod	47,234	1,011,445
Olonetz	57,436	296,392
Oofa	47,031	1,364,925
Orel	18,040	1,596,881
Orenburg	73,885	900,547
Penza	14,996	1,173,186
Perm	128,246	2,198,666
Podolia	10,222	1,933,188
Poltava	19,264	2,102,614
Pskov	17,068	775,701
Riazan	16,253	1,477,433
St. Petersburg	20,760	1,325,471
Samara	60,197	1,837,081
Saratov	32,622	1,751,268
Simbeersk	19,108	1,205,881
Smolensk	21,637	1,140,015
Tambov	25,683	2,150,971
Taurida	24,537	704,997
Tchernigov	20,231	1,659,600
Toola	11,955	1,167,878
Tver	25,223	1,528,881
Viatka	59,114	2,406,024
Vitebsk	17,438	888,727
Vladimeer	18,862	1,259,923
Volhynia	27,738	1,704,018
Vologda	155,498	1,003,039
Voronezh	25,437	2,152,696
Vilna	16,411	1,001,909
Yaroslav	13,750	1,000,748
Yekaterinoslav	26,146	1,352,300

Poland.

	Area.	Population.
Kalisz	4,392	660,231
Kielce	3,897	518,730
Lomza	4,667	489,699
Lublin	6,501	707,089
Piotrkov	4,729	682,495
Plock	4,200	471,938
Radom	4,769	532,466
Siedlec	5,534	504,606
Suwalki	4,846	524,489
Warsaw	5,622	925,639

Finland.

	Area.	Population.
Åbo-Björneborg	9,332	306,331
Kuopio	16,498	226,130
Nyland	4,584	173,141
St. Michael	8,819	179,348
Tavastehuus	8,324	193,477
Uleåborg	63,955	185,800
Vasa	16,143	310,937
Viborg	16,611	276,884

The old names, Great Russia or Muscovy (comprising the whole of the northern and central part of the country), Little Russia or Ukraine (Kiev, Tchernigov, Poltava, and Kharkov), New Russia (Bessarabia, Kherson, Taurida, Yekaterinoslav, and the Don Cossack Territory), Red Russia (Lithuania, Volhynia, Podolia, and parts of the present Galicia), White Russia (Vitebsk and Moheelev), Black Russia or Minsk, and the Baltic provinces (Courland,

Livonia, Esthonia, and Ingria), have now only an historical signification.

Asiatic Russia is described in the articles on Caucasus, Kirgheez, Siberia, and Toorkistan. European Russia, including Finland and Poland (which see), forms one vast plain, bounded E. by the Ural chain; S. by the Caucasian Alps and the Yaila Mountains, an isolated chain occupying the Crimean peninsula and rising to the height of about 5000 feet; S. W. and N. W. by spurs of the Carpathians and the Scandinavian Alps. Through the central part of this plain stretches an elevated plateau, the Valdai Hills, rising about 1000 feet, connecting to the E. with the Ural Mountains, and presenting an undulating surface covered with large forests of beech. From this plateau the ground slopes N. to the Arctic Ocean and the White Sea, traversed by the Onega, Dwina, Mezen, and Petchora; W. to the Baltic, drained by the Neva, Düna, Niemen, and Vistula; and S. to the Black and the Caspian seas, watered by the Pruth, Dniester, Dnieper, Don, Volga, and Ural. The northern slope terminates along the Arctic Ocean in frozen swamps, where all vegetation ceases; the western is dotted with numerous lakes, and is often marshy, but favorable to vegetable life; the southern presents many large, woodless tracts of steppes, unfit for agriculture. On an average, 20 per cent. of the surface of European Russia is arable land, 11 meadow, 27 pasture, and about 40 forest, but the ratio varies very much in the different parts of the empire. Finland has only 1.2 per cent. arable, but 53.3 forest; Russia proper has respectively 20.9 and 40.3, Poland 50 and 25.20. Rye, oats, barley, wheat, and maize are raised, and although the method of cultivation is still very primitive, the product far exceeds the home demand in quantity; the value of exported cereals amounted in 1872 to 134,600,000 rubles. In the Baltic provinces flax, hemp, and hops are much cultivated; in the above year the value of exported flax amounted to 37,900,000 rubles, of flaxseed to 22,300,000, of hemp to 11,900,000, of tow to 2,800,000, of cordage to 1,500,000. In Bessarabia and the Crimea the vine is grown with success, and about 54,000,000 gallons of good wine are annually produced. Tobacco is cultivated along the Volga, the Don, and in Bessarabia, and yields about 70,000,000 rubles annually. The potato is raised throughout the country, and the cultivation of beetroot is steadily increasing. Excellent fruits —apples, pears, apricots, peaches, but especially plums and cherries—are grown in Bessarabia, the Crimea, and Taurida, and the immense forests, consisting mostly of fir, spruce, and pine N. and E. of the Valdai Hills, and oak to the S., contain excellent timber for building purposes, and are administered with great care; the value of timber exported in 1872 amounted to 22,400,000 rubles. Cattle-rearing is extensively carried on in the western and southern provinces. Russia possessed in 1874 about 28,500,000 horned cattle; in 1872 the value of the export of cattle amounted to 10,200,000 rubles, that of hides to 3,300,000. Horses, numbering 20,000,000 in 1874, are numerous in the southern provinces and of a good breed; the annual export to Prussia and Austria is very large. Of sheep (64,500,000 in 1874) there are several species. The common Russian sheep yields only 4 pounds of wool a year, and, the wool being coarse, the pood (36 pounds) commands only 3 rubles in the market: but the animal requires no care and thrives on the scantiest and meagerest food. The Kirgheez sheep, introduced from the Kirgheez territories in Asia, where it still forms the fundamental unit in all valuations, is numerous in the steppes of the Volga and the Don, and is distinguished by its immense fat tail. It generally weighs from 4 to 5 poods, and yields often 2 poods of tallow; in 1872 the value of the export of tallow amounted to 2,900,000 rubles. Of improved breeds of sheep there are about 14,000,000, half of which belong to Bessarabia. Swine (11,000,000 in 1874) are reared in immense herds in the Lithuanian oak forests; in 1872 the value of the export of hogs' bristles amounted to 5,700,000 rubles. Bee-culture is general in Poland and on the Volga; about 7,000,000 pounds of wax and 21,000,000 of honey are annually produced. The silk-culture, which formerly was quite extensive in the southern provinces, has suffered much of late, partly from disease among the silk-worms, partly from the emigration of the Mennonites, who principally carried it on. Reindeer are kept in large herds in the N.; camels are bred in the S. Of wild animals, the ermine, sable, marten, bear, etc. are found in the N.; the elk, aurochs, and boar in the W. (Poland and Lithuania); the wolf, deer, and fox everywhere; the value of the export of furs amounted in 1872 to 3,200,000 rubles. The fisheries form a very important source of wealth—cod and herring in the White Sea; herring and flounder in the Baltic; mackerel, sardine, and herring on the Crimean coast; sturgeon in the Caspian; salmon, trout, and a great variety of delicious fresh-water fish in the lakes and rivers. In the circle of Kem, a subdivision of the government of Archangel, at the mouth of the Kem in the White Sea, 91,147,600 poods of salt-water fish and 58,793 poods of fresh-water fish were caught between 1847 and 1851, and several thousand people are steadily employed in the fisheries of the Volga and the Caspian Sea. The preparation of *caviare* from the roe of the sturgeon is a peculiar Russian branch of industry. The product was known to the rest of Europe as a delicacy in the time of Shakespeare. "'Twas caviare to the general," says Hamlet. It is now largely consumed.

Mining and manufacturing are carried on in Russia extensively, and with great success. Large deposits of coal and an abundance of salt are found in all the southern provinces: 402,300 tons of coal were raised in 1868, and 538,800 tons of salt were produced—250,000 tons alone from the brine springs of Taurida. The produce of coal is rapidly increasing. All the metals are found in the Ural and Altai mountains, some of them in great abundance and of excellent quality. In 1869, 61,700 pounds of gold were produced, and 39,300 pounds of silver. In 1868 the produce of copper was 4310 tons, and of iron 319,000 tons. Platinum is found only around Yekaterinburg; 8060 pounds were produced in 1861. The governments of St. Petersburg, Moscow, Nizhnee-Novgorod, Vladimeer, Saratov, Warsaw, Plock, and Kalisz are the principal seats of manufacturing industry, which is steadily increasing and receives much encouragement from the government. Peter the Great founded 21 large factories, besides some smaller ones; in 1820 the number had risen to 3724, in 1854 to 18,100, in 1870 to 19,431, exclusive of distilleries and breweries, employing 410,225 workmen, and producing goods to the value of about 373,000,000 rubles. The principal branches are the cotton and woollen manufactures. In 1870 about 122,000,000 pounds of raw cotton were imported, and 1508 factories produced goods to the value of 220,000,000 rubles. In the same year 1831 woollen manufactories, employing 105,135 hands, produced goods to the value of 63,000,000 rubles. In spite of recent disturbances, there are still 518 silk manufactories, employing about 12,000 workmen. In 1871 there were 325 beetroot-sugar manufactories, employing about 70,000 workmen. For its internal traffic Russia possesses excellent water-ways in its great rivers and extensive canal system, connecting the Baltic with the White, Black, and Caspian seas. For a large part of the year, however, from three to seven months, these roads are closed by frost, but in 1874 the country had 10,725 miles of railroad, and 2400 miles were under construction. In 1873 the receipts of the railways amounted to 122,800,000 rubles, but the government, having guarantied a certain interest, had in the same year to pay 14,590,000 rubles. In 1872 the length of telegraph lines was 44,692 miles, of wires, 90,430 miles; number of stations, 1333; of telegrams forwarded, 3,259,552; the revenue was 17,120,000 rubles; the expenses 14,957,000. In 1874 the commercial fleet numbered 2504 vessels of 520,584 tons burden; 227 were steamers. The total imports were valued in 1872 at 242,320,000 rubles, the exports at 272,870,000.

The population of Russia is very various; it comprises about 100 different nationalities, more or less distinct, and about 40 different languages are spoken in the empire. The Slavic element, however, is absolutely predominant in European Russia, numbering 61,000,000 out of 73,000,000. The principal non-Slavic races are the Finns in Finland, the Letts in Courland, the Germans in the Baltic provinces and Southern Russia, the Tartars, Cossacks, and other Mongolian tribes in the S., and the Jews, numbering 2,647,000, of whom 1,829,000 are in Russia proper and about 800,000 in Poland. The Slavic race falls into two very distinct and very antipathetic groups—the Russians, 56,600,000, and the Poles, about 5,000,000. The Russians, again, comprise a great number of subdivisions, of which the Ruthenians form one of the most prominent, but all these subdivisions centre in the Great Russians, whose religious creed, political sympathies and antipathies, and literary language have been adopted by them. With respect to the Poles and the non-Slavic nations, it is the policy of the government to Russianize them, and the measures employed for this purpose are in some cases, especially with respect to the Poles, really shocking. In 1869 the budget of the University of Warsaw was raised from 182,000 to 211,780 rubles, but at the same time the professors were informed that in the course of three years they were to make themselves masters of the Russian language, so as to be able to deliver their lectures in Russian; the Russian double eagle appeared over the front door of the building; all Polish inscriptions were replaced with Russian; all communications to the students were issued in Russian; and the officials belonging to the administration of the institution were ordered not to answer any question which was not


MAP OF
RUSSIA
Drawn and Engraved on Copper-Plate
EXPRESSLY
FOR
JOHNSON'S UNIVERSAL CYCLOPÆDIA
Scale of Miles
Longitude East from Greenwich
Longitude East from Washington
ARCTIC OCEAN
KARA SEA
NOVA ZEMBLA
LAPLAND
ARCHANGEL
WHITE SEA
Kanin Nos
North Cape
GULF OF BOTHNIA
ULEABORG
KUOPIO
VASA
ST MICHEL
VYBORG
OLONETZ
VOLOGDA
PERM
VIATKA
KOSTROMA
YAROSLAV
TVER
NOVGOROD
ST PETERSBURG
ESTHONIA
COURLAND
VITEBSK
SMOLENSK
MOSCOW
VLADIMIR
NIZHNEE NOVGOROD
KAZAN
UFA
ORENBURG
SIMBIRSK
PENZA
SARATOV
SAMARA
MINSK
GRODNO
VOLHYNIA
PODOLIA
KIEV
TSCHERNIGOW
KURSK
VORONETZ
POLTAVA
KHARKOV
KHERSON
YEKATERINOSLAV
SOUTH RUSSIA
ODESSA
CRIMEA
SEA OF AZOF
COSSACKS
ASTRAKHAN
CAUCASIA
STAVROPOL
CAUCASIAN PROVINCES
DERBEND
KIRGHIZ
TOORKOMANIA
SEA OF ARAL
BLACK SEA
BULGARIA
HUNGARY
MOLDAVIA
KASTAMOONI
TREBIZOND
KARS
URAL MOUNTAINS

made in the Russian language. In 1872 six professors, who declared themselves unable to use the Russian language, were discharged.

The GREEK CHURCH (which see) is the official religion of the state, professed by the imperial family and a large majority of the inhabitants—namely, 53,139,000 in Russia proper, 2,875,000 in Siberia, 1,930,000 in Caucasia, 42,000 in Finland, and 30,000 in Poland. In doctrine the Russian Church agrees with the other branches of the Greek Church, but with respect to its administrative organization it is entirely independent. At the head stands the emperor; next to him the Holy Synod, composed of seven bishops. Feodor I. appointed a Russian patriarch in 1589, after the flight of the Greek patriarch from Constantinople, and the four Oriental patriarchs recognized the new dignity. But Peter the Great found it too difficult to rule the empire with a patriarch at the head of the Church. He abolished the office and instituted the synod; and his successors have followed the same policy, never allowing the Church to become a state within the state. In 1870 the Russian Church comprised 62 archbishops and bishops, 385 monasteries with 5750 monks, 154 nunneries with 3226 nuns, 1334 arch-priests, 40,852 priests, 11,852 deacons, 70,280 clerks; 33,100 church buildings, among which were 59 cathedrals; 4 theological seminaries of the highest order, in St. Petersburg, Moscow, Kiev, and Kazan, with 106 professors and 410 students; and 51 theological seminaries of a lower order, with 15,585 students. Sects are very numerous, and some of them—as, for instance, the Raskolniks—are said to be very powerful. The Roman Catholic Church numbers 4,326,000 members in Poland, 2,883,000 in Russia proper, 25,000 in Siberia, 18,000 in Caucasia, 830 in Finland; the Reformed churches 2,234,000 in Russia proper, 1,797,000 in Finland, 331,000 in Poland, 10,600 in Caucasia, and 5700 in Siberia; the Mohammedans 2,843,000 in Central Asia, 2,359,000 in European Russia, 1,960,000 in Caucasia, 61,000 in Siberia. Roman Catholics and Protestants have equal civil rights with the members of the Greek Church, but not the Jews and Mohammedans. Only the Greek Church has the right to proselyte and to carry on missions among the non-Christian population. She also claims all the children of mixed marriages.

For science and art there is much done in Russia. The scientific societies, universities, libraries, art-galleries, theatres, and other institutions of learning and talent are of a high order; the higher educational institutions, general and special, male and female, are also excellent. Many features, however, indicate that as a whole the nation occupies a comparatively low stand-point of civilization. Both in religion and politics the Russian people are still liable to fall into extremes of fanaticism and superstition or coarse infidelity, of slavish submissiveness or revolutionary ideas of the most reckless and fantastic character. The cruel and widespread persecutions of the Jews in 1872 originated in Odessa from a rumor that a Jewish boy had thrown a dead cat into a Greek church. The conspiracy of the Nihilists in 1871 presented an equally singular aspect; they aimed at the abolition not only of despotism, but of government of whatever kind. Popular education is still utterly insufficient. In 1869 there were only 15 elementary schools in the government of St. Petersburg, and only 3 per cent. of the population could read. It was intended to establish 300 more in the course of the year, but it was necessary to use old pensioned soldiers for teachers. In 1872 the number of popular schools in the whole empire was 19,658, with 761,129 pupils—625,784 male and 135,345 female. In 1868 there were published 219 newspapers in the country—117 in Russian, 30 in German, 20 in Finnish, etc.—but against the full effect of this organ of popular instruction and enlightenment the censorship, particularly severe in the Polish and non-Slavic regions, acts as a heavy and vicious impediment.

The government is a pure despotism. There are no constitutional checks whatever to the power of the emperor. The army, which now is formed by universal conscription, consists of an active body numbering about 750,000, and a reserve of about the same number, with 1424 guns and 300,000 horses. Fleets are kept in the Baltic, the Black Sea, and the Caspian, squadrons in the Arctic and Pacific, comprising altogether 225 steam-vessels of 172,501 tons burden and 31,978 horse-power, with 521 guns and about 25,500 sailors. According to the budget of 1874, the revenues of the empire were estimated at 539,851,000 rubles, the expenses at 536,683,000. Up to 1871 the expenses considerably exceeded the revenue every year for a long period, and the country has a debt of 2,277,081,564 rubles.

The history of Russia, as a member of the political system of Europe and a constituent in the development of modern civilization, begins with Peter the Great (1689–1725), of the house of Romanoff, which ascended the throne in 1613, and still reigns over the country. The previous period, comprising the history of the house of Rurik (862–1588), is merely a struggle to form a fixed establishment, a state, among the multitude of nations which moved to and fro in the plain, and by degrees settled down in a rather chaotic form. The first part of this earlier period is very obscure. When the Greeks founded their commercial stations along the northern coast of the Black Sea, in the Crimea, and on the shores of the Sea of Azof, they found the interior occupied by roving tribes of a fierce and savage character. They called them Scythians and Sarmatians, and for about eight centuries these two nations continue to be mentioned in the history of Greece and Rome as inhabiting the same country, pursuing the same occupations, maintaining the same habits, and exhibiting the same character—just as if they had lived through eight centuries without undergoing any changes at all. Then came, during the migration of nations beginning in the fourth century, the Goths, Avars, Huns, Alans, etc., rolling over them, wave after wave. In the sixth century the name of the Slaves first appears. They founded Kiev and Novgorod, and each of these cities became the capital of a Slavic empire. E. and S. of Kiev were on the Caspian Sea the Petchevegs, and on the Black Sea the Khazars, who held very intimate intercourse with the Byzantine empire. N. and W. of Novgorod were the Tchudies, the Finns, and on the Baltic some Scandinavian tribes, the Varangians and the *Russians;* which latter name is first met with in the ninth century. Rurik, a Varangian chief, came to Novgorod in 862, not as a conqueror, but invited, and henceforth his family reigned in the country till it became extinct, and the people received the name of Russians, though they were Slaves. His successor, Oleg (879–912), conquered Kiev, defeated the Khazars, and even attacked the emperor of Constantinople. Under Olga, who governed during the minority of her son, Christianity began to be introduced among the Russians; she herself was baptized at Constantinople in 957. It became the official religion of the state under Vladimeer the Great, who was baptized in 988, and the same day married the sister of the emperor of Constantinople. He divided his realm between his sons; and these divisions of the country, which continued to take place during the next three or four centuries, were in many respects highly conducive to the establishment of a regular government and the development of trade and other fundamental elements of civilization. They occasioned the foundation of many new cities, among which were Tver and Moscow, the latter in 1147. But, on the other hand, they weakened the power of the nation by the perpetual feuds between the princes which followed. A sort of confederacy was intended and attempted, but it had no authority, and when, in the beginning of the thirteenth century, the Mongols under Genghis Khan broke in from Asia, the Russians were unable to withstand them. Most of the princes were wholly subdued; even the prince of Novgorod had to pay tribute, and the brilliant victories of Demetrius Donski, prince of Moscow, in 1378 and 1380, only caused the Mongols to return in larger hordes; in 1382, Moscow was burned to the ground and 24,000 of its inhabitants were slain. At last, the dissolution and decay of the Mongolian and the concentration and increase of the Russian power reversed the relation. Ivan III. the Great (1462–1505), who united Novgorod, Perm, and Pskov to Moscow, refused to pay the tribute, defeated the Mongols when they attempted to enforce their claims by arms, and commenced extending the Russian power to the E., conquering Kazan in 1469 and parts of Siberia in 1499. He married a princess of the imperial house of Constantinople, now in exile, adopted the double eagle in his escutcheon, and assumed the title of "lord of all the Russians;" and under him became visible that line of policy which subsequently has run like a thread through the whole history of the Russian empire. To the Russian people and their princes Constantinople was the sole representative of civilized life, the model after which they shaped themselves—the source whence they drew their religious creed and their military organization, their civil institutions, and the comforts and ornaments of private life, their dishes and wines, their silks and fashions, their architecture and literary tastes; and when Constantinople fell into the hands of the Turks (in 1453), the prince of Moscow, the czar of all the Russians, felt himself the heir and the avenger of the Byzantine empire. This idea fills to this very day the hearts of the Russian princes and the Russian people as a duty and as an ambition; and there is only one means of keeping them away from Constantinople, the Dardanelles, and Asia Minor—namely, to make the king of Greece emperor of Byzantium. Ivan IV. the Terrible (1533–84) conquered Astrakhan in 1554, the land of the Don Cossacks in 1570, Siberia in 1581; opened a road to Archangel in 1553; concluded a commercial treaty

with England; invited German and English settlers to Russia; established a printing-office in Moscow in 1569; and organized in 1545 a body-guard, the famous *strieltzi* (the "archers") His energy was only surpassed by his cruelty, which gave him his surname. Novgorod was at that time the largest, and in commercial respects the most important, city of the empire. Its fairs, visited by thousands of merchants, and its commercial connections extending in a northerly curve across the world from the cities of Hindostan to the cities of Amsterdam and London, engendered ideas of political freedom and necessitated institutions of civil liberty which collided with the policy of Ivan. The city revolted, and the czar put down the revolution by killing 60,000 of its inhabitants. With his son, Feodor I. (1584–98), the house of Rurik ceased to exist, and after a protracted and severe struggle between Boris Godunoff, Basil V., and the two pseudo-Demetriuses, who were supported by the Poles, Michael Feodorovitch Romanoff, the founder of the present dynasty, ascended the throne in 1612, elected czar by the boyars ("noblemen"). Peter the Great (1689–1725) discovered Western Europe. The Russian people had hitherto rested on their Asiatic descent and the Byzantine traditions. He introduced a new element in their life—modern civilization; and there is perhaps no other example in history of a ruler thus taking a whole nation, obtuse and refractory, and moulding it between his fingers like a piece of wax. The Russians saw annually a dozen Dutch and English vessels in the White Sea. The Swedes and the knights of the Teutonic order they met with in the regions of the Baltic, but only indirectly, in their wars with the Finns, Esthonians, Letts, etc.; and they were generally unsuccessful in these wars. The Poles had of late shown themselves a couple of times in Moscow, enthroning or dethroning the rulers, but their appearance had been as short as high-handed. The German emperors took no notice of the Russians, and France, Spain, and Italy, the bearers of European civilization at that period, were as foreign to them as the moon. Anecdotes of Peter's first travels (in 1697–98) show what Russia was, and how it was considered by the rest of Europe—his astonishment and delight when he first saw a watch, the embarrassment of the foreign monarchs whose countries he visited, and who did not know whether he was an actual king with a real crown or only some immense camel-driver. His royal dignity did not become thoroughly intelligible to Western Europe until after the battle of Poltava, the flight of Charles XII., the downfall of Stanislaus Leczinski, etc. He, however, understood both Europe and Russia very well, and the idea he formed as to the method by which these two powers could be brought together gives him a place among the first statesmen that ever lived. He saw that it was necessary for the people occupying these vast inland plains to break through to the sea in order to breathe freely. The White Sea was not enough; the Baltic, the Black Sea, and the Caspian were needed. In 1696 he took Azof from the Turks, and in spite of subsequent military reverses he kept it. As soon as he deemed his newly-organized army large enough and sufficiently well drilled, he attacked the Swedes, who held the whole eastern shore of the Baltic. His soldiers were terribly routed (Nov. 30, 1700) on the Narva. "I shot them down like ducks," wrote Charles XII. to Stockholm. Nevertheless, while the Swedish hero was busy in Poland, Peter pushed onward to the Gulf of Finland, founded in 1703 the city of St. Petersburg, compelled the boyars to build palaces and the merchants to establish offices in his new city, and sailed out with gorgeous array to receive the first merchant-vessel which entered the new harbor, a Dutch schooner which returned loaded with riches. By the Peace of Nystad (Nov. 1, 1721) he incorporated Ingria and parts of Karelia, Esthonia, and Livonia with Russia. In 1723, Persia ceded the provinces of Ghilan, Mazanderan, and Astrabad, situated along the Caspian Sea. No less energetic and successful were his internal reforms. Canals were dug, roads built, schools founded, manufactures established, and large numbers of skilled mechanics, engineers, artists, and scholars were invited to Russia and treated well, though the manners of their host were sometimes a little rough. A pattern of European dress, after which the boyars were commanded to cut their clothes, was hoisted over the gates of Moscow; they were also ordered to shave off their long beards, and the czar is known to have rushed into the street, caught a man by the throat, and cut off his beard with an imperial pair of scissors. He died Feb. 8, 1725, from a cold he caught by springing into the water and helping to rescue some shipwrecked persons. His greatest merit, however, was that the immense machine which he had put in motion did not stop when he died. Some progress was made under each of his successors—Catharine I. (1725–27), Peter II. (1727–30), Anne (1730–41), Elizabeth (1741–62), his daughter, who founded at Moscow the first Russian university; and especially under Catharine II. (1762–76). After the Peace of Nystad, Peter the Great had assumed the title of "emperor of Russia," but in spite of Anne's signal success against the Turks and Elizabeth's prominent participation in the Seven Years' war, on her accession to the throne Catharine found some difficulties in getting her title recognized and respected by foreign powers. Before her death, however, they had wholly disappeared. Her talent for show and her coquetry with the French philosophers, with Voltaire, D'Alembert, Diderot, etc., gave her great prestige, and her successful wars with Persia, Sweden, and Turkey, from whom she conquered the Crimea, and still more her marvellous diplomatic successes, by which she acquired Courland and the half of Poland, gave her weight. Her internal reforms bore sometimes a resemblance to the cities through which Potemkin conducted her on her journey to Taurida: they were paper only. Nevertheless, she brought a great number of good settlers, German and Swiss, to Russia, founded some excellent educational institutions, and gave to Russian life in general many impulses of freedom and refinement. Under her son, Paul I. (1796–1801), the intercourse between Russia and Europe became still more frequent and intimate, and under Alexander I. (1801–25) Russia appears not only as one of the great powers, but as the true arbiter in European politics. Alexander was a gifted man, imaginative, enthusiastic, and easily carried away through his great impressibility. In the Napoleonic wars he sided first with Austria, and was beaten at Austerlitz; then with Prussia, and was beaten at Friedland. There seems to have been no definite policy behind these alliances. But after his first personal meeting with Napoleon, who completely overwhelmed him by the vastness of his plans, his policy became fixed for several years. In the interior no change took place. Alexander was never a liberal, but in the beginning of his reign he was a philanthropist. The secret court for political cases, police supervision by spies, confiscation of property as a criminal punishment, and other similar mischievous or revolting practices, were abolished; a vast educational system was inaugurated, and industrial and commercial enterprises were encouraged. But his foreign policy had received a new goal. He had divided the world with Napoleon, and given up the western part. He only intended to regulate his frontiers in this direction, and was then prepared to advance to the East and meet the English in Bengal—an idea which, however, not Napoleon, but Catharine II., had infused into the Russian policy. By the Peace of Frederikshamn (1809) he obtained Finland from Sweden; by the Peace of Bucharest (1812), Bessarabia and Moldavia from Turkey; and the war with Persia—that is, the advance toward Bengal—was successfully progressing when his friendship with Napoleon suddenly began to wane. He could not fulfil the conditions which Napoleon had stipulated—namely, the introduction of the continental system—and the war with Turkey had shown him that, on the other hand, Napoleon by no means thought of keeping his part of the compact. A rupture took place, and now followed with fearful rapidity the invasion of Russia by Western Europe, the destruction of the grand army, and the overthrow of Napoleon. In 1814, Alexander stood as the liberator of Europe, received with enthusiasm by the nations and the kings, flattered and adored; after witnessing a review of the Russian troops in the Champs de Mars, Madame de Krüdener told him that she had thought all the while of the reign of Christ on earth. His treatment of France was noble and magnanimous; of Poland, liberal and wise; of Germany, although so utterly unsatisfactory to the German people, yet the best he could do. But from his tour in Western Europe he returned home another man, perplexed and seduced by some of the most eccentric movements of European civilization, disenchanted and polluted by the vile and depraved egotism of the European princes. Soon his whole internal policy was changed, and he became the founder of the Holy Alliance and the chief support of the European reaction. Suppression became the principle of his government—the censorship, the police, and an army of spies its organs. He was hated at home and abroad; and he knew it. A few hours before he died he learned that a widespread and powerful conspiracy against the house of Romanoff was about to explode. Under his brother, Nicholas I. (1825–55), and his grand-nephew, Alexander II., Russia continued to occupy the same position in European politics—at the head of the reaction, the stern and proud representative of the absolute monarchy, based partly on a bureaucratic, partly on a military organization. But in the interior an entirely new development took place of the greatest consequence to the empire itself and to the world at large—perfectly just and highly

beneficial in its general idea, though often terrible and shocking in the practical measures it has called forth. Under their frequent intercourse with foreign nations the national consciousness of the Russian people awoke, and under the reign of Nicholas I. a national party was formed both in literature and politics, representing those ideas and passions which compose the popular character of the Russians. As the most prominent results of this movement may be mentioned the Russianizing of the non-Russian nations belonging to the empire, and the closer and closer grasp of the heritage of the Byzantine empire. Nicholas claimed to be the patron and natural defender of the Greek Christians in Turkey. But Napoleon III., whom he would never call "Monsieur mon frère," and England, whose merchants have invested very largely in Turkish oppression and misrule, could not allow this patronage. The Crimean war ensued, and by the Peace of Paris (1856) Russia lost its supremacy in the Black Sea. It only bided its time, however, and Oct. 31, 1870, when neither England, France, nor Turkey was able to resist, Prince Gortschakoff informed the various cabinets that Russia felt compelled to deviate from the stipulations of the Treaty of Paris, and keep a fleet of sufficient capacity in the Black Sea. Between Nicholas I. and the national party there existed a deep sympathy; not so between Alexander II. and certain shades of the party, the Old Russians. The present emperor pursues a progressive policy—progressive toward liberty—which sometimes crosses the prejudices and passions of the Old Russians. The abolition of serfdom in 1861 seemed at one time liable to call forth serious complications. No disturbances took place, however. The censorship has been also mitigated, and great improvements have been introduced into the administration. (See Schnitzler, *Les Institutions de la Russie depuis les Réformes de l'Empereur Alexandre II.* (2 vols., 1867); also Gurowski, *Russia as it is* (New York, 1854); Eckardt, *Modern Russia* (translated from the German, London, 1870); Hepworth Dixon, *Free Russia* (London, 1870); Barry, *Russia in 1870* (London, 1871); Ralston, *Early Russian History* (London, 1874).)

CLEMENS PETERSEN.

Russia, p.-v. and tp., Herkimer co., N. Y., on Canada Creek, including E. portion of the celebrated Trenton Falls. P. 2220.

Russia, tp., Lorain co., O., on Lake Shore and Michigan Southern R. R., includes v. of Oberlin, seat of the college of the same name. P. 4207.

Russia, p.-v., Loramie tp., Shelby co., O., on Cleveland Columbus Cincinnati and Indianapolis R. R. P. 53.

Russia Leather. See LEATHER, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D., M. N. A. S.

Russian America. See ALASKA.

Rus'sian Lit'erature. Ancient as is the Russian language, the most flourishing section of the Slavonic branch of the Aryan family of speech, neither its name nor its literature can boast of any great antiquity. The former dates from the period in which, during the second half of the ninth century, the Varangian princes laid the foundations of what became the Russian empire. The latter is still more modern; for what is generally styled "Old Russian literature" was for a long time little more than a branch of that Church-Slavonic literature which was introduced into Russia after the conversion of the country to Christianity toward the end of the tenth century. Not that the Russian language is descended from the Church-Slavonic, the Old Bulgarian dialect of Slavonic speech employed by Cyril and Methodius for their translation of the Scriptures. The two languages are independent branches of the same stem. But the earliest literary productions of Russia, being due to ecclesiastics versed in Church-Slavonic, evince, so far as their diction is concerned, at least a strong Church-Slavonic influence. As regards their style, they are for the most part copies of Byzantine models, many of them, indeed, being direct translations from the Greek. Their contents, except in the case of the *Chronicles*, are mostly of a religious character. Of the *Chronicles*, the earliest is that of Kief, generally known under the name of its first compiler, the monk Nestor, of whom little is known except that he was received into the Lavra at Kief in 1073, when he was about seventeen years old, and that he probably died after the year 1113. Before his time, no doubt, records were kept in the monastery, but he seems to have been the first to digest them into a continuous narrative. It was followed by other works of a similar nature, such as the *Chronicles* of Novgorod, Volhynia, Tver, Moscow, etc., which run on almost without a break from the eleventh to the seventeenth century. Besides these invaluable foundations of Russian history and the religious works already mentioned, the first period of Russian literature, dating from the introduction of Christianity to the first defeat of the Russians by the Tartars (A. D. 988–1223), produced little that has been preserved. Certain political fictions of a Byzantine origin, as well as numerous moral writings and "apocryphal books" treating of heaven, hell, the creation, etc., came into Russia from the South Slavonic countries. Among the works of this period which may be referred to a Russian source the principal are—(1) the *Instructions* of the grand prince Vladimeer Monomachus to his children, written in 1099; (2) a *Memorial*, attributed to the twelfth century, in which one Daniel Zatochnik (or the "Prisoner") begs a Russian prince to restore him to liberty; (3) a poem, also attributed to the twelfth century, describing the expedition of Igor, prince of Novgorod, against the Polovtsy. Russian scholars generally ascribe the composition of this poem to one of the bards who in those days were attached to the courts of the numerous princes of Rurik's race. It was discovered in 1795 by Count Mussin Pushkin, and edited by him, but the MS., which is supposed to have been copied toward the end of the fourteenth century, was unfortunately burned in the great fire of Moscow in 1812. To this day there have been preserved by oral traditions among the peasantry numerous "metrical romances," some of which are supposed to be relics of a great cycle of semi-epic poetry narrating the exploits of the early princes and their "drujinas," or bands of military companions. Although these "builinas" are chiefly found in the N. E. provinces, the scene of their action is generally laid in Kief, the ancient capital of Russia, before the cities of Vladimeer or Moscow became pre-eminent. After the transfer of the principality of Kief to Poland, one of the consequences of the Mongol invasions, its language underwent a considerable change. The tongue now spoken in the S. W. provinces of Russia is known by the name of "Little Russian," as that of some of the north-western provinces is designated "White Russian." But at present we have to deal only with the "Great Russian" language, originally that spoken in the principality of Moscow, now the official and literary speech of the whole Russian empire and the native tongue of about 35,000,000 of its inhabitants.

The Mongol conquest suddenly stopped the development of Russian literature. For more than two centuries scarcely anything of note was written, and it was not till the Moscow princes established their independence that any improvement took place. Even then little attention was paid to education except by the monks, and very little was written that was not of an ecclesiastical nature. A few records of travel were produced, and some semi-historical tales, two of which narrate the defeats of the Mongols under Batu and Mamai, and the *Chronicles* were sedulously carried on. In the sixteenth century the printing-press was introduced into Russia. Its first production was the *Acts of the Apostles and Epistles of Paul*, which appeared at Moscow in 1564; the most important of its early fruits was the Bible, printed at Ostrog in 1581. Among early Russian MSS., it may be observed, the most important are the Ostromir Gospels, written in Novgorod A. D. 1056–57 for the burgomaster Ostromir, the *Izbornik* (*Sbornik* or "Collection"), written in 1073 for the grand prince Sviatoslaf, and a similar work written for him in 1076. The introduction of printing was due to the czar Ivan the Terrible. His writings, especially his correspondence with Prince Kurbsky, together with the *Domostroi*, a treatise by the priest Sylvester on the management of a household, form the most interesting of the secular literary productions of that period. During the "troublous times" which followed Ivan's death but little attention could be paid to education or its results, and it was not until the reign of Peter the Great that any decided impulse was given to literary activity. Seven centuries had passed away since the introduction of letters into the country, but as yet no national literature had sprung into life, for that title cannot be given to the religious utterances of the clergy, the historical compilations of the monks, or the various codes of laws—invaluable as are to the historian and the jurist the rich collections of *Chronicles*, such records of ancient jurisprudence as the eleventh-century *Russkaya Pravda* (or "Russian Right") of the grand prince Yaroslaf, or the *Code of Laws* founded upon it by his grandson, Vladimeer Monomachus, and such memorials of fifteenth and sixteenth century lawgivers as the *Sudebniki* (or "Codes") of Ivan III., his son, Vassily III., and his grandson, Ivan IV.—czars whose reigns cover the period from 1462 to 1584—or the *Sobornoe Ulozhenie* (or "General-Assembly Code") which was adopted by the "general assembly" or "states general" convoked for the purpose by the czar Alexis Mikhailovich in 1648. Certain religious dramas or mysteries, it is true, had been composed in Russian, notably by the ecclesiastical dignitaries Simeon of Polotsk and Demetrius of Rostof, and an unwritten literature existed

in the memories of the common people, among whom a number of songs and stories had been handed down from generation to generation. But as the latter have only recently been collected, and their present forms are, for the most part, not very old, it is impossible to ascertain the period to which their origin should be referred.

With the reign of Peter the Great begins the history of the modern literature of Russia. That great reformer, so anxious to introduce into his realm all that had given life and progress to the West of Europe, made an attempt to improve the neglected education of his subjects. Russian printing was encouraged, the Russian alphabet was simplified and rendered more apt for typographical uses, and by means of translations and imitations foreign culture was brought to bear upon the new empire. As Peter, however, was always in a hurry, and insisted, above all things, on what was practical and serviceable to his ends, neither literature nor science could fairly develop itself. Still, many books were printed. Not only such religious works appeared as those of Theophan Prokopovich and Stephen Yavorsky, but secular literature began to assert itself. Among its first representatives during the period which followed Peter's death was Prince Antiochus Kantemir (1708–44). A Russian by education, though not by birth or descent, a man of the world, a politician and a diplomatist, he wrote in Russian verse such satires as were natural to a period of transition. Founded upon those of Juvenal and Boileau, they attacked the faults and follies of the aristocracy and the various abuses which Peter had attempted to reform. Another was Vassily Tatishchef (1685–1750). Long in the public service, engaged in all kinds of official work, he gave his leisure to geography and history. His chief literary production was the *Russian History*, which was published about thirty years after his death. It was, for its time, a remarkable work, as also was a moral treatise which he wrote in 1733, entitling it his *Testament*, and giving in it his idea of what a Christian man in Russia should be. A third was Vassily Trediakovsky (1704–69). The son of a priest, he completed his education in Holland and France, returning to Russia in 1729. Receiving a professorial appointment, he translated much. The appearance of the guide to versification which he published in 1735 forms an epoch in the history of Russian poetry. His own verses, however, failed to do justice to the correctness of his theories on the subject. But the first lay writer of real mark was Michael Lomonosof (1711–65), the son of a serf engaged in fishery in the province of Archangel. Taught to read and write by his mother, he fled from his home to Moscow in 1729. Having completed his education in Germany, he returned to Russia, where, after enduring many hardships and meeting with much opposition from the German administrators of the Academy of Sciences, he at length achieved success, and produced many works, mostly of a scientific nature. But his chief merit was that he laid down the laws of Russian grammar, and rescued the literary language of his country from the state of anarchy into which it seemed to be falling under the pressure of many forces from without. The long-maintained influence of the Church-Slavonic over the real Russian language has already been mentioned. A great influence also was exercised on the language by Polish, especially during the considerable period throughout which the Polish-Lithuanian power extended over the S. and W. of what is now Russia. With the introduction of Western culture a third foreign element appeared in the shape of words and idioms belonging to other tongues, especially the German, and there seemed to be no small danger of a language becoming hopelessly corrupted which had no classic literature, no recognized laws or models on which to fall back. The services, therefore, rendered by Lomonosof as a linguistic reformer were very great, though his literary merits were less conspicuous than his scientific. From his time the Russian language, no longer cramped by the archaic stiffness of the Church-Slavonic, and to a great extent freed from the danger of being corrupted by alien influences, served as a fit interpreter of the ideas of the fast-increasing school of thinkers and writers who illustrated the brilliant age of Catharine II. —a monarch who greatly contributed by her influence to the development of Russian literature, besides adding to its stock several dramas, essays, etc. of her own composition. But although the written language became more natural, the spirit of Russian literature remained foreign to the land. Not only were translations numerous, but Russian authors turned for their models to other countries, and their productions were seldom marked by anything like originality. This was the age of the literature of the *salon*, marked by much culture, grace, and vivacity, but wanting in anything like depth or earnestness of thought; almost the sole exception being Radischef's *Journey from Petersburg to Moscow* (1790), in which appears an unusual seriousness, as well as such a strong feeling on the subject of serfdom as led to the author's exile. Of other writers the most remarkable were—Alexander Sumarokof (1717–77), who wrote twenty-six dramas of the "pseudo-classic" kind, his models being Corneille and Racine, besides numerous essays, satires, poems, etc.; Denis von Wizin (1744–92), scion of a knightly German family, a dramatist, satirist, and miscellaneous writer, best known by his comedies, *The Minor* and *The Brigadier;* Ivan Khemnitser (1744–84), also of German extraction, a fabulist of renown; Michael Kheraskof (1733–1807), the author of an immense number of dramas and poems, including two epics—the *Rossiad*, describing the capture of Kazan, and *Vladimir*, the theme of which is the conversion of Russia to Christianity; Ippolit Bogdanovich (1743–1803), a Little Russian, a prolific poet, best known by his *Dushenka*, an imitation in irregular verse of the tale of Cupid and Psyche, which La Fontaine adapted from Apuleius; and Gabriel Derzhavin (1743–1816), by far the most notable of all, who held various important government appointments, and wrote much poetry of various kinds. His fame, which is very great among his countrymen, chiefly rests upon his lyrical poems, one of which, the *Ode to God*, has acquired an immense reputation, confirmed by the critical opinion of an emperor of China. Many other Russian writers of renown illustrated the eighteenth century, for during the reigns of the three empresses literature became creditably represented in Russia in almost every branch. The drama from the year 1746, in which the first Russian theatre was founded in the provincial town of Yaroslaf, throve vigorously, and rooted itself in the affections even of the common people. Journalism had begun to make its way, though slowly, its first appearance being due to the activity of Gerhard Friedrich Müller (1705–83), a writer who also commenced the historical researches in which Russian literature has since distinguished itself so honorably. Like August Ludwig Schlözer (1735–1809) and many other fosterers of science in Russia, he was a German, but his studies were carried on in Russia, and greatly to the advantage of that country. The study of Russian history was greatly favored by Catharine II., and ample materials were gradually prepared for the work of the first Russian author who made his name known in the West of Europe. Nicholas Karamzin (1765–1826) may be taken as the first representative of the new school of writers which prevailed throughout the reign of Alexander I. and a considerable part of that of Nicholas. During those reigns Russian literature attained its full development, and it was illustrated by the greatest names of which it as yet had to boast. For their success the way was to a great extent prepared by Karamzin, who rendered to Russian style a service like that which Lomonosof had already rendered to Russian grammar, freeing it from the heavy and complicated forms of construction into which it had been led under Latin and German influences, rendering it far more fit than it had previously been for the expression of simple and natural ideas. His early works, including a number of tales in the sentimental vein then beginning to be in vogue, are of no great value, but after a time the historical studies, which obtained for him the title of "historiographer to the emperor," led him to compose (1803–16) the *History of the Russian Empire*, to which he owes his cosmopolitan reputation. Between those years the great events which rendered so memorable the first half of the reign of Alexander I. brought Russia into close contact with the rest of Europe, but at the same time evoked a strong national feeling. A genuine Russian literature, dealing not merely with courts and nobles, but broadly based upon the land and its people and reflecting their ordinary thoughts, feelings, and avocations, gradually made its way and held its ground. By influences from abroad it was still much moulded, but that which began to assert itself most, the English, produced upon it a salutary effect. During the reign of Nicholas, it is true, a severe censorship greatly fettered the press, rendering impossible the discussion of many questions, especially of those of a theological or philosophical nature. But by forcing the expression of thought into certain channels it may have added to the force, while it narrowed the range, of the current of printed speech. In verse this period was especially rich. The Russian language lends itself readily to versification; a genuine poetic feeling is widely diffused among the Russian people, the peasantry having from time immemorial been devoted to song. No poet of the first order, it is true, has as yet arisen among them, but, on the other hand, the number of their poetical writers is very great. For a considerable period a false classicism chilled the native glow of Russian poetry, but during the reign of Alexander I. a romantic school of poets arose. Among the first was Vassily Joukovsky (1783–1852), who took

the modern German poets, and especially Schiller, as his models. His poems, which, like those of the majority of Russian poets, were somewhat of the nature of imitations or adaptations, together with his numerous and excellent translations, exercised a great influence over the literature of his day, which became freed from the frigid classicism introduced from France. A healthy taste for the Greek classics, on the other hand, began to spring up at this time, and was fostered by such translations as that of the *Odyssey* by Joukovsky, of the *Iliad* by Gniedich, those from Sophocles, Pindar, and Anacreon by Martynof, and from Theocritus by Merzliakof; as well as by the poems which Konstantin Batyushkof (1787–1855) wrote under the influence of the Greek lyric poets, or at least of their French imitators. But the foreign influence which had the greatest effect upon Russia's chief poet came from a different quarter. Alexander Pushkin (1799–1837) owed much of his early inspiration to the genius of Byron. Endowed with true poetic fire, and with a power of expression unmatched among his countrymen, his best works reached the highest point to which Russian poetry has as yet attained. He wrote much in prose as well as in verse, his principal work being the poem called, after its hero, *Eugene Onegine*, which ranks as one of the chief masterpieces of Russian literature. Dealing with the Russian society of the period in which it appeared, that comprising the last portion of Alexander's reign and the first of his successor's, it had the great merit of offering a series of pictures carefully drawn from life, and yet sufficiently idealized to fascinate every eye. Readers familiar with its themes—such as the influence of Western ideas upon Russian society, the effect of romantic fancies upon the younger members of the upper classes in Russia—could recognize the accuracy of its portraiture, the subtlety of its analysis of character; while even those totally unacquainted with them could appreciate its poetic charm. Pushkin met with an untimely death, being killed in a duel, and a similar fate befell the second of Russia's poets. Michael Lermontof (1814–41), who also was killed in a duel, resembled Pushkin in some respects, as well in his Byronic scorn and *ennui* as in his healthy love of nature and his remarkable power of describing scenery. As several years of his unquiet life were spent in the Caucasus, he has been able to enrich his chief works with graphic descriptions of the romantic beauties of that grand mountain-range, as well as of the wild life then led by its picturesque inhabitants—scenes attractive to all eyes, but especially to those of a people inhabiting so flat and tame a land as Russia. These charms partly account for the immense popularity of his *Demon*, a poem in which is described the love of the chief of the fallen angels for a Circassian maiden; of his *Mtsyri*, another poem descriptive of the feelings of a young mountaineer who has been brought up in the peaceful seclusion of a monastery, but who cannot withstand his inborn craving for a free and open life—feelings with which those of the ardent youth of that oppressive period were in complete sympathy; and of his *Hero of Our Time*, a prose novelette, which has been translated as often and into as many languages as Pushkin's tale of *The Captain's Daughter*. One of the most vigorous of Lermontof's poems is one in which, imitating the style of the "metrical romances" current among the Russian peasantry, he tells a story of the time of Ivan the Terrible. It is when they fall back upon the popular poetry of their native land that the Russian poets evince most power. This is especially manifest in the writings of Alexis Koltsof (1809–42), a poet belonging to the *bourgeoisie*, his father having been a small trader in Voronezh. Endowed with rare poetic feeling and keenly appreciating the romantic side of country life, he has to a great extent borrowed his imagery as well as his versification from the rich store of national song, and his lyrics therefore bear a thoroughly Russian stamp. His fellow-townsman, Ivan Nikitin (1826–61), who also belonged to the class of small traders, has produced a number of poetic sketches of humble life, which foreign critics, who naturally lay more stress on an author's ideas than on his diction, may sometimes prefer to the more ambitious productions of his aristocratic contemporaries. Nikitin, however, belongs to the realistic school, which followed the romantic, the change being principally due to Gogol, the writer whom Russians put forward as their truly national representative, to whose influence the direction and tone of Russian fiction has for the last forty years been chiefly due. Satire has always been popular in Russia, where there is one instance of a great reputation being founded upon a single work of a satirical nature. This is the *Gore ot Uma* of Alexander Griboyedof (1795–1829), another of Russia's short-lived poets, killed in his thirty-fifth year during a riot at Teheran, whither he had gone as Russian plenipotentiary. The comedy to which he owes his fame, and which is regarded in Russia as one of the few acknowledged masterpieces of native literature, was completed in 1823. Its title expresses the misfortune of being too intellectual or *spirituel*, and its principal theme is the contrast between the old and new schools then existing in Russian society, the struggle going on between the past and present ideas, the obstructive party being represented by the elderly Famousof, and that of progress by the young Tchatsky. The immense success achieved by this drama in Russia may to some extent be accounted for by the love which the Russians have for seeing themselves held up to ridicule so long as the operation is performed by a native hand; and this creditable feeling partially explains, likewise, the unrivalled popularity of Gogol's principal works, the *Revizor* and *Dead Souls*. Nicholas Gogol (1806–52), a native of Little Russia, after trying and abandoning official and professorial life, devoted himself to literature, which by his time had become capable of being considered a profession. Naturally of an enthusiastic nature, he at first wrote stories of a romantic kind, but about 1834 he became the leader of the realistic school, to which so much of Russian literature has since that time belonged. In his shorter tales, such as the *Cloak*, etc., there is pathos mingled with the humor on which his reputation is mainly based, and some of them, especially two sketches of country life as led by the smaller Russian landowners, are from every point of view admirable. But the two works by which he seems destined to be immortalized are realistic studies of ridiculous, often repulsive, social types, into which little enters that is romantic or pathetic or ideal. Their influence on subsequent Russian fiction has been very great, and it to some extent accounts for the fact that Russian novels often prove distasteful to readers who are not sufficiently familiar with Russian society to recognize their fidelity to life. In Gogol's comedy of the *Revizor* a picture is drawn of the evils inherent in the official life of the time—evils which the author intended to be not only laughed at, but sorrowed over. The whole of the dramatic action is concentrated around the impatiently-awaited arrival of a government reviser or inspector, who is coming to examine into the state of provincial administration. The various types of chinovniks, or members of the civil service, are truthfully though grotesquely portrayed, and inexhaustible laughter is provided for a Russian audience by the errors into which they are led when mistaking an ordinary new-comer for the dreaded official. The subject of the play was suggested to Gogol by Pushkin, who exercised over him a great influence, as was also that of his most famous work, the novel, if it may so be styled, entitled *Dead Souls*. Its hero, Chichikof, ex-holder of a small post under the government, wanders about Russia buying "dead souls"—that is to say, having transferred to him the pretended ownership of such "souls" or male serfs as have died since the last census, but who still exist on paper, and are therefore capable of being pledged to the government and thereby turned to pecuniary uses. The real aim of the story is to introduce a number of types, mostly covetous and ignoble, under cover of whom the author may attack some of the social abuses of the day. The work obtained, and still enjoys, an immense success, but its reputation is never likely to become cosmopolitan. During the last ten years of his life Gogol sank into a state of despondency, devoting himself to mysticism, and no longer entertaining those ideas about the art of authorship which have had so powerful an influence upon modern Russian literature. His great merit, to a foreign eye, seems to be the thoroughly Russian character of his work. So much in Russian literature has been borrowed from abroad —if not in thought, at least in style—that the few writers who have shown themselves truly national stand out in clear relief from the host of imitators. Gogol is one, Koltsof another, and as a third may perhaps be mentioned the fabulist, Ivan Krilof (1768–1844). It is true that the form of Krilof's fables was borrowed from La Fontaine, as were the subjects of his earlier productions, but in his later and best works his ideas, his style, and his peculiar vein of humor were original and thoroughly Russian. He wrote much, especially as a journalist and dramatist, but it is to his fables that he is deservedly indebted for a fame which is as widespread as it is likely to be lasting. Beginning by paraphrasing La Fontaine, he eventually produced thoroughly original works, often employing his apologues as a vehicle for such sarcastic attacks upon official abuses as it might have been dangerous to publish in a more serious form. The terseness of his diction, the simple neatness of his versification, can be fully appreciated only by Russians, but numerous translations have enabled foreign readers to judge of the keenness of his insight into human nature, the sparkle of his wit, and the fresh brightness of his humor. His is one of the very few names of Russian authors which are at all familiar to foreigners, many of the writers who have considerably assisted in the development of Russian

literature being all but unknown beyond the Russian frontier. Such is the fate, for instance, of Byelinsky (1801–48), the prince of Russian critics, who during the last third of his life was the experienced guide, the enlightened appreciator, of every literary movement in Russia.

During the second half of the reign of Nicholas several writers of mark began to appear. Among those who made their names most known abroad was Alexander Herzen, whose remarkable abilities, however, were soon transferred from literature to politics. He may be taken as the representative of that revolutionary spirit which has since produced a literature of its own. Had he devoted himself to fiction, he might have achieved the success of which his novel *Whose Fault?* (published in 1847) gave promise. But founding a "free Russian press" abroad, he and his fellow-workers, of whom the poet Ogaref was, from a literary point of view, the most remarkable, turned their whole attention toward publishing, in England and in Switzerland, in the form of books, journals, and pamphlets, ceaseless attacks upon the government of the land from which they were exiled. Until the death of Nicholas this Russian revolutionary press exercised great power, but the sweeping reforms introduced by Alexander II. almost annihilated its influence. Freed from the crushing weight by which, in the time of Nicholas, it was kept down, Russian literature under the milder rule of his successor gained greatly in strength and in activity. In one department, indeed, that of poetry, it manifested a falling off, but in almost every other branch it throve rapidly and bore fruits both plentiful and rich. So numerous, indeed, have become the productions of the Russian press since the Crimean war, and so varied their subjects, that in speaking of them here it is barely possible to do more than to mention the leading representative of each of the classes into which they may be divided. In poetry the first place is due to Nicholas Nekrasof. Born in 1822, he began to write as early as 1838, and since that time his works have been as numerous as popular. A bitter satirist and an ardent reformer, he took as his early themes many of the evils of Russian life, laying especial stress upon the sad condition of the peasantry before the emancipation. Fully in earnest, at least theoretically, often hot with a generous indignation, and gifted with a great power of vigorous expression, he has drawn a series of pictures of village life, as well as of city sufferings, which are singularly clear and impressive. Many other subjects also have been treated by him, chiefly from the point of view of the social satirist, but his genius appears to the greatest advantage when he deals with such themes as are most truly Russian, and avails himself in handling them of the peculiar ideas and quaint expressions which have been preserved in the songs forming the poetic heritage of the common people of Russia. How great is the store of poetry which Russian literature possesses may be judged from the fact that the *Chrestomathy*, published by N. Gerbel in 1873, contains biographies and specimens of upward of 120 Russian poets. Among the best known of Nekrasof's rivals may be mentioned Leo Mei (1822–62) and Apollo Maikof and Afanasius Fet, both of whom were born in 1821. Among the younger generation there is not much poetic promise, Russian literature showing a tendency of late years to run more in the channel of prose than in that of verse. Of dramatic literature the leading representative is Alexander Ostrovsky, who was born in 1824. Besides carrying on the work begun by Griboyedof and Gogol in their satirical comedies, dealing with the sins of public functionaries and the weaknesses of the social circles in which they move, he created a special field of his own in representing on the stage the manners and customs of the Russian mercantile class, long an exclusive caste, of the private life of which other ranks knew little. Thus, in his *Lucrative Appointment* he has depicted the contrast between the old and the new school of officials, portraying in glowing colors the young *chinovnik* or civil servant, full of generous ideas, shocked at the thought of bribery, and standing out in bright relief against a background dark with the cynical corruption of bygone days. And so his *Groza* (or "Storm"), the best of his dramas devoted to commercial life, describes the tyranny with which a mother rules the house of her married son, a young Moscow merchant, and the infatuation with which his wife spurns his affection for that of a lover —the despair to which she ultimately yields herself after a thunderstorm has awakened her conscience to a sense of her guilt. Ostrovsky has also produced several historical dramas, as have some other of his contemporaries, among whom may be mentioned Count Alexis Tolstoi (1817–75), whose trilogy of *The Death of Ivan the Terrible, Tsar Fedor Ivanovich,* and *Tsar Boris,* deserves special notice on account of the careful study devoted to its representation of a very troublous period of Russian history. Among the numerous novelists of Russia several men of mark are to be found, but by far the first is Ivan Turgenief, the solitary Russian writer whose fame is cosmopolitan, whose works are widely read out of Russia for the sake of their artistic merit, and not merely on account of the information they convey or the light they may throw upon Russian history or manners. Born in 1818, he began his literary career as a poet, publishing numerous poems between 1841 and 1846. In 1843 appeared his first prose work, a dramatic sketch, and in 1844 his first tale, *Andrei Kolosof.* His principal works, most of which have been translated into many languages, are the *Zapiski Okhotnika* ("A Sportsman's Notes"), a series of exquisitely finished tales and sketches illustrating country life in Russia, with especial reference to the peasants and their sufferings from serfdom; the novels entitled *Dvoryanskoe Gnyezdo* (translated into French under the title of *Une Nichée de Gentilshommes,* and into English under that of "Liza"), *Fathers and Children, Smoke, Spring Floods, On the Eve, Roudine,* etc.; and numerous novelettes and tales, some of which, such as *Faust* and *Moomoo,* for instance, may rank with the best specimens of their class which the literature of any country has ever produced. Among other modern Russian novelists of note are Count Leo Tolstoi, whose *Peace and War* is by many Russian critics considered the best of Russian novels; Goncharof, whose chief work is *Oblomof,* in which the downward career is traced of the hero from whom the story takes its name, and in whom a weak will annuls many good qualities; Dostoefsky, best known by his *Crime and Chastisement,* which contains a careful psychological study of the effect of crime on the mind of the criminal, and by his *Notes from the Dead-House,* a series of sketches of convict-life in Siberia; Pisemsky, the author of many most realistic novels descriptive of modern society in Russia, such as *The Whirlpool, A Thousand Souls,* etc.; Saltykof, who, under the pseudonym of "Shchedrin," has produced a number of satirical fictions, such as the *Provincial Sketches,* the *Tashkentians,* and other works, in which he describes, or rather caricatures, the official and social faults and follies of the day; and a number of other writers, many of whom have deservedly obtained a considerable reputation in their own country.

It is not, however, so much in the field of imagination as in that of serious study that Russian literature has of late most distinguished itself. In no country has more been done than in Russia, during the last twenty years, toward investigating and editing national records. Besides producing many histories of Russia, of which the principal are those of Solovief, Ustrialof, Kostomarof, Pogodin, and Bestujef-Rymin, the literary activity of late years has given rise to the publication of an immense number of historical, archæological, and ethnographical books, essays, and pamphlets. To the popular mythology and literature of Russia more serious attention has been paid than has been given to similar subjects anywhere except in Germany, the collections of popular tales by Afanasief, of proverbs by Dahl, and of popular songs and metrical romances by Rybnikof, Hilferding, Shein, the brothers Kirievsky, and many others being all but unrivalled. Much similar work, moreover, has lately been excellently performed in Little Russia by Kulish, Rudchenko, Chubinsky, Dragomanof, Antonovich, and others, but their labors have not been fostered by the Russian authorities. Almost every department of science, indeed, is now creditably represented in Russian literature, special attention having been paid of late years to philosophy and jurisprudence. The publications of the great learned societies, such as the Academy of Sciences and the Geographical Society, may fairly compete with the best of similar works issued in other countries. But it is not so much a literature as the materials for a literature that the Russian press is now making public. Russian literary energy is at present restless, eager, and impatient, and lends itself more readily to the rapid exploration of what is new and practical than to the slow acquirement of wisdom or the steady polish of style, or to attempting prolonged flights in the regions of fancy and imagination. Journalism in Russia has had much to contend with, the censorship having of old been tyrannical, and being now somewhat capricious. But such newspapers as the *Vyedomosti* (or "News") of Moscow, edited by Katkof, the leading Russian journalist, and the *Golos* (or "Voice"), the *Russian Invalid,* and the *Exchange Vyedomosti* of St. Petersburg deserve to rank high if tried by any other standard than that of newspapers printed in English. Until quite recently the *St. Petersburg Vyedomosti* also occupied a distinguished position. Among magazines or reviews the principal are the *Vyestnik Evropui* (or "Messenger of Europe") and the *Russky Vyestnik* (or "Russian Messenger"), both of which are excellent; the former, indeed, being inferior to no European journal of the same kind except the *Revue des Deux Mondes.* Unfortunately for Russian literature, the reading class in

Russia forms but a very small section of the population, the masses of the people being quite illiterate. With the spread of education may come a greater demand for books, and the national literature may be able to boast of a development commensurate with that of the practical resources of the Russian empire. W. R. S. RALSTON.

Russian River, tp., Sonoma co., Cal., on the river of the same name, so called from a Russian settlement made there early in the nineteenth century.

Rust, Smut, Blight, Brand, and **Bunt** are diseases of plants produced by the growth of microscopic vegetation (fungi) upon the plant. (See MILDEW and UREDINES.)

Rus'tige (HEINRICH), b. at Werl, Westphalia, Apr. 12, 1810; studied painting at Düsseldorf under Schadow; settled in 1836 at Frankfort, and was appointed professor at the Academy of Stuttgart in 1844. He has painted genre pictures—*The Golden Wedding*, Leipsic; *The Inundation*, Berlin; *The Gueux Sermon*, America; *Soldiers in Camp*, Russia—and historical pictures, most of which are in Stuttgart. He also wrote art-criticisms, dramas, and songs, one of which, *Deutscher Marsch*, was set to music by Kücken and became very popular.

Rüs'tow (WILHELM), b. at Brandenburg, Prussia, May 25, 1821; entered the Prussian army in 1838; was arrested and indicted in 1850 for his *Der Deutsche Militärstaat vor und während der Revolution* (1850), but escaped; settled at Zurich; became a celebrated military author; found practical employment in the Swiss army, and took part with distinction in the campaigns of Garibaldi in Sicily and Naples in 1860. Besides his *Geschichte des Griechischen Kriegswesens* (1852) and *Heerwesen und Kriegführung Cäsars* (1855), he has given critical representations of all the recent European wars, and a number of theoretical works on tactics, strategy, elementary military organization and education, etc.

Rustschuk', town of European Turkey, eyalet of Silistria, is built on several hills along the Danube and surrounded with extensive fortifications. It is the see of a Greek archbishop, and has several fine mosques and extensive manufactures of leather, muslin, silk, and tobacco. P. about 30,000.

Ru'ta Ba'ga, the Swedish turnip, a highly important crop-root, believed to be an artificial variety of *Brassica campestris*. It has many sub-varieties, some of which are among the most valued of the turnips. (See TURNIP.)

Ruta'ceæ [from *Ruta*, one of the genera], a natural order of exogenous trees, shrubs, and herbs. Rue, buchu, and the prickly ash (*Xanthoxylum*) are representative plants of the order. Recently, botanists have attached the Aurantieæ (orange, lemon, citron, etc.) to this family, which now numbers some 500 species.

Ru'te, town of Spain, province of Cordova, has 6345 inhabitants.

Ruter (MARTIN), D. D., b. at Charlton, Mass., Apr. 3, 1785; received a common-school education; was licensed as a Methodist preacher when seventeen years of age; gained by private study a competent knowledge of several languages and sciences; presided at one time over the Wesleyan academy at Newmarket; became agent of the Western book establishment at Cincinnati 1820; was president of Allegheny College, Meadville, Pa., 1834–37, after which he went to Texas as superintendent of Methodist missions. D. there May 16, 1838. Author of a *Hebrew Grammar* and several theological treatises.

Rut'gers (HENRY), b. in New York about 1746; graduated at Columbia College 1766; was a captain during the war of the Revolution, and subsequently a colonel of militia. He was a wealthy citizen of New York, a prominent member of the Reformed Dutch Church, a philanthropist, and an active politician; was several times a member of the New York assembly and a regent of the University of New York from 1802 to 1826. D. in New York City Feb. 17, 1830. Rutgers College took his name in consequence of a donation of $5000, and several important charities in New York City were recipients of his bounty.

Rutgers College, originally called **Queen's College,** chartered in 1770 by Gov. William Franklin of New Jersey, was located in 1771 at New Brunswick, N. J., Rev. Dr. J. R. Hardenburgh being the first president. It was the outgrowth of a desire on the part of its Dutch founders to perpetuate their distinctive theology and forms of worship. During the Revolutionary war it was closed for six years, and on account of financial embarrassments again closed twice, being reopened in 1825 under the care of the General Synod of the Reformed Dutch Church, and the name changed to Rutgers College "in consideration of the character and services of Col. Henry Rutgers." The number of professors was increased, a residence for the president erected, and the endowment enlarged to $50,000. During the civil war over $100,000 in $100-scholarships was raised by the Reformed Church through the energetic labors of the present president, Rev. William H. Campbell, D. D., and the General Synod transferred its entire right to the trustees, rendering the college independent. In 1864 the State college for the benefit of agriculture and mechanic arts provided for by an act of Congress became attached to Rutgers College. Since Dr. Campbell assumed the presidency in 1863 the endowment has been increased from $50,000 to $500,000; an astronomical observatory, a noble geological hall, and a united chapel and library edifice have been erected. The number of professors is 12, and the number of students in the grammar school and college is about 400. T. SANDFORD DOOLITTLE.

Ruth, Book of, one of the Hebrew Hagiographa, a canonical book of the Old Testament. It is a beautiful pastoral story, relating the love of Ruth, a young Moabitess, the widow of a Hebrew, for her mother-in-law, Naomi, and of the subsequent marriage of Ruth to Boaz, a rich husbandman of Bethlehem-Judah. It is a picture of domestic virtue and happiness amidst the troubled times of the Judges, when might was right. Ruth was the great-grandmother of King David. The date and authorship of the book are quite unknown, but it must have been written after the time of David and before the time of Ezra. Goethe pronounces the book of Ruth "the loveliest thing in the shape of an epic or idyl which has come down to us."

Ruthe'nian Rite, a branch of the Roman Catholic Church, consisting of the United Greeks of Austria, Hungary, and Poland, who as a rule speak the Russniak language, a Slavic tongue resembling the Polish. They have an archbishop (Lemberg) and five bishops (Premizl, Kreuz, Eperies, Maukacz, Chelm). (See EASTERN RITE.) The Ruthenian Bible was first published in 1581.

Ruthenians, or **Russniaks,** a branch of the Slavic family of nations, inhabiting the eastern part of Galicia, the north-western part of Hungary, and the adjacent regions of Poland and Russia. Their number is estimated at from 5,000,000 to 13,000,000, according as a greater or smaller number of nearly-related tribes is comprised under the same appellation. They are agriculturists, and belong to the Greek Church. Their cities are inhabited by Poles and Jews, and their general standard of civilization is low, though they do not lack natural intelligence. Their language forms an intermediate link between the Russian and the Polish. They translated the Bible in 1581. Specimens of their rich folk-lore are found in Vaclav, *Piesni Polskie i Ruskie* (1833). A grammar was published by Levicki in 1833, *Grammatik der russinischen Sprache für Deutsche.* For centuries the Ruthenian territory belonged to the Polish crown, but the endeavors of the Polish Jesuits to convert the people to the Roman Catholic Church, and the systematic suppression of the Ruthenian idiom by the Polish government, engendered a deep hatred. During the Polish revolutions the Ruthenian peasantry butchered the Polonized nobility with great cruelty, and since the nation began to rise in civilization it has allied itself closely in literature and politics to the Russians.

Ruthe'nium, a metal discovered in association with native platinum by Claus in 1846. It occurs chiefly in the hard grains of iridosmine in small proportion, not above 6 per cent. Its extraction is difficult, tedious, and even very dangerous, owing to the deadly fumes of osmium. The metal is obtained as a white spongy mass, density 8.6, by calcining the ammonio-chloride. Next to osmium, it is the most infusible known metal, but Deville and Debray fused it, and found a density of 11.4. It is scarcely attacked by *aqua regia*, but easily oxidized by fusion with hydrate of potash, more easily with saltpetre. Chlorine attacks it at incandescence. It forms three chlorides, $RuCl_2$, $RuCl_3$, and $RuCl_4$; five oxides, RuO, Ru_2O_3, RuO_2, RuO_3, and RuO_4; and two sulphides, Ru_2S_3 and RuS_2. Its fumes are not poisonous. H. WURTZ.

Ruth'erford, county of S. W. North Carolina, on the head-waters of Broad River, has a rugged surface, but the valleys are extremely fertile, the staples being Indian corn, sweet potatoes, tobacco, butter, honey, and sorghum-molasses. Cap. Rutherfordton. Area, 850 sq. m. P. 13,121.

Rutherford, county of Central Tennessee, watered by Stone River and other tributaries of the Cumberland, has an undulating surface and a very productive soil, and is traversed by Nashville Chattanooga and St. Louis R. R. The staple productions are Indian corn, wheat, oats, cotton, sweet potatoes, sorghum-molasses, wool, and butter. Sheep

and swine are raised in considerable abundance. There are 4 wool-carding establishments and several flouring and saw mills. The battle of Stone River, one of the most important of the late civil war, was fought here Dec. 31, 1862, to Jan. 2, 1863. Cap. Murfreesboro'. Area, 550 sq. m. P. 33,289.

Rutherford, tp., Martin co., Ind., on E. fork of White River. P. 1030.

Rutherford (DANIEL), M. D., b. at Edinburgh, Scotland, Nov. 3, 1749; graduated in medicine at the University of Edinburgh 1772, announced in his graduation thesis, *De Aere Mephitico*, the existence of the gas since called azote or nitrogen; became professor of botany and keeper of the botanic garden 1786. D. at Edinburgh Nov. 15, 1819.

Rutherford (GRIFFITH), b. in Ireland about 1730; was one of the pioneers in the "Locke Settlement" in Western North Carolina; was a member of the North Carolina convention at Newberne 1775; commanded an expedition which penetrated into the Cherokee country 1776, in which year he was appointed a brigadier-general by the provincial congress; was taken prisoner at Camden Aug., 1780; took command at Wilmington upon its evacuation by the British; was a State senator 1784; removed soon afterward to Tennessee, where he was president of the legislature in Sept., 1794. The date of his death is unknown. Counties in North Carolina and Tennessee bear his name.

Rutherford (JOHN), M. D., b. at Yarrow, Selkirkshire, Scotland, Aug. 1, 1795; was apprenticed to a surgeon at Edinburgh; afterward studied at London, at Rheims, and at Leyden under Boerhaave, and, returning to Edinburgh, was associated with Dr. Munro and others in founding the famous medical school of Edinburgh, in which he lectured on medical practice for forty years. D. at Edinburgh in 1779.

Rutherford (JOHN), nephew of the earl of Stirling, b. in New York City 1760; graduated at Princeton 1776; became a lawyer; was a Presidential elector 1798, 1813, and 1821, and U. S. Senator 1791–98; retired early from public life to devote himself to the management of his immense landed estates in New Jersey; was an efficient promoter of scientific agriculture and of internal improvements, and was the last survivor of the Senators who sat in Congress during the administration of Washington. D. at Ederston, N. J., Feb. 23, 1840.

Rutherford (JOHN), b. at Richmond, Va., in 1794; graduated at Princeton; became a successful lawyer; sat in the Virginia general assembly twelve consecutive years; was fourteen years a member of the executive council; was lieutenant-governor for several years, and at one period acting governor; organized the Fayette Artillery at Richmond, which he commanded with the rank of colonel; was from 1836 the principal agent (a post equivalent to president) of the Mutual Assurance Society of Virginia, the oldest institution of the kind in the State, and long a member of the executive committee of the Democratic party. D. at Richmond Aug. 3, 1866.

Rutherford (SAMUEL), b. in Roxburghshire, Scotland, about 1600; graduated M. A. from the University of Edinburgh 1621; became minister of Anwoth 1627; was deprived by the high commission court of Galloway 1630, and silenced for preaching against the "Articles of Perth" 1636; was a delegate to the general assembly Nov., 1638; professor of divinity in New College, St. Andrew's, Oct., 1639; principal of that college and rector of the university 1649; was commissioner to the Westminster Assembly 1643–47, but was deprived of his posts 1660. D. at Edinburgh Mar. 20, 1661. He was prominent among the Presbyterian divines of his time, and author of a large number of theological treatises, which were highly esteemed; among them was a reply to Rev. Thomas Hooker's *Summe of Church Discipline*.

Rutherford Dépôt, p.-v., Gibson co., Tenn., on Rutherford fork of Obion River and on Mobile and Ohio R. R.

Rutherfordton, p.-v., cap. of Rutherford co., N. C., near Broad River, W. terminus of the proposed Wilmington Charlotte and Rutherford R. R., has 2 newspapers and is the centre of important mining interests. P. 4079.

Ruth'erforth (THOMAS), D. D., b. at Papworth-Everard, Cambridgeshire, in 1712; educated at and fellow of St. John's College, Cambridge; became regius professor of divinity at Cambridge 1745; rector of Barrow in Suffolk, Shenfield in Essex, and Barley in Hertfordshire, and archdeacon of Essex in 1752; besides sermons and charges to the clergy, wrote *Ordo Institutionum Physicarum, in privatis suis Lectionibus* (1743), *Essay on the Nature and Obligations of Virtue* (1744), *A System of Natural Philosophy, being a Course of Lectures on Mechanics, Optics, Hydrostatics, and Astronomy* (2 vols., 1748), *A Letter to Dr. Middleton in Defence of Bishop Sherlock on Prophecy* (1750), *A Discourse on Miracles* (1751), and *Institutes of Natural Law, being the Substance of a Course of Lectures on Grotius' De Jure Belli et Pacis, read in St. John's College, Cambridge* (2 vols., 1754–56). (See also Watt's *Bibliotheca Britannica.*) D. Oct., 1771.

Ruth'erfurd, p.-v., Bergen co., N. J., on Delaware Lackawanna and Western and Erie R. Rs., 8½ miles from Jersey City, has 4 churches, good schools, a large summer hotel, and 1 newspaper. P. about 3100.

JAS. N. BOOKSTAVER, ED. "HERALD."

Rutherfurd Ruling-Machine. See RULING-MACHINE.

Rutherglen (rug'len), town of Scotland, county of Lanark, on the Clyde, was formerly a place of great importance, but is now dependent on its connections with Glasgow both for its trade and manufactures. P. 9451.

Ru'ther Glen, p.-v. (P. O. name of CHESTER), Caroline co., Va., on Richmond Fredericksburg and Potomac R. R.

Rutiglia'no, town of Italy, province of Bari di Puglie, situated on a hill N. W. of Conversano and about 12 miles from Bari. The neighborbood is healthy, and fertile in grain, wine, oil, and fruits. P. 7000.

Ru'tile [Lat. *rutilus*, "red"], a ferruginous oxide of titanium, valued in coloring porcelains yellow. It is very widely distributed.

Rut'land, county of W. Vermont, on the New York frontier, at the head of Lake Champlain, watered by Otter Creek and its branches, and by Pawlet, Poultney, and Castleton rivers, is bounded on the E. by the Green Mountains, has a productive soil in the lowlands, abounds in iron ore, is celebrated for its quarries of excellent marble, is traversed by four railroads, which centre at the county-seat, and produces large quantities of wool, maple-sugar, butter, and cheese, besides a considerable yield of hay, potatoes, oats, and Indian corn. Marble is extensively worked; manufactories are numerous, as also saw and flouring mills. Cap. Rutland. Area, 950 sq. m. P. 40,651.

Rutland, tp., Kane co., Ill., on Freeport line of Chicago and North-western R. R. P. 960.

Rutland, tp., La Salle co., Ill., at the confluence of Illinois and Fox rivers. P. 1499.

Rutland, p.-v. and tp., Humboldt co., Ia., on W. fork of Des Moines River. P. 422.

Rutland, p.-v. and tp., Montgomery co., Kan. P. 485.

Rutland, p.-v. and tp., Worcester co., Mass., on Massachusetts Central R. R. P. 1024.

Rutland, tp., Barry co., Mich., on Grand Rapids division of Michigan Central R. R. P. 1156.

Rutland, p.-v. and tp., Martin co., Minn. P. 196.

Rutland, p.-v. and tp., Jefferson co., N. Y., on Black River and on Carthage Watertown and Sackett's Harbor R. R. P. 1903.

Rutland, p.-v. and tp., Meigs co., O., on Leading Creek. P. 2471.

Rutland, p.-v. and tp., Tioga co., Pa. P. 1157.

Rutland, p.-v. and tp., cap. of Rutland co., Vt., on Otter Creek and on Rutland R. R.; lat. 43° 37′, lon. 40° 4′. It is the northern terminus of Harlem Extension R. R., the eastern terminus of Rutland and Washington and of Rutland and Whitehall R. Rs., and is the principal station on Rutland R. R., the car and machine shops and engine-houses being located here. The town was chartered by New Hampshire in 1761, settled in 1770, and again chartered as "Socialborough" in 1772 by the royal government of New York. During the contest known as the "New York controversy" Rutland was an important point, and in 1774 three of her citizens were proclaimed "outlaws" and a price set on their heads by the royal governor and council of New York. During the Revolutionary war it was a frontier-town, and two forts were erected here, and it was the most northern town of the State that was not depopulated by the advance of Burgoyne after the capture of Ticonderoga in 1777. It was made the capital of Rutland co. in 1781, and since the admission of Vermont into the Union, in 1791, has been one of the places for holding U. S. courts. From 1784 to 1804 it was *one* of the capitals of the State; the State-house erected in 1784 is still standing, being, with one exception, the oldest public building in the State. In Nov., 1786, the courts were dispersed by a mob, and the court-house possessed by them, but the militia were ordered out, the mob overawed, and the courts resumed business after only a few hours' interruption. Prior to 1791 one of the four State post-offices was established here; there are now four under the general government—namely, Rutland, West Rutland, Centre Rutland, and Sutherland Falls. There are 11 churches, 18 school districts, a "graded school," 25 school buildings, 60 teachers, and about 2500 pupils. In addition to several private schools, the Rutland Military Institute has 75 students, and there are also 2 Roman Cath-

olic convents. There are 2 daily and 2 weekly newspapers, an amateur monthly paper, 3 national banks, with an aggregate capital of $1,000,000, a savings bank, with about $650,000 deposits, a fire department with 3 engine companies, 3 hose companies, and a hook-and-ladder company.

Post-Office and U. S. Court-house, and Congregational Church.

The public buildings are the U. S. court-house and post-office, the county court-house, and the town and village hall, all built of brick. There are 4 small public libraries and an extensive free public reading-room. The town is something over 6 miles square, the soil presenting all varieties, from a heavy loam to a light sand, the principal mineral being limestone, the chief variety of which is Rutland marble. When marble was first worked in Rutland is uncertain, but quarries were opened at Sutherland's Falls—where Otter Creek passes through and falls over a solid bed of marble—as early as 1830, and have been worked more or less extensively ever since. The principal seat of the marble interest, however, is at West Rutland, where the first quarry was opened in 1838, but which received its real impetus in 1843, when William F. Barnes commenced work on the rich deposit now owned by the Rutland Marble Co. He then bought for a yoke of oxen quarries now worth millions of dollars. There are 16 quarries and 12 mills now in operation, employing some 750 men, and producing annually 2,500,000 square feet of 2-inch marble. Blocks are also transported for manufacture elsewhere. The machines of the Steam-Cutter Co., Wardwell's patent, are manufactured here, and the introduction of their channelling-machines has cheapened as well as increased the production of marble. There is one of the largest mills for sawing marble in the world. The population of the town in 1870 was 9834, while the village is second only in importance. C. K. WILLIAMS, ED. "GLOBE."

Rutland, p.-v. and tp., Dane co., Wis. P. 1139.

Rut'landshire, an inland county of England, traversed by the river Wash, comprises an area of 150 sq. m., with 22,070 inhabitants. S. of the Wash the surface is hilly; N., it is level. The soil is rich and well cultivated. Rearing of cattle is the chief branch of industry. Principal town, Oakham.

Rut'ledge, p.-v., cap. of Crenshaw co., Ala., on Patsaliga River.

Rutledge, p.-v., Morgan co., Ga., on Georgia R. R. P. 235.

Rutledge, tp., De Witt co., Ill. P. 664.

Rutledge, p.-v., cap. of Grainger co., Tenn., near Holston River. P. 107.

Rutledge (EDWARD), b. at Charleston, S. C., Nov. 23, 1749; studied law in the office of his brother John and at the Temple in London; commenced practice in Charleston 1773; was elected a member of the first Continental Congress 1774; was one of the signers of the Declaration of Independence, a member of the first board of war (June, 1776) of the committee appointed to draft Gen. Washington's commission (1775) and to draw up the first Articles of Confederation; also of that sent to confer with Lord Howe on Staten Island; commanded a company of artillery during the siege of Charleston, where he was taken prisoner 1780, and detained eleven months a prisoner at St. Augustine; sat in the legislature 1791, when he drew up the act for the abolition of the rights of primogeniture; became U. S. Senator 1794; governor of South Carolina 1798. D. at Charleston Jan. 23, 1800.

Rutledge (FRANCIS HUGER), D. D., son of Chancellor Hugh, b. at Charleston, S. C., in 1799; graduated at Yale College 1821; studied at the General Theological Seminary of the Protestant Episcopal Church; was ordained deacon 1823, and priest Nov. 20, 1825; became rector of Trinity church, St. Augustine, Fla., 1839, of St. John's church, Tallahassee, 1845, and was ordained bishop of Florida Oct. 15, 1851. D. at Tallahassee Nov. 6, 1866.

Rutledge (HUGH), brother of Edward, b. at Charleston, S. C., about 1740; became judge of admiralty 1776; was Speaker of the legislative council 1777; imprisoned at St. Augustine 1780–81; Speaker of the house of representatives 1782–85, and chancellor of the State from 1791 until his death, Jan., 1811.

Rutledge (JOHN), brother of Edward, b. at Charleston, S. C., in 1739, was son of Dr. John, who came from Ireland about 1735; studied law at the Temple, London; commenced practice at Charleston 1761; attained a leading position at the bar; was a prominent member of the "Stamp Act Congress" at New York 1765, of the South Carolina convention of 1774, and of the Continental Congress 1774–75; sat in the South Carolina convention of 1776, in which he was chairman of the committee which drew up the State constitution; was president of the new government and commander-in-chief of the State; resigned, through dissatisfaction with the new State constitution, 1778; was chosen governor with extensive powers 1779; took the field at the head of the militia against the invaders; retired to North Carolina on the fall of Charleston, May, 1780; accompanied the army of Gates until 1782, when he was elected to Congress; became chancellor Mar., 1784; was a member of the convention which framed the Federal Constitution; was appointed a justice of the U. S. Supreme Court Sept., 1789; resigned that office 1791 to accept the chief-justiceship of South Carolina; was appointed by Washington chief-justice of the Supreme Court of the U. S. July, 1795, and presided at the succeeding term, but having lost his reason (which he never recovered) shortly afterward, the Senate declined to confirm the appointment. D. at Charleston July 23, 1800.—His son, GEN. JOHN, b. at Charleston in 1766, was member of Congress 1797–1803, and d. at Philadelphia Sept. 1, 1819.

Rütli. See GRÜTLI.

Ru'tuli, a people of ancient Italy, inhabiting the coast of Latium, where they built the city of Ardea. They figure very conspicuously in the legendary fictions about Æneas, etc., but they were subdued by the Romans before the overthrow of the monarchy, and they are not mentioned in history after that time.

Ru'vo di Pu'glia, town of Italy, province of Bari di Puglie, on a chalk hill commanding a wide view. It is surrounded by a wall, outside of which are extensive suburbs, and it is entered by four gates. The town is irregularly built, and the churches, though numerous, are not of special interest. The adjacent country is productive, grain, vegetables, and choice fruit being abundant. P. in 1874, including suburbs, 15,000.

Rux'ton (GEORGE FREDERICK AUGUSTUS), b. in Kent, England, in 1821; studied in the military college at Sandhurst; volunteered in the British Legion, which served against Don Carlos in Spain 1838; went to Canada as lieutenant in the British army 1839; travelled extensively in remote Western regions; published *Adventures in Mexico and the Rocky Mountains* (1847) and *Life in the Far West* (1849); travelled also in North Africa, and, returning for fresh explorations in the Rocky Mountains, d. at St. Louis, Mo., Aug. 30, 1848.

Ruys'broek (JOHN), the patriarch of the Dutch and German Mystics, b. about 1293, taking his name from the place of his nativity, a village between Brussels and Hall. About 1316 he became vicar of a church in Brussels; about 1352 joined the monastery of Grünthal. D. Dec. 2, 1381. He advocated oneness with God and assimilation to him, to be achieved by contemplation. He avoided the antinomianism of the pantheistic Mystics, and had the spirit of a reformer. (See Engelhardt's *Richard v. St. Victor u. Joh. Ruysbroek* (1838) and Ullmann's *Reformers before the Reformation* (1841; Eng. tr. 1855), vol. ii. pp. 36–55.) R. D. HITCHCOCK.

Ruysbroek [Lat. *Rubruquis, Rubruk*], **William of,** a distinguished Franciscan monk and missionary, b. near Brussels about 1230; was sent in 1253 by Innocent IV. (1243–54) to the court of Mangu Khan, the grandson of Genghis Khan, to attempt his conversion to Christianity; returned in 1255. D. after 1293. Roger Bacon speaks of him, and may very likely have seen him; and, as gunpowder was then in use among the Tartars, it has been conjec-

tured that Rubruk may have given Bacon a clue to the discovery. (For Bacon's recipe see his *Opera Inedita* (1859), p. 551. For a translation of the *Itinerarium* of Rubruk see *Purchas his Pilgrimes*, vol. iii.) R. D. Hitchcock.

Ruys'dael (Jacob), b. in Haarlem in 1625. Of his life little is known; there is controversy on nearly every point. He was the pupil and friend of Nicholas Berghem, and was a man of imagination and feeling, a nice observer, and an accomplished artist. It is not probable that he ever left Holland, for his pictures, evidently studied from nature, represent Dutch scenery and landscape on or near the Rhine. The variety of subject is not great, but the treatment is varied by the art and sensibility of the master, who imparted to his work an effect of openness, airiness, breeziness, and reach of vision that saves them from monotony and gives them a singular charm. The catalogues ascribe to him 448 pictures of undoubted genuineness. They are familiar to visitors in all continental galleries. D. at Haarlem 1661. O. B. Frothingham.

Ruys'selede, town of Belgium, province of West Flanders, is the seat of a celebrated reformatory founded by the government in 1849. The institution, which admits boys from seven to eighteen years of age and employs them during the summer in farm-labor, during the winter at different trades, numbered 522 boys in 1872, and was entirely self-supporting. P. about 7000.

Ruy'ter, van (Michael Adriaenzoon), b. at Vliessingen, Zealand, in 1607, of humble parentage; went to sea as a cabin-boy in 1618; was made a captain in the Dutch navy in 1635, and a rear-admiral in 1645. In the war between Spain and Portugal he sunk in 1647 an Algerine piratical squadron off the port of Salé, and subsequently distinguished himself still more in the war between Holland and England and in the Danish service. But his greatest deed he achieved in 1667, when he sailed up the Thames, destroyed the shipping at Sheerness, burnt a number of English men-of-war, and compelled England to conclude the Peace of Breda. In the war with France he commanded in the Mediterranean, but was defeated off the eastern coast of Sicily by Admiral Du Quesne. He succeeded in conducting his fleet safely into the harbor of Syracuse, where he d. next day, Apr. 29, 1676.

Ry'an, tp., Schuylkill co., Pa., on Lehigh Valley and Mauch Chunk R. Rs. P. 600.

Ryan, tp., Edgefield co., S. C. P. 836.

Ryan (Stephen Vincent), D. D., b. Jan. 1, 1826, in Upper Canada; removed to Pennsylvania in infancy; was educated at St. Charles's Seminary, Philadelphia, Pa.; completed his theological studies at St. Mary's Seminary, Barrens, Mo.; was ordained priest June 24, 1849, in St. Louis, Mo.; was prefect and professor for some years at St. Mary's Seminary, and afterward at St. Vincent's College, Cape Girardeau, Mo., of which institution he became president about the year 1856; was named provincial visitor of the Congregation of the Mission in 1857; appointed by the Holy See second bishop of Buffalo Mar. 3, 1868, and was consecrated Nov. 8 of the same year.

Ryan Glade, tp., Garrett co., Md., at head-waters of Potomac River. P. 851.

Rybinsk', town of European Russia, government of Yaroslav, on the Volga, carries on an immense transit-trade in corn, flour, tallow, timber, and metals between the interior of Russia and St. Petersburg. P. 14,192.

Rycaut' (Sir Paul), b. in London, England, about 1630; was secretary to the earl of Winchelsea during his embassy at Constantinople 1661–69; published *The Present State of the Ottoman Empire* (1668); was consul at Smyrna about 1670–81; secretary to the earl of Clarendon when lord lieutenant of Leinster and Connaught 1685, in which year he was knighted and made judge of the court of admiralty and privy councillor for Ireland; lost his offices at the revolution of 1688; was English resident at the Hanse Towns 1690–1700. D. in England in 1700; published *The History of the Turkish Empire from 1623 to 1677* (1680), edited Knolles's *History of the Turks*, with a continuation (1679; best ed. 3 vols., 1687–1700), translated Garcilaso de la Vega's *Royal Commentaries of Peru* (1688), and brought out in 1700 an appendix to his great work, entitled *A History of the Turks from 1679 to 1699*.

Ryde, town of England, on the northern coast of the Isle of Wight, is beautifully situated at the Spithead. It is an elegant and flourishing watering-place, and communicates every hour with Portsmouth. P. 11,234.

Ry'der (James), D. D., b. at Dublin, Ireland, in Oct., 1800; came to the U. S. in boyhood; became a novice in the Jesuit order 1813; was educated at Georgetown College; studied theology at Rome 1820–25; was ordained priest 1825; taught theology at Spoleto 1825–28; was for some time vice-president of Georgetown College, was its president 1840–45, and again 1848–51; pastor of churches at Philadelphia and at Frederick, Md., 1839–40; president of the college of the Holy Cross at Worcester, Mass., 1846–48; was superior of the order of Jesuits in North America; published several lectures and discourses, and contributed articles relating to the doctrines of his Church to the *Encyclopædia Americana*. D. at Philadelphia Jan. 12, 1860.

Ryder (William Henry), D. D., b. July 3, 1822, in Provincetown, Mass., and ordained to the ministry (Universalist) in 1843; in November of that year became pastor in Concord, N. H.; in Dec., 1845, in Nashua, N. H.; in 1848 went to Europe and Palestine, and studied in Berlin; in Jan., 1850, became pastor in Roxbury (now Boston Highlands), Mass.; in Jan., 1860, of St. Paul's church (First Universalist), Chicago, Ill., where he still remains.

Rye (*Secale cereale*), a cereal grain belonging to the sub-tribe Hordeineæ, which flourishes in the higher latitudes of the temperate zone, thrives upon poor soil, and yields a straw which is in great request for stuffing beds, saddlery, etc. and for braiding mats. The grain is wholesome, but darker and less nutritious than wheat. Whisky is extensively distilled from rye in the U. S., gin in Holland, and a liquor called *quass* in Russia. The annual production of rye in the U. S. is about 20,000,000 bushels, the States producing the largest quantities being Pennsylvania, New York, and Illinois.

Rye, p.-v. and tp., Rockingham co., N. H., on Atlantic Ocean, at the mouth of Piscataqua River, adjoining Portsmouth, is famed for its extensive beach, a place of summer resort. P. 993.

Rye, p.-v. and tp., Westchester co., N. Y., on Long Island Sound and on New York New Haven and Hartford R. R., includes the village of Port Chester. P. 7150.

Rye, tp., Perry co., Pa., on Susquehanna River and on Pennsylvania R. R. P. 703.

Rye'gate, p.-v. and tp., Caledonia co., Vt., on Connecticut River and Connecticut and Passumpsic Rivers R. R. P. 935.

Rye-Grass, the *Lolium perenne*, a European grass naturalized in the U. S. In Europe it is highly esteemed both for hay and pasture, and is the most important of all forage-plants, but in the U. S. it is not very highly valued. The Italian rye-grass (*L. Italicum*) is also greatly valued in Great Britain. (For the *Lolium temulentum* see Darnel.)

Rye'house Plot [so called from the Rye-house, a farm near Newmarket, where the murder of the king was to be undertaken], was a scheme devised by some English Whigs to kill King Charles II. while on his way from Newmarket, and to give the crown to the duke of Monmouth. The plot was discovered, and many leading Whigs, including Algernon Sydney and Lord Russell, were sent to the block, and many others were severely punished.

Ry'erson (Adolphus Egerton), D. D., LL.D., b. at Charlotteville, Upper Canada, Mar. 24, 1803; was ordained to the (Wesleyan) Methodist ministry 1825; became editor of the *Guardian*, the organ of the M. E. Church in Canada, 1829; became principal of the University of Coburg (Victoria College) 1841; was superintendent of public schools for Upper Canada 1844–50; travelled in the U. S. studying systems of education, and prepared the legislation for a new scheme of public instruction. Author of a *History of the United Empire Loyalists*.

Rye, Spurred. See Ergot.

Ry'mer (Thomas), b. at North Allerton, Yorkshire, England, about 1639; educated at Sydney College, Cambridge; studied law at Gray's Inn; became historiographer to William III. 1692; now chiefly remembered for the vast Latin collection of English historical and diplomatic documents known as *Rymer's Fœdera* (20 vols. folio, 1704–35), of which 15 were edited by himself and the remainder by Robert Sanderson. D. in London Dec. 14, 1713. Rymer left 58 MS. vols. of important historical documents, now in the British Museum. A *Syllabus* (in English) of the *Fœdera* was published in 1869 by Sir Thomas Duffus Hardy.

Rys'ingh (John Claude), the last Swedish governor of the colony on the Delaware, was sent out in the ship Aren in 1654, having previously been secretary of the chamber of commerce at Stockholm. He was commissioned as vice-governor of New Sweden, and received orders not to molest the Dutch, but at once surprised and occupied the Dutch fort Casimir, assumed the title of director-general, and concluded a treaty with the Indians; but in 1655 the Dutch attacked New Sweden and put an end to the Swedish authority, which had been sustained for seventeen years.

Rys'wick, v. of the Netherlands, province of South Holland, is famous as the place in which the treaty of peace between France and the allies, Germany, Holland, England, and Spain, was signed Sept. 20, 1697.